

June 3, 2021

Karen Sweet Customer & Market Insights Enbridge Gas Inc.

RE: Customer Engagement – Phase One Statement of Work

Dear Karen,

On behalf of Innovative Research Group Inc. (INNOVATIVE), I would like to thank you for the opportunity to work with Enbridge Gas Inc. (Enbridge) to conduct Phase One of the 2024 Rate Rebasing Customer Engagement.

As per our discussions, INNOVATIVE is being engaged to conduct a study as per the Terms of Project on the following page.

Once you have signed and returned this **Statement of Work**, INNOVATIVE will commence the work on this project.

We are looking forward to working with you. Once you have reviewed this letter, please sign and return to my attention. If you have any questions, please feel free to contact me at 416-642-6341.

Yours truly,

Susan Oakes

Vice President Innovative Research Group Inc. 56 The Esplanade, Suite 310 Toronto, Ontario M5E 1A7

E-mail: soakes@innovativeresearch.ca

Qualitative Research

This is the development phase of the customer engagement program where we give customers an opportunity to identify key issues that they feel Enbridge needs to address.

Online Focus Groups with Residential Customers

Project Scope:

- Semi-structured discussions based on a written discussion guide
- 6-8 participants per session
- A total of 10 focus groups to provide regional and legacy coverage (see list below)
- All participants receive a monetary incentive of \$100 for participating

Group Descriptions

Group	Region	Number
LUG North	Northern	2
LUG Central / East	Hamilton/Halton, Eastern	2
LUG South / West	Windsor/Chatham, London/Sarnia, Waterloo/Brantford	2
LEG GTA	Toronto (1), Central West (21) Central East (45 and 35)	2
LEG Other	Eastern (65), Niagara (76) Central West (53), Central East (47)	2

Focus group costs include project management, the finalization of the recruitment screener and moderator's guide, a combination of online and telephone recruitment of all participants, incentives, moderating, research consultant support and a report based on the research.

We will conduct two groups per evening, over a total of five evenings. The cost per evening is bringing the total budget for the focus groups to bringing.

IDIs with Small and Medium-Large Commercial Customers

Project Scope:

- Semi-structured discussions based on a written discussion guide
- A total of 20 interviews, divided evenly between small and med-lg customers
- The interviews will also be evenly divided between LUG and LEG customers
- A charitable donation in the amount of \$100 will be made on behalf of each participant

Costs include project management, the finalization of the recruitment screener and interview guide, a combination of online and telephone recruitment of all participants, incentives (charitable donations), interviews by senior consultants (Susan Oakes and Julian Garas), and a report based on the research.

The total cost for the in-depth interviews is

Total Phase One Project Costs

+ HST

- Invoice 1 of 2 (50%) upon project commencement
- Invoice 2 of 2 (50%) upon receipt of final report



July 22, 2021

Karen Sweet Customer & Market Insights Enbridge Gas Inc.

RE: Customer Engagement – Phase Two Statement of Work [REVISED]

Dear Karen,

On behalf of Innovative Research Group Inc. (INNOVATIVE), I would like to thank you for the opportunity to work with Enbridge Gas Inc. (Enbridge) to conduct Phase Two of the 2024 Rate Rebasing Customer Engagement.

As per our discussions, INNOVATIVE is being engaged to conduct a study as per the Terms of Project on the following page.

Once you have approved this **Statement of Work**, INNOVATIVE will commence the work on this project.

We are looking forward to working with you. Once you have reviewed this letter, please send me an email with approval to proceed. If you have any questions, please feel free to contact me at 416-642-6341.

Yours truly,

Susan Oakes

Vice President Innovative Research Group Inc. 56 The Esplanade, Suite 310 Toronto, Ontario M5E 1A7

E-mail: soakes@innovativeresearch.ca

Phase Two is the Refinement phase, and will involve surveys with residential customers, as well as small and medium-large commercial / industrial customers. INNOVATIVE will provide two reports for this phase: one for residential customers and one for commercial / industrial customers. Per our proposal, we have assumed in all cases Enbridge research staff will provide initial drafts of the surveys.

Residential Customers

With residential customers, we will conduct an online survey of 2,400 which will ensure representation across rate zones and regions. We will also conduct a telephone survey of 600 residential customers, with a regional distribution that is reflective of actual distribution across the province. The cost for telephone set-up assumes we are adjusting from the online survey. Demographic questions within the survey will allow us to identify low-income customers and other important customer segments for analysis purposes.

This budget is based on the current version of the survey, which is at 60 questions for residential customers. Note that open-ended questions are counted as three questions due to the extra time involved in coding verbatim responses.

Please note that we are not including incentives for residential customers.

Cost Breakdown	Online (n=2,400)	Telephone (n=600)
Set-up/platform		
Data collection		
Analysis and reporting		
TOTAL:		

Commercial / Industrial Customers

For the commercial and industrial customers, we will use a mixed methodology of online and telephone surveys. Customers will first be sent an email inviting them to complete an online survey, and reminders will encourage participation from those who don't respond initially. Depending on response rate, we will supplement with telephone interviews in order to arrive at a final sample of 200 small C/I customers and 200 Med-Large C/I customers.

The surveys will be identical with only slight adjustments in the language to accommodate the differences in methodology. *This budget is based on the current version of the survey, which is at 61 questions for commercial customers.* Note that open-ended questions are counted as three questions due to the extra time involved in coding verbatim responses. The telephone survey will include some questions to ensure we are directed to the most appropriate person.

Cost Breakdown	Online	Telephone
Set-up/platform		
Analysis and reporting		
TOTAL FIXED COST:		
СРІ		
Incentives (400 x \$15+\$350 admin)		

Total Phase Two Project Costs

The total cost for Phase Two will depend on the number of interviews completed by phone with C/I customers vs the number completed online. The lowest and highest points of the range of total costs are shown below.

	Lowest Range (all C/I interviews completed online)		Highest Range (all C/I interviews completed by telephone)		views	
Residential customers: online						
Residential customers: telephone						
Small & Med-Large C/I customers						
Incentives						
TOTAL:						

- Invoice 1 of 2 (50% of lowest range cost) upon project commencement
- Invoice 2 of 2 (remaining cost based on mix of telephone and online C/I completes) upon receipt of final report



October 6, 2021

Karen Sweet Customer & Market Insights Enbridge Gas Inc.

RE: Customer Engagement – Phase Three Statement of Work

Dear Karen,

On behalf of Innovative Research Group Inc. (INNOVATIVE), I would like to thank you for the opportunity to work with Enbridge Gas Inc. (Enbridge) to conduct Phase Three of the 2024 Rate Rebasing Customer Engagement.

As per our discussions, INNOVATIVE is being engaged to conduct a study as per the Terms of Project on the following page.

Once you have approved this **Statement of Work**, INNOVATIVE will commence the work on this project.

We are looking forward to working with you. Once you have reviewed this letter, please send me an email with approval to proceed. If you have any questions, please feel free to contact me at 416-642-6341.

Yours truly,

Susan Oakes

Vice President Innovative Research Group Inc. 56 The Esplanade, Suite 310 Toronto, Ontario M5E 1A7

E-mail: soakes@innovativeresearch.ca

Phase Three is the validation phase is where we obtain results that can be generalized across the various customer segments. As with Phase Two, Enbridge Gas will provide draft workbook-style surveys for this phase. INNOVATIVE will provide suggested edits to these surveys based on our previous experience as well as what we learned in the first two phases of the engagement.

Greg Lyle and Susan Oakes will work with Enbridge Gas to finalize the workbook. Time spent on workbook design and development will be charged at an hourly rate of \$350 for Greg and \$300 for Susan.

Methodology Options in RFQ vs Final Planned Engagement

The original RFQ specified engagement options for each customer segment for Phase Three. The final planned engagement activities differ and the length of the survey is more likely to be in the range of 25 minutes than 15 minutes, so the budget has been adjusted to accurately reflect the final planned approach. Based on our experience, we are basing all budget estimates on a survey that includes 50 closed and 10 open-ended questions. The final budget will be adjusted to reflect the actual number and type of questions.

In addition to the change in the length of the survey, it will be necessary to use a workbook format in order to effectively engage customers and allow them to give more informed opinions. Programming these workbooks is significantly more time-consuming than programming a standard survey. We are also adding workbook testing, with a broad enough scope to give us some directional notion of where the numbers are heading in advance of a full launch.

Customer Segments	Options in RFQ	Final Planned Engagement
Residential	Telephone – 1,800 interviews Online – 1,800 interviews; OR Consider an open link survey invitation shared via bill insert / myaccount	 Representative online workbook-style survey – n=7,200 Openlink survey No telephone survey
General Service / Small Commercial	Online – 400 Telephone – 400 (depending on online response)	 Online survey with invitations sent to all available sample No telephone survey
Medium – Large Commercial / Industrial (Billed)	Online – invitation to participate sent to all (assume n=100) Telephone – 200 (depending on online response)	 Online survey with invitations sent to all available sample No telephone survey
Commercial / Industrial (Contract) Strategic (Large	Online – invitation to participate sent to all (assume n=100) Online – invitation to participate	Online survey with invitations sent to all available sample Online survey with invitations
Volume Commercial) Transportation	sent to all (assume n=30) N/A – contact with these customers will most likely be an internal effort Consider set of validation interviews (5-10 min in length); OR Online – invitation to participate sent to all (assume n=30)	 Telephone validation interviews No online survey

Statement of Work Prepared by Innovative Research Group

Workbook Testing

The final report will focus on this phase, so it is critical to ensure we are asking the right questions and providing the right information to customers in a manner that is easy to understand. To that end, we strongly recommend that senior INNOVATIVE consultants test the workbook with the target customer segments prior to the start of any data collection.

The workbook will be tested with various customer segments in a series of one-on-one interviews using Zoom. During each session, the facilitator will give control of his/her computer to the customer and ask them to work their way through the workbook, responding to the survey questions as they go. The facilitator will ask the customer if there are any issues with clarity as they progress through the workbook, and at the end of the session there will be an opportunity for the customer to comment on the amount and type of information provided, and whether they felt anything was missing.

For this type of testing, the workbook will need to be programmed to make it as realistic an experience as possible. The actual cost for programming will depend on the length and complexity of the workbooks, as well as the degree to which the Contract workbook is similar to the General Service workbook. To give a sense of what the programming may cost, we have developed the following budget estimates based on our experience with large electrical utilities, and we have assumed that the Contract workbook is about 75% the same as the GS version.

WORKBOOK VERSION	ESTIMATED # OF HOURS	HOURLY RATE	TOTAL	
Residential	60			
Small/med-large business*	15			
Commercial/industrial (contract)	15			
		TOTAL:		

* Assumes minor changes, such as changes to rate impacts and "home" vs "business"

As long as no major programming changes are required, adjustments can be made as the testing progresses to incorporate customer feedback, with the goal of optimizing the workbook prior to rolling it out to all customers.

The final amount charged for programming will be based on the actual number of hours required to program and make adjustments to all versions of the workbook.

CUSTOMER SEGMENT	NUMBER OF INTERVIEWS	COST PER INTERVIEW	INCENTIVE*	TOTAL
Residential	20		\$100	
Small business	15		\$150	
Commercial/industrial (contract)	5		\$150	
			TOTAL:	

* In recognition of the fact that some organizations have policies against accepting gifts or cash, incentives for business customers will be offered as either a direct incentive to the individual, or in the form of a donation to a charity of their choosing.

Statement of Work

Prepared by Innovative Research Group

General Service Workbook

For residential customers, there will be an invitation-based online survey for which the sample will be stratified based on region/legacy and consumption in order to arrive at a final sample that is representative of that customer group. Based on the incidence of LEAP qualified customers in Phase Two, it is estimated that a total sample of 7,200 will garner about n=400 completes from residential customers who qualify for the LEAP program.

Invitations will also be sent to all small and medium-large business customers who did not participate in either Phase One or Phase Two of the customer engagement. The goal will to be obtain as many completes as possible from these customers, so there will be no sample stratification. However, we will include region/legacy and consumption as sample variables and use that information to weight the final data to be representative. It should be noted that we may have to weight the sample size down significantly to arrive at a representative sample because we want to avoid using weights any higher than 2.

A voluntary, openlink survey will also be publicized by Enbridge Gas to residential customers to ensure that all residential customers have a chance to take part in the customer engagement. The reporting on the representative vs openlink data can be done separately (costs are broken out below), or we may be able to create a hybrid report to keep costs down.

The budget below is based on a survey that is comprised of 50 closed and 10 open-ended questions. The final number of open-ended questions will impact the budget due to the time needed to code verbatim responses.

In order to keep the budget down, we would suggest coding all of the residential representative survey verbatims, and a random selection of no more than 2,500 verbatims from the openlink version of the survey at a cost of the survey per question.

Please note that we are not including incentives for residential customers. For business customers, we recommend two prize draws of \$500 for small business and two prize draws of \$500 for med/lg business.

COST BREAKDOWN	COST
Set-up/platform	
Data collection	
Incentives & facilitation	
Analysis and reporting:	
Residential representative	
Residential openlink	
GS business	
TOTAL:	

Statement of Work

Prepared by Innovative Research Group

Contract Customers

All Enbridge Gas Contract customers (as well as about 30 Strategic customers) will be sent an invitation with a unique link to an online workbook survey. Where possible, the workbook will be similar to the General Service version, but there will be differences due to the specific nature of this customer segment. We have provided a cost for creating a separate report for this customer segment.

The budget below is based on a survey that is comprised of 50 closed and 10 open-ended questions. The final number of open-ended questions will impact the budget due to the time needed to code verbatim responses.

For contract customers, we recommend two prize draws of \$500.

COST BREAKDOWN	COST
Set-up/platform	
Data collection	
Incentives & fulfillment	
Analysis and reporting	
TOTAL:	

Transportation Customers

Enbridge Gas will engage with Transportation customers directly. INNOVATIVE will follow-up with a brief, 5-minute telephone survey. The goal of the survey will be to confirm that the customer spoke with Enbridge Gas, that key topics were covered, and that they understood the information that was provided to them.

There are about 30 customers in this rate class, and INNOVATIVE will make all reasonable attempts to follow-up with each customer once Enbridge Gas has spoken with them. The total budget for this aspect of the consultation, including reporting, is set out below.

COST BREAKDOWN	COST
Data collection	
Analysis and reporting	
TOTAL:	

Total Phase Three Project Costs

The total costs for Phase Three are set out below.

The two variable costs are the professional fees for workbook development and programming.

- Time spent on workbook design and development will be charged at an hourly rate of for Greg and for Susan. *These hours are not included in the budget summary below.*
- The final amount charged for workbook programming will be based on the actual number of hours, at an hourly rate of

ENGAGEMENT COMPONENT	COST
Programming	
Workbook testing	
General service workbook	
Contract workbook	
Transport validation interviews	
TOTAL:	

- Invoice 1 of 2 upon project commencement
- Invoice 2 of 2 upon receipt of final report



May 31, 2022

Karen Sweet Customer & Market Insights Enbridge Gas Inc.

RE: Rate Rebasing - Qualitative Customer Engagement

Dear Karen,

On behalf of Innovative Research Group Inc. (INNOVATIVE), I would like to thank you for the opportunity to work once again with Enbridge Gas Inc. (Enbridge) to conduct an additional round of qualitative research as part of the 2024 Rate Rebasing Customer Engagement.

As per our discussions, INNOVATIVE is being engaged to conduct a study as per the Terms of Project on the following page.

Once you have signed and returned this **Statement of Work**, INNOVATIVE will commence the work on this project.

We are looking forward to working with you. Once you have reviewed this letter, please sign and return to my attention. If you have any questions, please feel free to contact me at 416-642-6341.

Yours truly,

Susan Oakes

Vice President Innovative Research Group Inc. 56 The Esplanade, Suite 310 Toronto, Ontario M5E 1A7

E-mail: soakes@innovativeresearch.ca

Statement of Work Prepared by Innovative Research Group

Qualitative Research

This follow-up round of qualitative research will build on what we learned in all three phases of the comprehensive 2024 Rate Rebasing Customer Engagement. The objectives of this round of qualitative research will be to:

- Understand how customer distinguish between fixed and variable costs (incurred by Enbridge Gas) of providing service.
- Further explore how customers think about rate design:
 - What do customers consider as their usage consider annual vs. daily
 - How to do customers understand the differing costs of being connected to the system and cost of system capacity
 - How do customers view the cost of gas and how do they relate it to the usage in their home or business
- Participants will also be presented with various bill presentment options, including a mock-up of a new sample bill.

Online Focus Groups with Residential Customers

Project Scope:

- Semi-structured discussions based on a written discussion guide
- 6-8 participants per session
- One evening (two groups) which will serve as a testing phase and will not be included in the final report, but will serve instead to finalize stimuli and the moderator's guide
- Following the testing and any resulting revisions, a total of 10 online focus groups to provide regional coverage (see list below)
- All participants receive a monetary incentive of \$100 for participating

Group Descriptions

Group	Region	Number
Enbridge Gas	GTA	2
Enbridge Gas	Non-GTA	2
Union Gas	South/West	2
Union Gas	Central	2
Union Gas	North/East	2

When designing the recruitment screeners, additional factors will be taken into consideration both to ensure representation across a range of customers, as well as potentially recruiting such that certain types of customers are not in the same group. This may included things such as:

- Screening for Hydro One (primarily non-GTA) or Toronto Hydro (GTA) customers
- Paper vs ebill customers
- Level of attention paid to bills
- Consumption level

Statement of Work Prepared by Innovative Research Group

Focus group costs include project management, the finalization of the recruitment screener and moderator's guide, a combination of online and telephone recruitment of all participants, incentives, moderating, research consultant support and a report based on the research.

We will conduct two groups per evening, over a total of five evenings. The cost per evening is bringing the total budget for the focus groups to

IDIs with Small and Medium-Large Commercial Customers

Project Scope:

- Semi-structured discussions based on a written discussion guide
- A total of 20 interviews, divided evenly between small and med-lg customers
- The interviews will also be evenly divided between EGI and former Union Gas customers
- A charitable donation in the amount of \$100 will be made on behalf of each participant

Costs include project management, the finalization of the recruitment screener and interview guide, a combination of online and telephone recruitment of all participants, incentives (charitable donations), interviews by senior consultants, and a report based on the research.

The total cost for the in-depth interviews is

Total Project Costs

Fixed Cost: + HST

- Invoice 1 of 2 (50%) upon project commencement
- Invoice 2 of 2 (50%) upon receipt of final report

Variable Design and Development Cost: The extent to which INNOVATIVE will be involved in designing and developing stimulus and other materials to be used during the groups/interviews is not known at this point. As such, time spent on such activities will be billed at a rate of per hour.



50 Keil Drive North, Box 2001 Chatham ON N7M 5M1 Sophear Net, Specialist BD Tel: 519-436-4600 ext. 5002394 Email: sophear.net@enbridge.com

July 20, 2020

POSTERITY GROUP CONSULTING INC. 43 Eccles Street, Unit 2 – Second Floor Ottawa Ontario K1R 6S3

Dear Sir / Madam,

RE: Consulting Agreement with Enbridge Gas Inc.

Attached please find for signature our Consulting Agreement. Kindly arrange to have the Agreement and the attached Schedule signed. Please ensure you read and understand all of the terms and conditions of the Agreement, as well as the enclosed Statement on Business Conduct and Lifesaving Rules.

We will also require the following:

 A current clearance certificate or letter of exemption from the Ontario Workplace Safety and Insurance Board ("WSIB"). If your employees are in a jurisdiction other than Ontario, please provide equivalent proof of coverage, and new proof of coverage must be filed with us upon expiry/renewal of such proof of coverage.

Please return the applicable WSIB document noted above, together with a signed copy of the Consulting Agreement and a signed copy of the Schedule, promptly following receipt of this letter. Upon receipt of all the documents in our office, we will execute the Agreement and a PDF copy of the Agreement will be returned to you for your records.

If you have any questions, please contact me at the above-noted telephone number.

Sincerely,

Sophear Net Specialist BD

Encls.

CONSULTING AGREEMENT

THIS AGREEMENT made effective July 20, 2020.

BETWEEN:

ENBRIDGE GAS INC.

("Enbridge")

- and -

POSTERITY GROUP CONSULTING INC. (the "Consultant")

WITNESSES THAT in consideration of the mutual covenants and agreements herein contained, the parties hereto covenant and agree as follows:

1. Scope of Services

- (a) During the term hereof (as hereinafter defined), the Consultant shall provide consulting services (the "Services") to Enbridge, on the terms and conditions set forth below.
- (b) The scope of work for specific projects to be undertaken by the Consultant at the request of Enbridge will be described in separate schedules referencing this Agreement, each of which shall become effective, be incorporated by reference and form an integral part of this Agreement upon the execution of each such schedule by Enbridge and the Consultant. The schedule for each project will specify the names of key individuals, scope of Services, deliverables, commencement and completion dates, rate of compensation and payment terms applicable to such project. Each schedule described above shall be prepared using a form similar to the attached Schedule "A".

2. Compensation

In consideration of the Services and deliverables to be provided by the Consultant hereunder, and provided that the Consultant is not in default of its obligations hereunder, Enbridge shall remit to the Consultant all amounts required to be paid in accordance with the applicable schedule.

Consultant shall be responsible for charging, collecting and remitting all applicable federal and provincial sales, use and value-added taxes in respect of the fees paid or payable to Consultant and, in particular, the goods and services tax ("GST") and harmonized sales tax ("HST") imposed under Part IX of the Excise Tax Act (the "ETA"), the Quebec sales tax ("QST") imposed under an Act respecting the Quebec Sales Tax (the "QSTA") and any provincial sales taxes ("PST"); and such taxes, if applicable, shall be shown separately on all invoices. Where Consultant is required to collect any GST/HST, QST or similar tax, Consultant shall provide Enbridge with the documentary evidence as prescribed pursuant to the ETA or QSTA, any successor provision thereto or any similar provision of any other taxing statute as is required to entitle Enbridge to claim an input tax credit, input tax refund, rebate, refund or any other form of relief in respect of such taxes.

Where the Consultant is a non-resident of Canada for purposes of the Income Tax Act (Canada) (the "ITA"), with respect to the invoice or statement of Fees issued pursuant to any Schedule, the Consultant will identify the location where the Services are provided, separate Services performed in Canada from Services performed outside of Canada, identify the number of days Services were performed in Canada (including travel days to/from Canada) and, for Services performed in Canada, identify the physical location, indicating city and province, where such Services were performed. Where the non-resident Consultant has not obtained and provided to Enbridge a non-resident withholding tax waiver at such time as Enbridge makes any payment to the Consultant for Services, Enbridge shall withhold such percentage

of any payment as mandated under the ITA with respect to the Services provided in Canada or on the full invoice or statement amount where the Consultant has not clearly separated the Services performed in Canada from Services performed outside of Canada. Enbridge shall remit the withheld amount to Canada Revenue Agency, or its successor, in the manner and at the time required by the ITA. For further clarification, it is the Consultant's responsibility to obtain the tax waiver, if available. In the event that Enbridge is assessed for any non-resident withholding taxes payable, the Consultant agrees to forthwith reimburse Enbridge for such amount together with applicable interest and penalties, if any.

3. Term

Subject to earlier termination as provided for herein, the term of this Agreement shall commence on the day set forth above and expire on July 19, 2023 (hereinafter the "Term").

4. Termination

- (a) Enbridge may terminate this Agreement or any schedule to this Agreement for convenience upon giving two (2) weeks written notice to the Consultant.
- (b) Either party may terminate this Agreement in case of a breach by the other party of its obligations hereunder, provided that the breach is not cured within five (5) days of written notification by the non-defaulting party to the defaulting party setting out the particulars of the breach.
- (c) Either party may terminate this Agreement upon written notice to the other party, if: (i) the other party is subject to proceedings in bankruptcy, or insolvency, whether voluntary or involuntary, (ii) a receiver is appointed in respect of all or a substantial portion of the other party's assets; or (iii) the other party assigns its property to its creditors or generally becomes unable to pay its debts as they become due.

Upon any termination of this Agreement, the Consultant shall deliver to Enbridge the results of all Services provided as of the date of termination, including completed or uncompleted deliverables for which payment has been received in accordance with the terms of this Agreement.

5. Facilities

Enbridge shall provide to the Consultant use of such office facilities as may be required by the Consultant, acting reasonably, to perform the Services during the Term.

6. Reimbursement for Expenses

In addition to the payments to be made pursuant to Section 2 hereof, Enbridge shall reimburse the Consultant for all reasonable expenses properly incurred by the Consultant in connection with the Services provided to Enbridge hereunder and that have been pre-approved by Enbridge in writing, including, without limitation, reasonable travel and other costs and expenses in connection therewith. Such pre-approved reasonable expenses incurred by the Consultant in rendering Services shall be reimbursed by Enbridge net of GST/HST. GST/HST shall be charged, where applicable, by the Consultant on the expenses incurred, net of the input tax credits/reimbursements for GST/HST claimed by the Consultant. Concurrently with its delivery of invoices to Enbridge as contemplated by Section 2 hereof, the Consultant shall submit to Enbridge invoices and statements setting out in reasonable detail the nature and amount of the expenses or costs incurred by the Consultant for which the Consultant claims reimburse the Consultant for all approved invoiced expenses and costs. The Consultant shall provide to Enbridge copies of all documentation in support of invoiced expenses as Enbridge may request from time to time during the Term hereof.

7. Independent Contractor

Notwithstanding anything to the contrary herein contained, the Consultant shall not, for any purpose, be or be deemed to be an employee of Enbridge during the Term or at any time during which the Services described in Section 1 hereof are provided to Enbridge nor shall anything in this Agreement create or be

construed for any purpose as creating any relationship between Enbridge and the Consultant of employer and employee. Except as expressly provided herein, Enbridge shall not be liable to contribute to any employee benefit or pension plan or pay premiums for any policy or form of insurance whatsoever on behalf of the Consultant nor to pay any amounts or premiums on its behalf in respect of the Canada Pension Plan, Ontario Health Insurance Plan, Workplace Safety and Insurance Board or Employment Insurance, nor to deduct or withhold from source any amount from amounts payable by Enbridge to the Consultant hereunder in respect of any income tax obligation or liability payable by the Consultant to the Canada Revenue Agency. The Consultant agrees to indemnify and hold Enbridge harmless from and against any order, penalty, interest or tax that may be assessed or levied against Enbridge as a result of the failure or delay of the Consultant to file any return or information required to be filed by the Consultant by any law, ordinance or regulation relating to the Services performed by the Consultant herein.

8. Confidential Information and Personal Information

- (a) For the purposes of this Section 8, the following definitions will apply:
 - (i) <u>"Confidential Information"</u>, means all information pertaining to the business and affairs of Enbridge, its affiliates and subsidiaries, whether oral or written, furnished by Enbridge to the Consultant, its employees and representatives, whether furnished or prepared before or after the date of this Agreement, and includes all analysis, compilations, data, studies, reports or other documents prepared by the Consultant based upon or including any of the information furnished by Enbridge, but does not include information which:
 - A. is at the time of disclosure or thereafter becomes generally available to the public other than as a result of disclosure by the Consultant or anyone to whom the Consultant transmits the information;
 - B. is at the time of disclosure or thereafter becomes known or available to the Consultant on a non-confidential basis and not in contravention of applicable law from a source other than Enbridge that is entitled to disclose the information; or
 - C. is already in the possession of the Consultant or is lawfully acquired, provided that such information is not subject to another confidentiality agreement with, or obligations of secrecy to Enbridge.
 - (ii) "Person" includes individuals, partnerships, firms and corporations.
- (b) Enbridge is furnishing the Confidential Information to the Consultant solely for the purpose of assisting the Consultant in the performance of Services which the Consultant provides to Enbridge. The Consultant shall not use the Confidential Information for any purpose other than the performance of Services provided to Enbridge.
- (c) The Consultant acknowledges that the Confidential Information is the property of Enbridge, which is confidential and material to the interests, business and affairs of Enbridge and that disclosure thereof would be detrimental to the interests, business and affairs of Enbridge. Accordingly, the Consultant agrees that it shall maintain the confidentiality of the Confidential Information and that it shall not disclose the Confidential Information to any Person for any reason whatsoever except as expressly provided herein.
- (d) The Consultant may disclose Confidential Information to the extent required by a court of competent jurisdiction or other governmental or regulatory authority or otherwise as required by applicable law, provided that the Consultant first give Enbridge prompt written notice (except where the governmental or regulatory authority has expressly ordered that no notice be given) and co-operate with and assist Enbridge in responding to the request or demand for disclosure.
- (e) The Consultant acknowledges and agrees that Enbridge would be irreparably harmed if any provision of this Agreement is not performed by the Consultant in accordance with its terms. Accordingly, Enbridge shall be entitled to an injunction or injunctions to prevent breaches of any of the provisions of this Agreement and may specifically enforce such provisions by an action

instituted in a court having jurisdiction. These specific remedies are in addition to any other remedy to which Enbridge may be entitled at law or equity.

- (f) If in the course of performing Services hereunder, the Consultant obtains or accesses personal information about an individual, including without limitation, a customer, potential customer or employee or contractor of Enbridge ("Personal Information") the Consultant agrees to treat such Personal Information in compliance with all applicable federal or provincial privacy or protection of personal information laws and to use such Personal Information only for purposes of providing the Services hereunder. Furthermore, the Consultant acknowledges and agrees that it will:
 - (i) not otherwise copy, retain, use, modify, manipulate, disclose or make available any Personal Information, except as required by applicable law;
 - (ii) establish or maintain in place appropriate policies and procedures to protect Personal Information from unauthorized collection, use or disclosure;
 - (iii) implement such policies and procedures thoroughly and effectively;
 - (iv) except as required for purposes of providing the Services hereunder, will not develop or derive, for any purpose whatsoever, any products in machine-readable form or otherwise, that incorporates, modifies, or uses in any manner whatsoever, any Personal Information; and
 - (v) upon completion of its Services for or on behalf of Enbridge, will at Enbridge's direction: A. return; or B. destroy all Personal Information and all copies and records thereof in its possession.

9. Indemnification

The Consultant hereby agrees to and shall:

- (a) be liable to Enbridge and its directors, officers and employees, for all claims, liabilities, damages, costs, losses and expenses whatsoever which Enbridge or any of its directors, officers and employees may suffer, sustain or incur; and
- (b) indemnify and save harmless Enbridge, Enbridge's affiliated and subsidiary companies, and their directors, officers, agents, employees and representatives from and against any and all liabilities, claims, demands, damages, loss, costs and expenses (including without limitation all applicable solicitors' fees, court costs and disbursements, investigation expenses, adjusters' fees and disbursements) to or which any third party may suffer, sustain or incur,

in respect of all matters or anything which may arise out of any act or omission directly or indirectly related to any breach of this Agreement by the Consultant, its employees or representatives.

10. Work Product

- (a) For the purposes of this Section 10, "Work Product" shall include any of the following, which are developed in the course of or arise from the Services provided by the Consultant to Enbridge hereunder throughout the Term: (i) any deliverables produced under any schedule to this Agreement together with any and all notes, reports, research information, compilations, data specifications, designs, programs, documentation, software (including object code and source materials), development tools, products and other materials or things; (ii) any and all knowledge, know-how, techniques, inventions, processes, trade secrets, methodologies, approaches and other intangible intellectual property rights; and (iii) all designs, patent applications, issued patents, industrial design registrations, design patents, trade-mark applications, registered trade-marks and copyright which may relate thereto.
- (b) For the purposes of this Section 10, "Consultant Materials" comprises any of the following, which were developed by the Consultant, at its own cost and expense in advance of and independent of

this Agreement and as proven by the Consultant to be the case in the event of a dispute concerning the same: (i) any and all notes, research, information, data, specifications, designs, programs, documentation, software (including object code and source materials), development tools, products and other materials or things; (ii) any and all knowledge, know-how, techniques, inventions, processes, trade secrets, methodologies, approaches and other intangible intellectual property rights; and (iii) all designs, patent applications, issued patents, industrial design registrations, design patents, trade-mark applications, registered trade-marks and copyright which may relate thereto.

- (c) All right, title and interest in and to the Work Product shall be the property of Enbridge. The Consultant shall ensure that any agent or employee of the Consultant shall have waived in writing all of his or her moral rights over any such Intellectual Property. During and after the Term of this Agreement, the Consultant shall from time to time as and when requested by Enbridge execute all papers and documents and perform other acts as necessary or appropriate to evidence or further document Enbridge's ownership of the Work Product and the intellectual property rights therein.
- (d) The Consultant retains all right, title and interest in and to the Consultant Materials. The Consultant hereby grants to Enbridge a non-exclusive, perpetual, irrevocable, non-terminable, transferable, assignable and royalty-free license to copy, disclose, use, operate, maintain, repair, modify, enhance, make derivative works, license, sub-license and otherwise commercially exploit without limitation or restriction those Consultant Materials used in connection with the delivery of the Services or to the extent contained within any Work Product.
- (e) The Consultant agrees to fully indemnify and hold harmless Enbridge from and against any and all: (i) claims, demands and actions; (ii) liabilities, damages or losses awarded by a court of competent jurisdiction or as agreed to as part of a settlement; and (iii) litigation costs and/or expenses (including reasonable legal fees and disbursements) reasonably incurred by Enbridge in connection with any claim that the Services or Work Product provided hereunder infringe any patent, copyright, trade secret or other right of any third party.

11. Representations and Warranties

- (a) The Consultant represents, warrants and covenants with Enbridge that: (i) it will perform all Services in a good and workmanlike manner using reasonable care (at a level that is at least consistent with industry standards for the provision of similar services) and in accordance with the terms of this Agreement; (ii) it possesses the knowledge, skill and experience necessary for the provision and completion of the Services in accordance with the terms of this Agreement; and (iii) any deliverables provided hereunder shall conform to their relevant specifications as described in the applicable schedule.
- (b) The Consultant agrees that under no circumstances will it interface a non-Enbridge computing device (including without limitation desktops, laptops, handheld device) with the Enbridge intranet or internet without obtaining the prior written approval of Enbridge. To the extent the deliverables produced hereunder involve the provision or development of any software application, interface or electronic data, the Consultant shall use commercially reasonable efforts to prevent the introduction of any virus to the hardware and computer systems upon which the application, interface or electronic data are to be installed. During the Term of this Agreement, the Consultant shall implement and run virus prevention and detection control procedures in accordance with industry standards.
- (c) In addition to the policies described in Section 25, the Consultant shall ensure that it is familiar with and understands all of Enbridge's current policies, procedures and standards that are pertinent to the activities associated with the Services and which have been provided to the Consultant in advance of the execution of this Agreement.

12. Subcontractors

The Consultant shall not enter into any agreement with any other party to assist in the provision of the Services described in Section 1 hereof (hereinafter described as a "Subcontract") nor shall the Consultant allow any other party to perform such Services or any part thereof without first obtaining the consent in writing of Enbridge, which consent may be withheld by Enbridge, acting reasonably. Notwithstanding any approval or consent that may be provided by Enbridge in connection with any Subcontract, the Consultant shall not be relieved of any of its liabilities and responsibilities hereunder. Any party which enters into a Subcontract with the Consultant shall be required by the terms of such Subcontract to comply with and be bound by the obligations and responsibilities of the Consultant described hereunder and without restricting the generality of the foregoing, any Subcontract which has been entered into without the prior written consent of Enbridge shall be null and void and without force and effect.

13. Insurance

Save and except where Enbridge specifies otherwise in writing, the Consultant shall at its own expense maintain and keep in full force and effect during the Term hereof and for a period of two (2) years following the expiry of the Term or other termination of this Agreement:

- (a) Commercial General Liability insurance having a minimum inclusive coverage limit, including personal injury and property damage, of at least Two Million Dollars (\$2,000,000) per occurrence. Enbridge Gas Inc. must be listed as the certificate holder and be added as an additional insured in the insurance policy, which should be extended to cover contractual liability, products/completed operations liability, owners'/ contractors' protective liability and must also contain a cross liability clause;
- (b) Automobile Liability insurance on all vehicles used in connection with this Agreement and such insurance shall have a limit of at least Two Million Dollars (\$2,000,000) in respect of bodily injury (including passenger hazard) and property damage inclusive of any one accident;
- (c) Non-Owned Automobile Liability insurance and such insurance shall have a limit of at least Two Million Dollars (\$2,000,000) in respect of bodily injury (including passenger hazard) and property damage, inclusive in any one accident; and
- (d) such other insurance as Enbridge may in its discretion determine to be necessary, including, but not limited to, Professional Liability or Errors and Omissions insurance.

The Consultant shall forthwith after entering into this Agreement, and from time to time thereafter at the request of Enbridge, furnish to Enbridge a memorandum of insurance or an insurance certificate setting out the terms and conditions of each policy of insurance (all such policies of insurance being hereinafter described as the "Insurance Policies") maintained by the Consultant in order to satisfy the requirements of this section. At any time and from time to time at the request of Enbridge, the Consultant shall furnish Enbridge with one or more duly completed insurance certificates in the form requested by Enbridge to evidence the details of all the Insurance Policies. The Insurance Policies shall be arranged with insurers acceptable to Enbridge, acting reasonably, and shall contain such terms and conditions as are reasonably acceptable to Enbridge. The Consultant shall not cancel, terminate or materially alter the terms of any of the Insurance Policies without giving prior notice in writing to Enbridge. The Consultant shall cause or arrange for any of its insurers under any one or more of the Insurance Policies to oblige itself contractually in writing to Enbridge to provide fifteen (15) days prior notice in writing before cancelling, terminating or materially altering the Insurance Policies under which it is an insurer.

14. Compliance with Laws

The Consultant agrees to comply with the Occupational Health and Safety Act (Ontario) and the Workplace Safety and Insurance Act (Ontario) and with all other prevailing federal, provincial and municipal laws and regulations or any other laws or regulations in force in any jurisdiction where the Services are performed (the "Laws") and which are applicable to the Consultant, its subcontractors and the Services provided hereunder, and the Consultant shall familiarize itself and procure all required permits and licenses and pay all charges and fees necessary or incidental to the due and lawful prosecution of this Agreement, and

maintain all documentation as may be required by the Laws, and shall indemnify and save harmless Enbridge, its directors, officers, agents and employees thereof against any claim or liability from or based on the violation of any Laws, whether by the Consultant, its officers, employees, subcontractors, representatives or agents. The Consultant shall, from time to time, if requested by Enbridge, furnish Enbridge with evidence of such compliance, and in particular: (i) evidence from the Workplace Safety and Insurance Board, or the equivalent thereof in any jurisdiction where the Services provided hereunder are carried out, that the Consultant and any party with which it has entered into a Subcontract are in compliance with and have paid all assessments and other amounts owing pursuant to the workers' compensation legislation of such jurisdiction; and (ii) evidence of the Consultant's compliance with any training requirements under the Laws including, without limitation, the provision of such statements or certificates pertaining to the Consultant's compliance in the form(s) prescribed by Enbridge from time to time.

Enbridge is committed to compliance with the Accessibility for Ontarians with Disabilities Act, 2005, O.Reg. 429/07 and O.Reg. 191/11, the Enbridge Customer Service Policy for Providing Goods and Services to People with Disabilities and the Enbridge Integrated Accessibility Standards Policy (collectively the "AODA"). The Consultant shall ensure that it is in full compliance with all of its obligations under AODA. Without limiting the generality of the foregoing the Consultant shall ensure that all of its employees, agents, volunteers, or others engaged by the Consultant in the delivery of services under this Agreement receive training in connection with the requirements of the AODA. If requested to do so, the Consultant shall provide Enbridge with copies of its policies, practices, procedures, training materials and training records including the dates on when the training is provided, and the names of the individuals trained, and confirmation the Consultant has reported its compliance to the Ministry of Community and Social Services or such other governmental authority as provided in the AODA.

The Consultant will ensure that any personnel it assigns to work in Canada, where they are not a Canadian citizen or Canadian permanent resident of Canada, will obtain and maintain the lawful ability to engage in commercial activities in Canada through the issuance of the appropriate documentation from Canada Border Services Agency and Citizenship and Immigration Canada. The Consultant's personnel where necessary will obtain lawful work permits to engage in business-related activities as temporary foreign workers and will notify Enbridge if any applications for work permits and work permit renewals are refused. The Consultant will not send personnel to any Enbridge-related work site if they do not possess the necessary lawful permission to work in Canada. The Consultant will take full responsibility to secure the necessary documentation and produce such documentation when entering a Canadian work site of Enbridge.

15. Waiver

Either the Consultant or Enbridge may, in writing, extend the time for performance by the other and waive non-compliance or non-performance by the other of any of the other's obligations, covenants and agreements under this Agreement and any compliance therewith or performance thereof. However, no such extension or waiver shall operate so as to waive, diminish or reduce the scope of or otherwise affect any obligation, covenant or agreement of such other which is not the subject matter of such extension or waiver or, except to the extent of such extension or waiver, of the obligation, covenant and agreement which is the subject matter of such waiver. No act or failure to act of either the Consultant or Enbridge shall be or be deemed to be an extension or waiver of timely or strict performance by the other of the other's obligations, covenants and agreements under this Agreement except to the extent notice thereof is given to the other.

16. Notice

Any notice or other communication to be given under or pursuant to the provisions hereof or in any way concerning this Agreement shall be sufficiently given if reduced to writing and delivered to the person to whom such communication is to be given or sent by facsimile or electronic internet communication, addressed to such person at the address set forth below:

If to Enbridge:

ENBRIDGE GAS INC.

50 Keil Drive North, Box 2001 Chatham ON N7M 5M1 Attention: Sophear Net, Specialist BD Phone: 519-436-4600 ext. 5002394 Email: sophear.net@enbridge.com

With a copy to: Law Department Facsimile: 416-495-5994

If to the Consultant:

POSTERITY GROUP CONSULTING INC. 43 Eccles Street, Unit 2 – Second Floor Ottawa Ontario K1R 6S3 Attention: Alex Tiessen, Principal Phone: (613) 219-5312 Ext. Email: tiessen@posteritygroup.ca

or at such other address as may be specified therefor by proper notice hereunder. A notice or communication shall be deemed to have been sent and received on the day it is delivered personally or by courier or by facsimile or by electronic internet communication. If such day is not a business day or if the notice or communication is received after 5:00 PM (at the place of receipt) on any business day, the notice or communication shall be deemed to have been sent and received on the immediately following business day.

17. Interpretation

This Agreement shall be governed by and construed in accordance with the laws of the Province of Ontario and the laws of Canada applicable therein. Headings used herein are for the convenience of reference only and shall not be considered in construing or interpreting this Agreement. The words "herein", "hereunder", "hereof" and other similar words refer to this Agreement as a whole and not to any particular paragraph. Any provision herein prohibited by law shall to the extent prohibited be ineffective without invalidating any other provisions hereof. All references to amounts of money in this Agreement and any schedule shall mean lawful currency of Canada.

18. Assignment

The Consultant may not assign this Agreement in whole or in part without the express prior consent in writing of Enbridge. This Agreement shall be binding upon and enure to the benefit of the successors and assigns of Enbridge.

19. Use of Enbridge Name and Logo

The Consultant shall not use or display Enbridge's name or any symbols, signs, trademarks and other marks denoting and identifying Enbridge in any manner whatsoever without the prior written authorization of Enbridge.

20. Time of Essence

Time shall be of the essence in the performance of the Services.

[remainder of page intentionally left blank]

21. Survival

All warranties and indemnities contained in this Agreement, and the obligations contained in Section 8, shall survive the termination of this Agreement irrespective of the time of or party responsible for such termination, and such warranties, indemnities and obligations shall remain in full force and effect and be binding on the Contractor notwithstanding such termination.

22. Further Assurances

Each of the parties shall, from the time of the written request of the other party, do all such further acts and execute and deliver or cause to be done, executed or delivered all such further acts, deeds, documents, assurances and things as may be required, acting reasonably, in order to fully perform and to more effectively implement and carry out the terms of this Agreement.

23. Entire Agreement

This Agreement, including any schedules attached hereto, constitutes the entire agreement between the parties with respect to the subject matter set out herein and replaces any prior understandings or agreements, whether written or oral, regarding such subject matter. No change or modification of this Agreement is valid unless it is in writing and signed by both parties. No disclaimers, purchase order documents, invoices or other documents of the Consultant shall be binding upon Enbridge.

24. Audit

The Consultant shall, following no less than seven (7) business days advance notice in writing, provide to such auditors (including external auditors and Enbridge's internal audit staff or agents) as Enbridge may designate in writing, supervised access to the data, records and supporting documentation maintained by the Consultant with respect to the Services solely for the purpose of: (i) performing audits and inspections to enable Enbridge to satisfy applicable regulatory requirements or certify compliance with applicable laws; and (ii) to confirm that the Services are being provided in accordance with the terms of this Agreement. Enbridge and its auditors shall use commercially reasonable efforts to conduct such audits in a manner that will result in a minimum of inconvenience and disruption to the Consultant's business operations. In the event that if any such audit reveals any: (a) errors or deficiencies in the completion of the Services or invoicing of the Services; or (b) overpayments to the Consultant by Enbridge, then the Consultant shall forthwith correct such errors or deficiencies, including if applicable refunding any overpayment to Enbridge. The Consultant shall retain all records for ten (10) years from the date of expiration or earlier termination of this Agreement, or such longer period as Enbridge may require having regard to the nature of the Services.

25. Enbridge Policies

The Consultant acknowledges receipt of a copy of each of Enbridge Inc.'s Statement on Business Conduct for Enbridge Inc. and its Subsidiaries and Lifesaving Rules, each as amended from time to time (the "Policies"). The Consultant agrees to comply with the Policies in connection with its delivery of the Services described in this Agreement, and agrees that, if requested by Enbridge, it will ensure all personnel delivering the Services herein attend training on the Lifesaving Rules.

26. ISNetworld Requirement

If required by Enbridge, the Consultant shall subscribe with ISN Software Corporation as a registrant of ISNetworld ("ISN") or any successor service mandated by Enbridge from time to time, and maintain a performance grading within ISN that is acceptable to Enbridge (the "ISNetworld Requirement") and shall: (a) provide all records and information as required by ISN or Enbridge, including, but not limited to, training and qualification data of the Consultant personnel, including subcontractors and employees, relating to the Services; and (b) maintain compliance with the ISNetworld Requirement during the currency of this Agreement.

[remainder of page intentionally left blank]

27. Counterparts and Execution

This Agreement may be executed by the parties in separate counterparts, each of which when so executed and delivered will be deemed to be an original, and all such counterparts will together constitute one and the same instrument. Delivery of a signature by electronic transmission or by facsimile transmission, including by email delivery of a "portable document format" ("pdf") document, shall create a valid and binding obligation. This Agreement may be executed using electronic signatures.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date first written above.

POSTERITY GROUP CONSULTING INC.	ENBRIDGE GAS INC.	
By:	By: Fiona Glasford (Jul 23, 2020 09:09 EDT)	
Name: Alex Tiessen	Name: Fiona Oliver-Glasford	
Title: Principal	Title: Manager Carbon Strategy	
Ву:	Ву:	
Name:	Name: **	
Title:	Title: *	
(Please print name and title of Signing Officer)		
Witness:		
Name:		

(Witness required if Contractor is a Sole Proprietor)

SCHEDULE A

TO THE CONSULTING AGREEMENT BETWEEN ENBRIDGE GAS INC. AND POSTERITY GROUP CONSULTING INC. Dated July 20, 2020

This Schedule is made under the above referenced consulting agreement (the "Agreement") between ENBRIDGE GAS INC. ("Enbridge") and POSTERITY GROUP CONSULTING INC. (the "Consultant").

1. SCOPE OF SERVICES

The Consultant will undertake the following Services:

Support the Energy Transition Scenario Analysis ("ETSA") by modeling future load at the granular level of energy end uses, different building types, rate classes, and regions, and undertaking scenario analysis to explore several possible economic and policy scenarios under which Enbridge may operate in the future.

A description of Services and key personnel to be provided by the Consultant is set forth in the proposal dated July 15, 2020 prepared by the Consultant, which is attached as Attachment 1 to this Schedule (the "Proposal") and incorporated by reference herein. In the event of a conflict between the terms and conditions set out in the Proposal and those set out in this Agreement, the terms and conditions in this Agreement (including this Schedule) will govern and take precedence.

2. DELIVERABLES

The Consultant will provide the following deliverables:

Complete activities under four work packages:

Work Package 1: Characterize Critical Drivers and Finish Developing Reference Case

Work Package 2: Parametric Analysis and Boundary Scenario Definitions

Work Package 3: Planning Scenario Definitions

Work Package 4: Scenario Analysis and Modelling

As detailed further in the attached proposal.

3. TERM AND COMMENCEMENT AND COMPLETION DATES

This Schedule shall be effective as of July 20, 2020 and expire March 1, 2021, or such other date as the parties may mutually agree in writing.

4. KEY PERSONNEL

The Consultant will provide the following personnel to deliver the services set out above under Scope of Services:

Alex Tiessen, Principal

5. FEES AND PAYMENT TERMS

Fees:

Expenses: N/A

The above fees and expenses cannot be exceeded without prior written approval from Enbridge.

Fees are payable by Enbridge within forty-five (45) days of receipt from the Consultant of an appropriate invoice setting out in reasonable detail the nature of the services provided.

[Remainder of page intentionally left blank; signature page to follow]

Dated as of July 20, 2020.

POSTERITY GROUP CONSULTING INC. ENBRIDGE GAS INC.

By:Bully Z- By:Bully Z- By:	By:	Fiona Cliver Glasford (Jul 23, 2020 09:09 EDT)
Name: Alex Tiessen	Name:	Fiona Oliver-Glasford
Title: Principal	Title:	Manager Carbon Strategy
Ву:	By:	
Name:	Name:	* *
Title:	Title:	*
(Please print name and title of Signing Officer)		
Witness:		
Name:		

(Witness required if Contractor is a Sole Proprietor)

ATTACHMENT 1, Proposal is attached at the following pages.

REDACTED Filed: 2023-03-08 EB-2022-0200 Exhibit I.1.2-CCC-3, Attachment 2, Page 30 of 221



Proposal: Long Term Planning Scenario Analyses to Support ETP – Final Version

Date: July 15, 2020

Fiona Oliver-Glasford Enbridge Gas Inc. 500 Consumers Road North York, M2J 1P8 Posterity Group 140 Yonge Street, Unit 200 Toronto, ON M5C 6S3

Contents

1 Introduction	1
2 Approach	3
<u>3 Schedule</u>	10
4 Budget and Level of Effort	11

1 Introduction

Posterity Group Consulting Inc. (Posterity Group) is pleased to submit this draft proposal to Enbridge Gas Inc. (Enbridge). We understand senior staff at Enbridge need to consider the financial and operational impacts of the range of climate policy related impacts Enbridge could face over the next 30 years. Enbridge's Energy Transition Planning (ETP) project team is working across departments (Load Forecasting, Network planning/system planning, Asset Management, Gas Supply, Rate and Regulations) to facilitate discussions, collect information, and provide senior decision makers with a quantified range of potential planning scenarios.

This document outlines how Posterity Group will support the Energy Transition Scenario Analysis (ETSA) by modeling future load at the granular level of energy end uses, different building types, rate classes, and regions, and undertaking scenario analysis to explore several possible economic and policy scenarios under which Enbridge may operate in the future.

We propose a methodology which has successfully been used with FortisBC to undertake scenario analyses in support of its Long-Term Gas Resource Plan (LTGRP) filings to the BCUC. Posterity Group successfully supported FortisBC using this methodology for its 2017 LTGRP filing and is currently engaged in support of their 2022 LTGRP submission.

In this engagement, Enbridge will be able leverage internal modelling, forecasting and research the company is already undertaking (e.g., Enbridge's load forecast, Enbridge's hydraulic model 'Synergi Gas'). Enbridge will also be able to build on previous investments in its:

- Jurisdictional end-use level dataset developed in support of ongoing DSM planning and IRP analysis, and the
- Power BI user-interface tool currently being developed to support energy efficiency planning for both DSM and IRP.

The approach presented in the following section will involve:

- Defining critical drivers, characterizing their relational effects, and establishing possible ranges and likely probability distribution of these ranges;
- Building out a more comprehensive end-use level reference case, including adding electric end-uses and gas rate classes;
- Undertaking parametric analysis to understand the effects of each critical driver over its range in the forecast period;
- Undertaking analysis to bound the possible futures, i.e., defining upper and lower boundaries to establish a cone of uncertainty;
- Using visualization via the Power BI user-interface tool to facilitate development of 'what if' planning scenario narratives; and
- Assessing directional change of critical drivers for each planning scenario, quantifying impacts to critical drivers, and undertaking scenario modelling.

At the end of this engagement Enbridge will have a comprehensive end-use level dataset that reflects several possible futures and a user-interface tool that allows decision makers to explore

this dataset and distill quantitative impacts (e.g., how gas use and GHG emissions will change) under different forecast scenarios.

2 Approach

Our proposed approach involves defining the range of possible future operating environments from two perspectives:

- An 'if, then' bottom up method that identifies critical drivers which could have a meaningful influence on gas use in Ontario (e.g., carbon price), defines the relational effects between each driver and how gas use is influenced (e.g., carbon price will influence fuel switching via price elasticity at the customer level), and the possible range (e.g., \$50/tonne \$200/tonne). We can then examine the impacts of these drivers varying over their possible ranges and use this analysis to define an upper and lower bound. [Work Packages 1 and 2]
- 2) A 'what if' scenario development method that leverages the 'if, then' analysis to explore and define plausible future narratives (e.g., 80% GHG reduction by 2050) and quantifies what critical drivers look like under these scenarios; allowing each scenario to be modelled at an end-use level. *[Work Packages 3 and 4]*

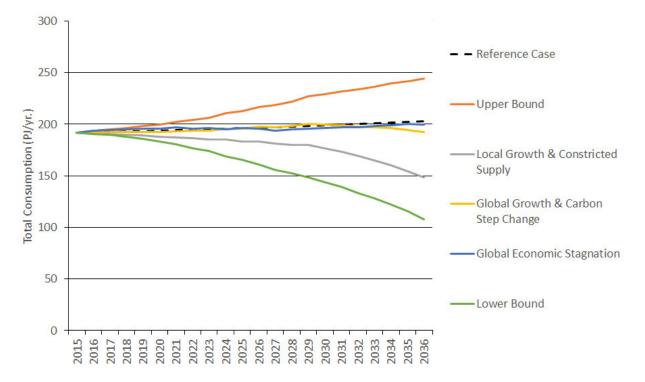


Exhibit 1 – Example Output after Completing Both 'If, Then' and 'What If' Methods

We recommend completing activities under four work packages:

- Work Package 1: Characterize Critical Drivers and Finish Developing Reference Case
- Work Package 2: Parametric Analysis and Boundary Scenario Definitions
- Work Package 3: Planning Scenario Definitions
- Work Package 4: Scenario Analysis and Modelling

Work Package 1 – Characterize Critical Drivers and Finish Developing Reference Case *Activity 1.1 – Initiation Meeting*

Objective: Define key critical drivers; Solicit input and direction from Enbridge Energy Transition Scenario Analysis (ETSA) team

Deliverables: Meeting minutes

The initiation meeting will identify logistical, scheduling and communications issues and protocols and will be an opportunity for the consulting team to request specific data and research products.

The second part of the meeting will involve a working session which will focus on prioritizing critical drivers "CDs" and collecting input and context from the Enbridge ETSA team [See Appendix A for a list of potential CDs]. We will also identify relevant internal Enbridge stakeholders and define agenda items ahead of the discovery sessions described in Activity 1.2.

Activity 1.2 – Discovery Sessions

Objective: Meet with Enbridge staff to identify relevant internal data and research, discuss relational effects and solicit input on reasonable ranges (and likely probability distribution of these ranges) for each of the key critical drivers.

Deliverables: Meeting minutes

Under this activity, a series of discovery meetings (1-2 hours each) will be held with Enbridge staff across different departments to solicit input and identify relevant internal data sources (e.g., information on RNG, Hydrogen research and forecasts). These may include:

- Network Planning/IRP
- Load Forecast (and load forecast inputs),
- Gas Supply Planning
- Renewable Gases forecasting (staff familiar with RNG and Hydrogen),
- Carbon Capture & Storage,
- Transportation or other load growth
- Codes/Standards/Government Relations
- Carbon Pricing
- Revenue Requirements/Rate Impacts

*If Enbridge can do most of this work, PG effort can be scaled back, but not completely. At a minimum, effort needed to provide direction on what input is required and to review and process outputs (~ 16 hours).

Activity 1.3 – Identify & Collect Additional Data Sources, Finalize Critical Driver Assumption Tables

Objective: Compile a complete characterization of key critical drivers, with details on relational effects, possible ranges, and the likely probability distribution of these ranges (e.g., are they normally distributed?).

Deliverables: Critical Driver Assumption Tables

We will work with the Enbridge ETSA team to follow up and collect information discussed during the discovery sessions. If forecasts for certain drivers do not exist (e.g., RNG potential and cost points), Posterity Group can help advise on reasonable ranges.

We will also work with Enbridge to facilitate access to relevant external data sources. For example:

- Permission to use data from Posterity Group's 2017 MOECC study; and
- Permission to use IESO APS data, so that end-use fuel share components can be built out and be aligned with APS.

Activity 1.4 – Finish Developing Reference Case

Objective: Build out a more comprehensive end-use level reference case, including adding electric enduses and gas rate classes

Deliverables: More comprehensive reference case dataset (to be provided under Work Packages 2 and 4)

During this activity we will build-out additional elements of the reference case in Enbridge's existing end-use model. For example, the current model does not include electricity or other fuel use (or gas fuel shares) so effort will be required to determine the scale of potential for switching from electricity (or other fuels) to/from gas.

We also plan to add gas rate classes at this point to enhance future functionality of the model (e.g., introducing rate classes will be important for assessing rate impacts of forecasted gas use changes).

Work Package 2 – Parametric Analysis and Boundary Scenario Definitions Activity 2.1 – Parametric Analyses

Objective: Understand the effects of each critical driver over its range in the forecast period

Deliverable: Inputs to Activity 2.2 deliverable

A parametric analysis will be undertaken for each critical driver of interest to understand the effects of each critical driver over its range in the forecast period. This activity will include analysis against the reference case.

The output of this parametric analysis will be represented as a set of functions describing how volume and peak is affected by each critical driver over its range.

Activity 2.2 – Boundary Scenario Definitions

Objective: Bound the possible futures, i.e., defining upper and lower boundaries to establish a cone of uncertainty.

Deliverable: Planning dataset (including reference case outputs, upper and lower boundary scenarios, and critical driver sensitivity outputs)

Subject to discussion with Enbridge, this activity could involve conducting stochastic (i.e., probabilistic) simulation using the probability distributions assigned to the critical drivers. We

plan to vary the 5 most impactful critical drivers, while holding all others constant. The outcome of this simulation will allow us to define upper and lower bounds to the forecast.

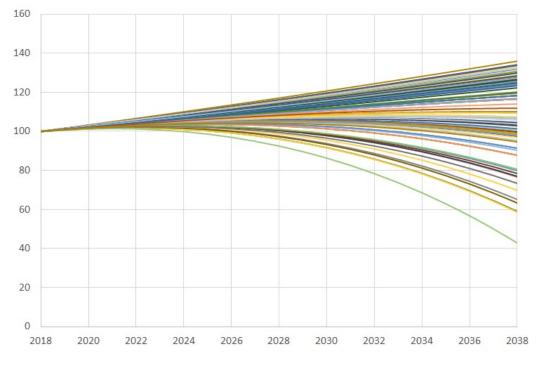


Exhibit 2 – Stochastic Simulation Example

Activity 2.3 – Update User-Interface Tool

Objective: Provide intuitive access to the planning dataset and present information in an actionable format

Deliverable: Updated Power BI user-interface to support Work Package 3 planning session

This activity involves updating the Power BI user-interface tool currently being developed to support DSM and IRP planning. This tool will allow Enbridge users to interact with the detailed modelled planning data set and quickly explore the impact of changing one or several critical drivers over a planning period. Users will be able to adjust 'sliders' to see the effects of varying different critical drivers and see how outcomes compare to the reference case, and where they are positioned relative to the upper and lower boundaries.

Work Package 3 – Planning Scenario Definitions

Activity 3.1 – Planning Session to Develop Scenario Narratives

Objective: Define planning scenario narratives

Deliverable: Scenario narratives and instructions on directional change of critical drivers

Under this activity, the consulting team will facilitate a workshop with Enbridge stakeholders to define a set of 'what if' planning scenarios; first via narrative, then in relation to the directional change in each of the critical drivers. This activity will have three parts:

Part 1 - Pre-planning session preparation

The objective of part one is to develop strawman planning scenario descriptions

Ahead of the planning session, we will solicit input from the Enbridge ETSA team and additional company stakeholders to draft strawman scenario descriptions. We have budgeted for 3 planning scenarios, which could potentially include:

- A consensus scenario that describes what Enbridge "thinks will happen",
- An aggressive decarbonization scenario (e.g., 80% GHG reduction by 2050), and
- A utility decentralization scenario with rapid technological disruption, lower electric prices, the advent of smart cities and clean tech.

We imagine some of the thinking that went into the MaRs scenario work may be useful inputs to consider when developing these scenarios along with many other key thinking and work products for recent filings, etc.

Part 2 - Planning session

The objective of Part 2 is to finalize planning scenario narratives.

The planning session will be aided by the strawman scenario descriptions and by the user-interface tool developed in Work Package 2.

We will structure the planning session to provide attendees an overview of the critical drivers and their impacts, introduce the reference case and upper and lower boundaries, and then table the 'what if' planning scenarios for discussion.

We will discuss critical drivers relative to each planning scenario and session stakeholders will be able to adjust critical drivers across their range to see the impacts on the planning forecast.

Part 3 - Post-planning session investigation and input

The objective of Part 3 is to collect input on directional change and magnitude of change for each critical driver under each planning scenario.

As a following up to the session, we will provide instructions for users to navigate the userinterface tool to explore each planning scenario narrative and record their input on critical driver changes. We hope to solicit input from planning session attendees, as well as additional key stakeholder at Enbridge who were not able to attend the session. The goal is to have input from a large enough group of Enbridge stakeholders to leverage the benefits of 'crowd forecasting' to establish consensus on the direction of change (and the magnitude of this change) for each critical driver for each planning scenario.

Activity 3.1a – External Stakeholders - Develop Scenario Narratives

Objective: OPTIONAL ACTIVITY - Define external stakeholder-driven scenario narratives

Deliverable: Scenario narratives and instructions on directional change of critical drivers

Under this activity, the consulting team will facilitate a workshop with Enbridge's external stakeholders to define 'what if' planning scenarios that incorporate external stakeholder views and input. This process can provide value in two ways:

- A more robust analysis can be developed by drawing on external knowledge and expertise, and
- Enbridge is given the opportunity to discuss ETP issues constructively with external stakeholders in an informal forum rather than as part of a regulatory proceeding. In Posterity Group's experience, this approach has often led to fewer, and more focused intervenor requests in subsequent regulatory filings.

This activity will be structured similarly to Activity 3.1, step 2. We anticipate using much of the same material and process to deliver an external-facing workshop to define scenarios, first via narrative; then in relation to the directional change in each of the CDs.

For the purposes of this proposal, we assume outputs from this session will inform 'Part 3' of the internal process outlined above (i.e., external input will ultimately inform the three internal planning scenarios).

Activity 3.2 – Develop Input Assumptions for Planning Scenarios

Objective: Define input assumptions for each planning scenario based on outputs of Activity 3.1

Deliverable: Scenario input assumption tables

We will review and collate findings from Activity 3.1 and draft a set of input assumptions for each planning scenario. The draft assumption tables will be circulated to the Enbridge ETSA team for review and input before finalizing.

Work Package 4 – Scenario Analysis and Modelling

Activity 4.1 – Scenario Modelling

Objective: Provide a comprehensive end-use level dataset that reflects several possible futures and a user-interface tool that allows decision makers to explore this dataset and distill quantitative impacts (e.g., how gas use and GHG emissions will change) under different forecast scenarios

Deliverable: Complete planning dataset (including reference case outputs, upper and lower boundary scenarios, critical driver sensitivity outputs, and planning scenarios); Updated Power BI user-interface

We will undertake detailed modelling of the defined planning scenarios, each representing a potential "future world" under which Enbridge would deliver services. The parametric analyses outputs developed under Work Package 2 and the input assumption developed under Work Package 3 will be used as inputs to model analyses for each of the planning scenarios.

The user interface tool will be updated as part of this activity to enable exploration of the future planning scenarios.

Activity 4.2 – Review Scenario Results with Enbridge and Revise

Objective: Assess the degree of variation of results, and ground truth modelled impacts

Deliverable: Revised planning dataset and User-interface

This activity is proposed because we understand producing scenario results can sometimes necessitate iteration. During this step we will review modelled results with the Enbridge ETSA team with two objectives:

- To assess whether the degree of variation in the results is sufficient to explore the desired range of outcomes, and
- To 'ground truth' the modelled impacts with respect to required actions in the physical world (e.g., rate of efficient new construction).

This activity is included as an explicit step for review and iteration.

3 Schedule

We propose the following milestone schedule:

Exhibit 3 – Milestone Schedule

Work Package	Work Package Timelines	Activity Completion Dates
1 – Characterize Critical Drivers and Finish	Mid July –	A1.1 Late Jul
Developing Reference Case	Early September	A1.2 Early Aug
		A1.3 Mid Aug
		A1.4 Early Sep
2 – Parametric Analysis and Boundary	Mid September –	A2.1 Early Oct
Scenario Definitions	Late October	A2.2 Mid Oct
		A2.3 Late Oct
3 – Planning Scenario Definitions	Early November –	A3.1 Late Nov
	Early December	A3.2 Early Dec
4 – Scenario Analysis and Modelling	Mid December –	A4.1 Mid Jan
	Early Feb	A4.2 Early Feb

4 Budget and Level of Effort

Exhibit 4 presents an estimated level of effort for each project activity; actual time required could vary across activities and work packages.

Exhibit 5 includes notes on each budget line item and indicates which activities are optional and where there is additional flexibility in the budget estimate.

Similar to previous engagements with Enbridge, we propose undertaking work on an hourly basis against an overall budget ceiling, with a monthly billing cycle for fees incurred in the preceding month.

Activity	Activity Name	Total Hours	Total Cost
WP1 - Cri	tical Drivers & Reference Case		
1.1	Initiation Meeting		
1.2	Discovery Sessions		
1.3	Additional Data Sources, Finalize CD Tables		
1.4	Finish Developing Reference Case		
1.3a, 1.4a	Provide Documentation		
	PM allowance		_
	WP1 Sub-total		
WP2 - Pa	rametric Analysis and Boundary Definitions		
2.1	Parametric Analysis		
2.2	Boundary Definitions		
2.3	Update User-Interface Tool		
	PM allowance		
	WP2 Sub-total		
WP3 - Pla	nning Scenario Definitions		
3.1	Planning Session to Develop Narratives (Internal)		
3.1a	Planning Session to Develop Narratives (External)		
3.2	Develop Input Assumptions for Planning Scenarios		
3.2a	Incorporate External Input		
	PM allowance		
	WP3 Sub-total		
WP4 - Sc	enario Analysis and Modelling		
4.1	Scenario Modelling		
4.2	Review Scenario Results w/ EGI & Revise		
4.1a, 4.2a	Provide Documentation		
	PM allowance		
	WP4 Sub-total		L
PROPOS	ED BUDGET CEILING		

Exhibit 4 – Proposed Budget

Exhibit	5 -	Budg	get]	Notes

Work Package	Activity	Flexibility Category	Notes
WP1	1.1 Initiation Meeting	Core	Required to define key critical drivers, and solicit input and direction
WP1	1.2 Discovery Sessions	Flexible	If Enbridge can do most of this work, PG effort can be scaled back, but not completely. At a minimum, approximately needed to provide direction on what input is required and to review and process outputs.
WP1	1.3 Additional Data Sources, Finalize CD Tables	Core	Scales based on final list of CDs. Relationship is not linear – some CDs require more effort to characterize and model.
WP1	1.4 Finish Developing Reference Case	Core	Required to build out a more comprehensive end- use level reference case, including adding electric end-uses and gas rate classes.
WP1	1.3a, 1.4a Provide Documentation	Core	Required to document assumptions.
WP1	PM Allowance	Core	Scales based on total WP effort.
WP2	2.1 Parametric Analysis	Core	Scales based on final list of CDs. Relationship is not linear – some CDs require more effort to characterize and model.
WP2	2.2 Boundary Definitions	Core	Required to define upper and lower boundaries.
WP2	2.3 Update User- Interface Tool	Core	Required to update and customize User-Interface to support WP3.
WP2	PM Allowance	Core	Scales based on total WP effort.
WP3	3.1 Internal Planning Session	Core	Scales based on final list of CDs, and # of planning scenarios.
WP3	3.1a External Planning Session	Optional	External stakeholder input.

Work Package	Activity	Flexibility Category	Notes
WP3	3.2 Develop Input Assumptions	Core	Scales based on final list of CDs, and # of planning scenarios.
WP3	3.2a Incorporate External Input	Optional	External stakeholder input.
WP3	PM Allowance	Core	Scales based on total WP effort.
WP4	4.1 Scenario Modelling	Core	Scales based on final list of CDs, and # of planning scenarios.
WP4	4.2 Review Scenario Results w/ EGI & Revise	Core	Scales based on depth of review and # of iterations required to finalize analysis.
WP4	4.1a, 4.2a Provide Documentation	Core	Required to document assumptions.
WP4	PM Allowance	Core	Scales based on total WP effort.

Appendix A Possible Critical Drivers

Exhibit 5 identifies 16 possible critical drivers (CDs).

Exhibit 6 - Potential Critical Drivers for Analysis & Inclusion in Scenario Analyses

#	Critical Driver	r Source Comments		Mode of Operation
1	Carbon price	Range defined by Enbridge/PG	Potential for multiple discrete trajectories. Note that current model does not include electricity or other fuel use (or gas fuel shares) so significant effort would be required to determine the scale of potential for switching from electricity (or other fuels) to/from gas based on additional carbon price.	Price driver – fuel switching via elasticity at the customer level
2	Natural gas price	Range defined by Enbridge	Note that current model does not include electricity or other fuel use (or gas fuel shares) so significant effort would be required to determine the scale of potential for switching from electricity (or other fuels) to/from gas based on commodity price.	Price driver – fuel switching via elasticity at the customer level
3	Renewable Natural Gas supply	Enbridge, based on internal (and perhaps external) stakeholder input	Potential for multiple discrete trajectories	Fuel switching: defined level of displacement of natural gas at the system level, possibly policy-driven via clean fuel standards.
4	RNG cost	Enbridge, based on internal (and perhaps external) stakeholder input	Potential for multiple discrete trajectories	Exogenous – assume RNG cost based on external Enbridge forecasts.

REDACTED Filed: 2023-03-08 EB-2022-0200 Exhibit I.1.2-CCC-3, Attachment 2, Page 46 of 221

#	Critical Driver	Source	Comments	Mode of Operation
5	Hydrogen supply	Enbridge, based on internal (and perhaps external) stakeholder input	Potential for multiple discrete trajectories	Fuel switching: defined level of displacement of natural gas at the system level, possibly policy-driven via clean fuel standards.
6	Hydrogen cost	Enbridge, based on internal (and perhaps external) stakeholder input	Potential for multiple discrete trajectories	Exogenous – assume H2 cost based on external Enbridge forecast.
7	Customer growth	Enbridge	Potential for regional variation at the municipal level. (May require ability to hold customer numbers constant after specific years in specific regions)	Account growth
8	Natural Gas Transportation demand	Enbridge, based on internal (and perhaps external) stakeholder input	Customer segment definition would be required.	Defined level of fuel switching (from traditional transportation fuels). Addition of natural gas load in specific regions
9	Fuel switching	Enbridge or Enbridge/PG, based on internal (and perhaps external) stakeholder input	Potential for multiple discrete trajectories. Note that current model does not include Electricity use, so some effort would be required to determine scale of potential for switching from Electricity to Gas.	Policy Driver – Defined level of fuel switching: displacement of natural gas in specific regions, with the ability to vary input by sector. Price driver – fuel switching via elasticity at the customer level
10	Climate change impacts	PG to provide HDD/CDD estimates over study period	Potential for multiple discrete trajectories.	Treat as an exogenous driver: Examine effect of alternate HDD regimes on key scenarios.

#	Critical Driver	Source	Comments	Mode of Operation
11	Carbon capture impacts	Enbridge or Enbridge/PG, based on internal (and perhaps external) stakeholder input	Multiple discrete trajectories	Fuel switching: defined level of displacement of natural gas by "carbon captured natural gas" at the system or equipment level
12	Carbon capture costs	Enbridge, based on internal (and perhaps external) stakeholder input	Multiple discrete trajectories	Price driver – fuel switching via elasticity at the customer level
13	Price elasticity	Reference long-run price elasticity values developed by Posterity	Investigate at effects within a price elasticity range.	Treat as an exogenous driver: Examine effect of moving elasticity over its range on key scenarios.
14	New construction codes	Enbridge internal expertise & PG input to translate government statements into model inputs	Model how code impacts annual demand and the potential for running DSM programs.	Develop as a DSM scenario, or as an alternate baseline.
15	Retrofit codes	Enbridge internal expertise & PG input to translate government statements into model inputs	Model how code impacts annual demand and the potential for running DSM programs.	Develop as a DSM scenario, or as an alternate baseline.
16	Appliance standards	Enbridge/ PG	Model how standard impacts annual demand and the potential for running DSM programs.	Develop as a DSM scenario, or as an alternate baseline.

ETSA – Additional Hours Proposal

Project: Energy Transition Scenario Analysis (ETSA)
Re: Additional hours required to help assemble data and fill data gaps
Submitted to: Enbridge
Submitted by: Posterity Group
Date Submitted: 16 November 2020

1 Introduction & Background

Posterity Group (PG) and Enbridge (EGI) recently conducted Discovery Sessions for the ETSA project and are now preparing to undertake parametric analysis for each of the Critical Drivers (CDs). Although the EGI project team is working hard to collect and prepare data related to the CDs, we have realized we underestimated the amount of time and effort required to finalize the CD data. We apologize that the effort to assemble data was underestimated in the original proposal.

Value and outcomes for Enbridge

An investment of additional time now will:

- Allow the PG team to provide the support required at this important phase of the project to help establish internal frameworks for thinking about long term planning and processes to collect and aggregate data. This investment will be valuable to EGI in future planning cycles.
- Reduce the risk of data and important information being missed or incorrectly used, resulting in a better planning dataset and possibly less re-work required later.
- Ensure we do not run out of hours later in the project. We want to make sure budgeted hours for future tasks are available so that we can successfully complete the project.

Request for additional hours

We are requesting additional hours to allow our team to:

- 1) <u>Support EGI in its internal process of collecting CD input data</u>. Guided by our recent work with FortisBC (who is going through their 3rd end-use based long-term resource planning cycle), we underestimated the support EGI requires.
- 2) <u>Undertake research to fill data gaps</u>. We did not budget specific effort to undertake independent research to fill CD data gaps (e.g., long-term price elasticity literature review research). The effort to undertake this research is less than we have incurred for similar work with other clients thanks to the expertise we have already established.
- 3) Adapt CD data provided by EGI and facilitate iterative consultations with EGI to finalize. We did not account for differences in data and approaches between legacy UG and EGD. We also overlooked the extent to which we need to extrapolate, fill data gaps, and propose assumptions regarding potential upper and lower scenario planning bounds (in our work with FortisBC, they have typically undertaken this effort internally).

2 Additional Support Activities

We are requesting additional level of effort for three activities.

Activity 1.5.1 - Support EGI in its internal process of collecting CD input data

- Additional hours to support EGI in identifying what information is relevant to a CD and thinking through modelling impacts. This includes additional working meetings, phone calls, and email communication.
- Providing additional templates and guidance to facilitate data assembly

Outcome: An easier experience for EGI staff to assemble CD-related data.

Activity 1.5.2 - Undertake research to fill data gaps

There are gaps in data that EGI would like to address through additional research. For example, we have already identified EGI's short-term price elasticity assumptions are not applicable to the long-term planning exercise and there is a need for our team to propose long-term price elasticity assumptions based on a literature review. We anticipate there may be similar additional requirements to fill data gaps once the initial data from Enbridge has been assembled.

Outcome: The project has all the necessary input data to inform parametric analysis and scenario development activities; reduced burden on EGI staff to provide data.

Activity 1.5.3 - Adapt CD data provided by EGI and facilitate iterative consultations with EGI to finalize

- Extrapolate, consolidate, and adapt data
- Propose assumptions regarding potential upper and lower scenario planning bounds
- Consult with EGI to ensure any augmentations to the data (e.g., extrapolating or consolidating) are reasonable, and iterate if necessary

Outcome: CD data is structured properly to support parametric analysis and scenario development, minimizing the risk of data being misinterpreted or improperly treated in the modelling tasks; consensus on data augmentation.

3 Estimated Level of Effort

The table below presents a level of effort estimate for this work, but actual time required could vary for each activity. We recommend EGI consider approving a slightly higher budget ceiling; this would allow for greater flexibility in a situation where we (PG and EGI) jointly decide that more hours are required.

Activity	Activity Name	Hourly Rate:	
		Hours	Fee
1.5.1	Support EGI in its internal process of collecting CD input data		
1.5.2	Undertake research to fill data gaps		
1.5.3	Adapt CD data and consult with EGI		
1.5.4	Contingency/Other		
PROPOS	SED TOTAL		

ETSA – Reference Case Calibration Proposal

Project: Energy Transition Scenario Analysis (ETSA)
Re: Additional effort required to calibrate reference case to updated data
Submitted to: Sophear Net, Enbridge
Submitted by: Posterity Group
Date Submitted: 20 November 2020

1 Introduction & Background

The reference case being used for the ETSA project is based on the one developed for the recently completed APS (but includes some modifications made through our work supporting DSM planning and IRP activities). We understand Enbridge (EGI) has more recent base year and forecast data available. If EGI wants the ETSA project to reflect this updated information we could calibrate the APS reference case to align with EGI's recent data more closely; however, effort for this has not been scoped.

We would need direction very shortly if EGI wanted to make this update to avoid costly re-work (the reference case ideally needs to be updated before we can finalize parametric analysis and start scenario development activities).

Value for Enbridge

We understand EGI has an updated forecast that is using 2019 as the base year and includes an updated 10-year reference case trajectory.

Aligning the ETSA reference case with this updated information will allow ETSA scenarios to be compared to the most recent complete year of data and forecast. This means that changes to critical drivers will be more intuitive to EGI team members because alternate scenarios will be anchored around current base year data and an updated forecast trajectory.

It also improves the credibility of the outputs. For example, using the APS reference case assumptions entails a certain degree of risk; not all APS reference case assumptions make sense anymore, and some base year assumptions are unclear and difficult to trace.

Considerations for Enbridge

If moving to a 2019 base year and updated forecast trajectory, EGI needs to consider a couple elements:

- The ETSA project will be using base year and reference case numbers that differ from the DSM planning group (which is using the APS reference case); EGI needs to decide internally whether this is something that is acceptable.
- Whether EGI still wants to maintain a fully granular APS reference case for the ETSA project (2017 Base Year and forecast, with rate class and account information).

2 Proposed approach

We do not recommend undertaking a full, comprehensive update to the reference case; this is an extensive undertaking which we do not think is a good investment for EGI right now. Instead, a full update to the reference case should ideally be timed to support the next ETSA and APS planning cycles.

The simplified approach we recommend involves:

- Calibrating the APS 2019 consumption numbers so that they align with 2019 normalized actuals; essentially a step function change in the model, moving from a 2017 to a 2019 base year.
- Updating the APS reference case growth assumptions (2020-2038) to align with the EGI's updated 10-year forecast. In other words, adjusting the trajectory of the reference case to match EGI's current outlook.

What APS assumptions and structure would need to be maintained?

- Assumption about end use share. I.e., the % of gas that goes to each end use within each segment (except for industrial and large volume HVAC assumptions, which we are fixing).
- Sector segmentation structure. For example, to avoid significant additional effort, we need to maintain APS segment categories so that APS analysis outputs are still applicable.
- Similarly, assumptions about equipment/measure saturation will not be adjusted (nothing beyond what we have already adjusted for DSM planning purposes).
- Electricity end-use assumptions.

What are the impacts to the CD parametric analysis?

- We will need a full list of assumption that went into the updated 10-year forecast so that it is clear what CD assumption have changed between 2018 and 2020.
- This will be important because CD parametric analysis will be modelling the delta between a future CD assumption and the assumption embedded in the reference case.

3 Reference Case Calibration Activities

To calibrate the reference case to 2019 data, we would undertake two activities.

Activity 1.6.1 – Calibrate to 2019 actual data

- Calibrate 2019 APS data using 2019 normalized actuals for each sector, by segment and by rate zone
- Discuss data inconsistencies with EGI, if required, and iterate calibration.

Outcome: ETSA scenarios can be compared to the most recent complete year of data; More credible outputs.

Activity 1.6.2 – Update reference case growth assumptions

- Update the APS reference case growth assumptions (2020-2038) to align with the EGI's updated 10-year forecast. This includes updating the account growth and consumption growth for each sector, by segment and rate zone and extrapolating trend out to 2038.
- Discuss data inconsistencies with EGI, if required, and iterate calibration.
- We will require from EGI a full list of assumptions embedded in 10-year forecast, including but not limited to assumptions on codes and standards, gas price, carbon price, price driven fuel switching, and DSM.
- We will also need to understand if growth assumption should flatline (rather than continuing on the same trajectory) beyond the 10 year forecast for any of the segments-rate zone combinations.

Outcome: More intuitive critical drive modelling outputs because alternate scenarios will be anchored around current base year data and an updated forecast trajectory; More credible outputs.

4 Estimated Level of Effort & Schedule Impact

The table below presents a level of effort estimate for this work, but actual time required could vary for each activity.

Activity	Activity Name	Hourly Rate:	
		Hours	Fee
1.6.1	Calibrate to 2019 actual data		
1.6.2	Update reference case growth assumptions		
PROPO	SED TOTAL		

The project schedule would be impacted by approximately 2-3 weeks. We would need to complete this work prior to finalizing parametric analysis and undertaking scenario analysis.

Energy Transition Scenario Analysis project Workplan & Schedule Revision

Project: Energy Transition Scenario Analysis
Re: Request to end the project by May 31, 2021
Submitted to: Jennifer Murphy and Cora Carriveau, Enbridge
Date Submitted: Revised 19 February 2021

1 Introduction & Background

We understand EGI would like to complete the project early because the current project completion date of June 30 is out of sync with internal needs. We believe we can complete the project a month earlier (May 31) by making workplan adjustments and revising the project budget.

Value for Enbridge

Finalizing the project sooner will allow EGI to incorporate project outputs in their internal planning processes. It should also reduce the risk of additional budget overruns.

Areas of Opportunity

We reviewed each active and upcoming project work package for opportunities to accelerate the project schedule without compromising the deliverables. We identified five areas of opportunity:

- 1) ETSA team (PG, EGI) to commit to timelines for providing feedback and information [Additional Budget Required? No]
 - Moving forward, we should be screening issues, questions, and items flagged for input to assess whether they have a material impact on the project outcomes, including whether input/feedback is on the critical path. Priority issues require deadlines for feedback and turn-around.
- 2) Support to address unbudgeted effort [Additional Budget Required? Ideally]
 - The project is currently tracking over budget, largely due to additional time required in work package (WP) #1 for the initiation meetings, discovery sessions, and defining and developing critical driver (CD) inputs.
 - This unbudgeted effort was important to help the EGI ETSA team build awareness about the scenario planning process and invest in its internal capacity to understand critical drivers and identify key input assumptions across the company

- In hindsight, we underestimated the time required to work with EGI to accomplish these activities largely because our budget estimate was guided by recent projects with FortisBC, who has already gone through several planning cycles
- The budget overrun is larger than we would like, but we acknowledge Posterity Group should share part of this risk
- We would like to request EGI consider adding budget to cover a portion of this overrun; any additional budget will be applied to the remaining project activities and will allow Posterity Group to complete the project with an improved budget outcome.
- 3) Remove external stakeholder activities from WP3 [Additional Budget Required? No, budget reduction]
 - After discussion with Enbridge, we should decide whether external stakeholder tasks are required and if effort can be redeployed. Omitting activities 3.1a and 3.2a from the schedule will shorten the timeline for WP3 and reduce the risk of further schedule slip.
 - Budget for these external stakeholder activities can be redeployed. The additional budget can support the scenario planning
 exercise, which we hope will ensure the subsequent tasks of scenario analysis and modelling can be conducted very efficiently.
- 4) Start WP3 now to complete WP3 sooner [Additional Budget Required? Yes]
 - Initiate WP3 now so that we start working on the scenario narratives in parallel to WP2. We suggest having a draft of the scenario narratives and qualitative input assumptions in mid-March and finalize them using the results of WP2 in late March.
 - We propose adding budget to cover additional effort in February and beginning of March. This effort will focus on facilitating a constructive planning session and streamlining post-planning input.
- 5) Reduce need for revisions in WP4 [Additional Budget Required? No]
 - To meet a May 31 deadline, we are assuming revisions to the scenarios will be minimal, or perhaps not even required, due to time invested in the preceding work packages.

The following sections provide a summary of the current workplan, our proposed adjustments to accelerate the project timeline, and the estimated additional level of effort.

2 Current Workplan & Schedule

Figure 1 below provides a Gantt view of the schedule. This information is current as of February 12th, 2021 and shows that:

- The work packages (WP) are sequential, and currently have the following status:
 - WP1 is nearly complete
 - o WP2 is underway
 - WP3 and WP4 have not started
- Project end date of June 30th, 2021

Figure 1 – Current Schedule, Gantt view

Work Packages	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June
WP1: Critical Drivers & Reference Case												
WP2: Parametric Analysis & Boundary Definitions												
WP3: Scenario Definitions												
WP4: Scenario Modelling & Analysis												

3 Revised Workplan & Schedule

We have reviewed each active and upcoming project work package for opportunities to accelerate the project schedule without compromising the deliverables:

All Work Packages

- Screen issues, questions, and items flagged for input to assess whether they have a material impact on the project outcomes, including whether input/feedback is on the critical path.
 - For priority issues, ETSA team to commit to timelines for providing feedback and information.
- Ensure sufficient budget is available to complete remaining activities.
 - WP1 is currently over budget, largely due to additional time required for the initiation meetings, discovery sessions, and defining and developing CD inputs.
 - We propose adding budget to ensure sufficient effort is available for the remaining project activities.

Work Package 2 – Parametric Analysis & Boundary Definitions

• We do not think it is feasible to accelerate WP2. The tasks in this work package are time intensive and are very difficult to accelerate without jeopardizing project outcomes.

Work Package 3 – Scenario Definitions

- We believe we can accelerate WP3 so that is starts mid-February and ends in late March:
 - Initiate WP3 now so that we start working on the scenario narratives in parallel to WP2. We suggest having a draft of the scenario narratives and qualitative input assumptions in early March and finalize them using the results of WP2 in late March.
 - We'd like to discuss how to we can update our approach for WP3. The objectives are:
 - Capitalize on the time window between mid-February and completion of WP2 to facilitate scenario narrative discussions and strategies with Enbridge [Activity 3.1.1]
 - Hold a constructive planning session as soon as WP2 is complete (i.e., as soon as the parametric analysis and slider tool are ready) [Activity 3.1.2]

- Streamline post-planning session feedback and input to arrive at a final set of scenario definitions and qualitative input assumptions. [Activity 3.1.3]
- After discussion with Enbridge, we should decide whether external stakeholder tasks are required and if effort can be redeployed. Omitting tasks 3.1a and 3.2a from the schedule will shorten the timeline for WP3 and reduce the risk of further schedule slip.
- Posterity Group to work with EGI to agree on a revised approach for WP3; the goal is to initiate work package activities as soon as possible, streamline stakeholder input, and minimize rework in WP4.

Work Package 4 - Scenario Analysis and Modelling

- We think we can slightly reduce length of WP4 so that the project can be completed by May 31st.
 - The main opportunity for reducing the timeline is in Activity 4.2 (reviewing and revising scenario modelling outputs). We expect the comprehensive feedback and input provided in the preceding work packages (WP1, WP2, and WP3) will ensure the scenario results are robust and will facilitate a shortened review and revision timeline.
 - We also propose redeploying effort from Activity 4.2 to Activity 4.1, to ensure draft results align with the intentions documented in WP3.
 - To meet a May 31 deadline, we are assuming revisions to the scenarios will be minimal, or not necessary.
- Rerunning the scenarios is time intensive and is difficult to accelerate due to the complexity of the model and size of the datasets. There is a minimum level of effort to make one adjustment because revisions to one aspect of a scenario typically have cascading effects in the model. If revisions are required, we will need to carefully discuss and agree on a complete list of revisions required prior to re-running the scenario models.

Revised Schedule

These suggested revisions result in the revised schedule presented in Figure 2 and Table 2 below.

REDACTED Filed: 2023-03-08 EB-2022-0200 Exhibit I.1.2-CCC-3, Attachment 2, Page 58 of 221



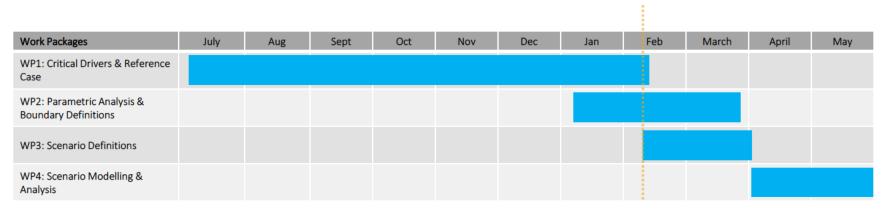


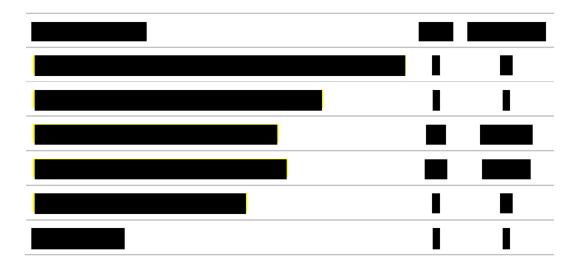
Table 1 – Revised Workplan

Task Name	Start	Finish	Status
WP1 - Critical Drivers & Reference Case	07-20-20	01-12-21	
WP1 PM	07-20-20	10-23-20	Complete
1.1 Initiation	08-25-20	08-25-20	Complete
1.2 Discovery Sessions	10-05-20	10-16-20	Complete
1.3 Additional Data Sources, Finalize CD Tables	08-31-20	10-09-20	Complete
1.4 Finish Developing Reference Case	09-28-20	12-04-20	Complete
1.4.1 Calibrate to 2019 actual data	12-07-20	01-04-21	Complete
1.4.2 Update reference case growth assumptions	12-14-20	01-11-21	Complete
1.5.1 - Support EGI in its internal process of collecting CD input data	10-19-20	12-31-20	Complete
1.5.2 - Undertake research to fill data gaps	10-19-20	12-31-20	Complete
1.5.3 - Adapt CD data and consult with EGI	10-26-20	12-31-20	In Progress
1.5.4 - Contingency	11-02-20	12-31-20	Complete
WP1 Documentation	12-23-20	01-12-21	Complete
WP 2 - Parametric Analysis & Boundary Definitions	01-12-21	03-22-21	
WP2 PM	01-19-21	03-22-21	In Progress

Task Name	Start	Finish	Status
2.1 Parametric Analysis	01-12-21	03-01-21	In Progress
2.2 Boundary Definitions	02-23-21	03-15-21	Not Started
2.3 Update User-Interface Tool	02-01-21	03-05-21	In Progress
WP2 Documentation	03-02-21	03-22-21	In Progress
WP 3 - Scenario Definitions	02-16-21	03-26-21	
WP3 PM	02-16-21	03-26-21	Not Started
3.1.1 Scenario Narrative Sessions Preparation	02-16-21	03-05-21	Not Started
3.1.2 Scenario Narrative Development Session	03-08-21	03-12-21	Not Started
3.1.3 Post-Session Information Consolidation	03-08-21	03-19-21	Not Started
3.2 Develop & Finalize Input Assumptions for Planning Scenarios	03-08-21	03-26-21	Not Started
WP3 Documentation	02-22-21	03-26-21	Not Started
WP 4 - Scenario Analysis and Modelling	03-29-21	05-28-21	
WP4 PM	03-29-21	05-28-21	Not Started
4.1 Scenario Modelling	03-29-21	05-14-21	Not Started
4.2 Review Scenario Results with Enbridge and Revise	05-17-21	05-28-21	Not Started
WP4 Documentation	05-03-21	05-28-21	Not Started

4 Estimated Additional Level of Effort & Budget

The table below presents a level of effort estimate and associated budget to complete the project on an accelerated schedule.



Level of Effort Estimate: Rebasing Support

Project: Energy Transition Scenario Analysis (ETSA)
Re: Estimated level of effort to facilitate using ETSA outputs for the rebasing application
Submitted to: Jennifer Murphy and Cora Carriveau, Enbridge
Submitted by: Alex Tiessen & Erika Aruja, Posterity Group
Version: 1
Date Submitted: 30 July 2021

The memo provides details on the additional effort and budget associated with supporting EGI with its rebasing application.

1 Scope of Work: Supporting EGI's Rebasing Application

As of July 15th, the ETSA project has gone over budget by 140 hours (\$28,000):

- A component of this budget overrun is attributed to support Posterity provided to facilitate the use of ETSA scenario outputs by EGI's load forecasting group in their preparation for the upcoming rebasing application
- The project charter had not originally anticipated direct use of ETSA scenario outputs in EGI's rebasing application
- Additional effort was required to:
 - respond to inquiries,
 - participate in meetings,
 - enhance reporting outputs, and
 - revisit previous decisions made on critical drivers, scenario inputs, and base year and reference case calibration

2 Level of Effort & Budget: Supporting EGI's Rebasing Application

Exhibit 2 presents an estimate of the hours spent by the Posterity team between June 14 and July 15 in support of the rebasing application.

Exhibit 1 – Estimated Effort and Cost for Rebasing Application Support

Activity	Hours	<mark>Cost</mark>
Supporting EGI's Rebasing Application		
TOTAL		

Scoping Document: Adjusting ETSA Scenarios

Project: Energy Transition Scenario Analysis (ETSA) Re: Estimated level of effort to adjust the Diversified and Steady Progress scenarios Submitted to: Jennifer Murphy and Cora Carriveau, Enbridge Submitted by: Alex Tiessen & Erika Aruja, Posterity Group Version: 2 Date Submitted: 30 July 2021

This memo provides an estimate of the level of effort, budget and schedule required to adjust the Steady Progress and Diversified Portfolio ETSA scenarios based on EGI's direction. We estimate a and an elapsed project schedule of 6 weeks.

1 Scope of Work: Scenario Adjustments

1.1 Adjustments Required

After reviewing outputs for the Steady Progress and Diversified Portfolio scenarios, EGI determined the scenario analysis should be revised to incorporate different input assumptions:

Scenario Title:	"Steady Progress"	"Diversified Portfolio"
ORIGINAL DRIVER ASSUMPTIONS Customer Accounts (growth due to population/economic growth)	Detached/Attached Residential: High (due to community expansion) Commercial and Multifamily Residential: High (due to community expansion) Industrial: Reference	Detached/Attached Residential: High (due to community expansion) Commercial and Multifamily Residential: High (due to community expansion) Industrial: Reference
ADJUSTED DRIVER ASSUMPTIONS Customer Accounts (growth due to population/economic growth)	Reference Case for all sectors.	Reference Case for all sectors.

1. Apply the reference case account forecast to the Steady Progress and Diversified scenarios.

2. Incorporate a customer defection assumption into non-price driven fuel switching for existing buildings in the Diversified scenario:

Scenario Title:	"Diversified Portfolio"
ORIGINAL DRIVER ASSUMPTIONS Non-price driven fuel switching	 New Construction (Res, Com sectors) Starting in 2030, 10% of new Res and Com buildings across the province won't connect to the gas grid because select communities ban gas; by 2038, 20% of new construction won't connect.

Scenario Title:	"Diversified Portfolio"		
	 Existing Buildings (Res, Com sectors) Starting in 2026, province wide, 10% of gas-fired space & water heating equipment that is being replaced annually (due to equipment reaching end-of-life) will be replaced with electric equipment (due to incentives). 		
ADJUSTED DRIVER ASSUMPTIONS Non-price driven fuel switching	 New Construction (Res, Com sectors) Starting in 2030, 10% of new Res and Com buildings across the province won't connect to the gas grid because select communities ban gas; by 2038, 20% of new construction won't connect. Existing Buildings (Res, Com sectors) Starting in 2026, province wide, 10% of gas-fired space & water heating equipment that is being replaced annually (due to equipment reaching end-of-life) will be replaced with electric equipment (due to incentives). 10% of the customers installing new electric space heating equipment will disconnect from the gas system (the assumption is these customers only have 1 gas appliance) 		

1.2 Assumptions

- All remaining Critical Driver settings will be maintained.
- The output and results from these 'adjusted' scenarios will replace the 'original' output/results (i.e., these adjustments do not create new scenarios).

1.3 Activities Involved

As discussed, adjustments to critical drivers typically require cascading updates to other critical driver inputs and elements of the scenario analysis. For each scenario, we will need to:

- Adjust the model input assumptions for the 'customer accounts' driver [both scenarios] and 'non-price fuel switching' driver [Diversified Portfolio scenario only]
- Re-run the model:
 - Account growth modelling instructions will need to be updated [both scenarios]
 - Existing account modelling instructions will need to be updated [Diversified Portfolio scenario only]
 - Fuel share modelling instructions for existing accounts will need to be updated [Diversified Portfolio scenario only]
 - Target PJ/Blend % modelling instructions for RNG and Hydrogen will need to be recalibrated [both scenarios]
 - DSM savings potential modelling instructions will need re-solved and re-applied at the rate class level [both scenarios]
- Quality Control review the adjusted scenario outputs
- Update the study report and PowerBI dashboard
- Review with EGI and respond to questions
- Edit and submit final deliverables.

2 Schedule: Scenario Adjustments

The proposed schedule incorporates the following:

- Time to rerun the DSM budget solver model which takes several days of elapsed time.
- Time to incorporate final comments on the ETSA study report and PowerBI dashboard
- Summer vacation schedules (which may cause our team to take a bit longer to finish some activities).

Exhibit 1 – Proposed Schedule

Activity	Completion Timeline	
Adjust model input assumptions	1 weeks after project initiation	
Re-run the two scenarios	4 weeks after project initiation	
QC output	5 weeks after project initiation	
Update the study report and PowerBI dashboard	5 weeks after project initiation	
Review with EGI and answer questions	6 weeks after project initiation	
Submit final deliverables	6 weeks after project initiation	

3 Level of Effort & Budget: Scenario Adjustments

Exhibit 2 presents a level of effort estimate and associated budget to complete the proposed scenario adjustments.

Exhibit 2 – Estimated Effort and Cost for Scenario Adjustments

Activity	Hours	<mark>Cost</mark>
Adjust model input assumptions		
Re-run the two scenarios		
QC output		
Update the study report and PowerBI dashboard		
Review with EGI and answer questions		
Edit and submit final deliverables		
TOTAL		

July 20, 2021

Heidi Steinberg Laxton

Project Manager heidi.steinberglaxton@enbridge.com Jennifer Murphy Project Lead jennifer.murphy@enbridge.com Enbridge Gas Inc. (EGI)

Subject: Decarbonization Pathways Study

Dear Heidi & Jennifer,

With Enbridge Gas Inc. (EGI) currently preparing for a key rate rebasing period (2024-2028) and the continued policy narrative challenging the economy to address climate change, Ontario's integrated energy system is reaching a critical juncture. Energy systems are currently undergoing massive transformation in the ways that energy is generated, delivered, and consumed. The transformation is driven by a need to decarbonize systems and maintain resilient operations. Many advocacy groups and jurisdictional governments are promoting aggressive electrification of the energy system as an ideal solution to meet climate change targets. However, this position is largely unsupported by data on the feasibility and cost effectiveness.

Guidehouse is pleased to provide this proposal to EGI to provide a Decarbonization Pathways Study. We recognize that delivery of a decarbonized energy system requires a change to the commercial and regulatory structures governing the distribution sector. Policy and regulatory structure should provide a fair return for assets that serve the public's interest while supporting Canadian and Ontario government goals. These structures should also embrace mechanisms to mitigate risks associated with decarbonization. Specific and measurable guidelines are needed for utilities to demonstrate their assets complement the future energy system. This study will utilize our Low Carbon Pathways tools and analysis process to provide insights to inform internal planning efforts and educate external stakeholders, as necessary.

Our proposal highlights the extensive experience we have gained supporting the energy sector, including: utility companies, NGOs, and governments, with low carbon pathways analysis and GHG mitigation strategies. This proposal summarizes our tested approach that will support EGI with this very important work for the province of Ontario. The study will inform internal energy transition planning efforts related to, but not limited to, rebasing regulatory proceedings, scope 3 emission reduction targets, the Energy Transition Scenario Analysis (ETSA) project, and Integrated Resource Planning (IRP) work (i.e. the consideration of non-pipe solutions as alternatives instead of traditional infrastructure). The Study will also provide EGI with supporting material, including robust and defensible quantification of costs and benefits, to educate government, regulators and external stakeholders who are making energy transition decisions.

The key objectives of the project are to:

- **Develop** a robust comparative analysis of two decarbonization scenarios for the Ontario economy, including one focused on electrification-based mitigation strategies and one adopting a diversified, optimized low carbon fuels approach.
- Analyse the societal cost impacts of each decarbonization scenario.

• **Examine** the feasibility of decarbonization pathways and uncover a defendable and balanced policy narrative that supports provincial GHG reduction goals, manages costs for ratepayers and consumers and builds a narrative for EGI to communicate the role for clean fuels in a decarbonized future.

Guidehouse is uniquely positioned to support EGI with this assignment. The value of our approach includes:

- 1. Extensive experience with the energy sector and climate change mitigation strategy activities of Ontario and jurisdictions across North America, as well as expertise gained from our pioneering role in reframing the decarbonization narrative in Europe and British Columbia in the context of clean fuels.
- 2. A tested database of GHG mitigation technologies and decarbonization initiatives, inclusive of feasibility, potential, performance, and cost. For example, Guidehouse has led the DSM potentials examination for five provinces over the last several years and manages an industry-leading research practice tracking cost and performance data of electrification-focused clean tech and hydrogen production and storage technology
- Recent energy supply and demand modelling projects, providing deep experience with provincial data and pre-established projections offering start up and level-setting efficiencies
- 4. **Deep understanding of the Ontario and Canadian climate policy experience**, the challenges, the opportunities, and lessons learned from narrowly focused, or siloed approaches to low carbon policy
- 5. Access to core data, models, and cost information to support a rigorous analysis at high value for money for EGI.

As a result of these capabilities and traits, our team is poised and excited to begin the next phase of Ontario's low carbon journey with you. We will deliver impactful and innovative thinking, tailored to the unique circumstances of the province and of EGI's customers.

Guidehouse is a leading global provider of consulting services to the public and commercial markets with broad capabilities in management, technology, and risk consulting. We help clients address their toughest challenges with a focus on markets and clients facing transformational change, technology-driven innovation and significant regulatory pressure. Across a range of advisory, consulting, outsourcing, and technology/analytics services, we help clients create scalable, innovative solutions that prepare them for future growth and success. Headquartered in Washington DC, the company has more than 10,000 professionals in more than 50 locations. Guidehouse is led by seasoned professionals with proven and diverse expertise in traditional and emerging technologies, markets and agenda-setting issues driving national and global economies. For more information, please visit: www.guidehouse.com.

Should you have any questions or concerns with this proposal, please contact me at 647.212.7187, or <u>craig.sabine@guidehouse.com</u> at your convenience.

Sincerely,

Gy Sler

Craig Sabine, Director, Energy Lead Canada



Proposal for: Decarbonization Pathways Study



Submitted by:

Guidehouse Canada Ltd. 100 King Street West, Suite 4950 Toronto, ON M5X 1B1

416-956-5008 guidehouse.com

Reference No.: 219427 July 20, 2021

Table of Contents

1. Approach to Scope of Work	4
1.1 Task 1. Project Initiation	5
1.2 Task 2. Scenario Development	7
1.3 Task 3. Data Collection & Input Development	
1.4 Task 4. Decarbonization Pathways Modelling	
1.5 Task 5. Reporting	
1.6 Task 6. Stakeholder Engagement (if necessary)	25
2. Project Schedule and Deliverables	
2.1 Assumptions	26
3. Our Team	
4. Pricing	32
Appendix A. Qualifications	A-1
Appendix B. Guidehouse Overview	B-1

Executive Summary

The Guidehouse team is ready and immediately available to support EGI with an examination of practical decarbonization pathways for the province of Ontario and determine the benefits and impacts of a diversified, low carbon fuels strategy to achieve GHG reduction commitments.

Guidehouse is uniquely positioned to provide EGI with industry-leading analytic capabilities, decarbonization thought leadership and utility strategy, as well as access to economy-wide models and tools that are necessary to generate robust quantitative analysis of the energy system in Ontario. We have a deep understanding of the future role of gas in a decarbonized world which informs the appropriate framing for scenarios and guides the analysis, as demonstrated in our industry leading Gas for Climate, low carbon 2050 strategic work¹.

We are confident the Guidehouse solution will further empower EGI with innovative and practical insights about jurisdictional decarbonization. Our goal is to work with you and provide a policy platform from which to build a practical decarbonization roadmap for the province and a long-term strategy that cements the sustainability and resiliency of the gas infrastructure business.

Our core team is based in Canada and has delivered multiple provincial and national-level analyses of low carbon futures in this country and in Ontario. Our proposed low carbon pathways SME (Craig Sabine) has experience in low carbon scenario analysis going back to 2005; developing one of the first national level assessments of GHG abatement curves and the impacts on energy use and process emissions across economic sectors for the National Roundtable on the Environment and Economy (NRTEE). Our leadership team are senior, highly experienced and have recently conducted extensive analyses in Canada and globally, offering insights on the low carbon opportunities for jurisdictions from British Columbia, to Sweden and New York, as well as the associated societal cost impacts of decarbonization strategies.

Our solution leverages our in-house and proprietary *Low Carbon Pathways* (LCP) model (see Figure 1 below), combined with our deep industry knowledge and expertise with electricity and natural gas utility systems and related commodity markets. We have developed a powerful model to determine key energy flows, regional abatement opportunities and GHG impacts of clean energy supply, as well as demand-side GHG mitigation initiatives at the sectoral, subsectoral and end-use levels. Our analytic platforms also enable hourly and coincident energy peak capabilities, to ensure that the key energy system impacts are viewed holistically, and real costs are captured to better uncover more optimal low carbon and net-zero futures. Our LCP model produces a forecast of the costs and benefits of each scenario that can be shared and understood by stakeholders including government, the regulator and customers.

We recently completed a first of its kind analysis to determine the societal costs of low carbon pathways, inclusive of peak energy system investment requirements, utility rate impacts and stranded asset costs in the province of British Columbia, for FortisBC.²

¹ Gas for Climate: A Path to 2050 Link

² Pathways for British Columbia. Link

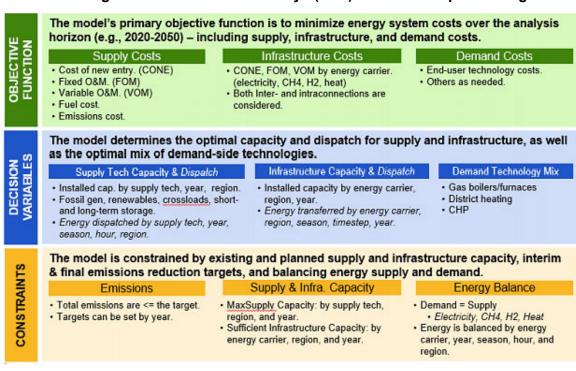


Figure 1. Low Carbon Pathways (LCP) Model Conceptual Design

Addressing Your Needs

For EGI, we will deliver an augmented decarbonization analysis of the Ontario energy sector that leverages learnings and data from our prior work. Guidehouse offers a tested approach to support EGI with this very important work for the province.

In alignment with many of our past analyses, decarbonization pathway scenarios will be developed to determine the GHG and cost impacts and test feasibility of differing approaches that are supportive of provincial decarbonization goals. The study will provide EGI with key support for internal energy transition planning efforts, including EGI's critical and current rebasing proceeding that will thrust EGI toward the short term 2030 GHG target. Robust decarbonization analysis can also support establishment of scope 3 GHG emission reduction targets, and Integrated Resource Planning (IRP) work (i.e. the consideration of non-pipe solutions as alternatives instead of our traditional infrastructure).

Our analysis will also offer insight for new regulatory structures and policy mechanisms needed to mitigate the risks associated with decarbonization. Specific and measurable guidelines are needed now so that utilities can demonstrate their assets complement the future energy system.

The Guidehouse solution is based on deep collaboration between Guidehouse and EGI, using workshops to determine the best data sources and discuss the key factors to consider in bounding the clean energy resources (CERs) and initiatives that will be modelled. We will build up a profile of CER initiatives and apply them against cross-sectoral energy demand scenarios to identify key opportunities to deliver GHG reductions in the economy.

Transformative CER potentials will be established, as only fully transformative pathways will support the achievement of 2050 targets. These transformative potentials will be bounded by reasonableness, guided by our experience conducting dozens of similar analyses and having a strong feel for the challenges and costs.

Why Guidehouse

Guidehouse is uniquely positioned to provide support to EGI on low carbon pathways and offer an analytic study that will provide deep insight and practical next steps. Our team is extensively experienced in Canada's energy sector, with low carbon pathways modelling and highly familiar with the Ontario context, based on our prior fuels sector technical study as part of the 2016 LTEP process, our widely known Achievable Potentials Study work with IESO and OEB, as well as extensive analysis of the provincial electricity sector policy, costs and programs.

Globally, Guidehouse pioneered a new direction toward energy sector decarbonization — transforming the net zero conversation from one where gas utilities were seen as an impediment, to one where they are part of the solution. We orchaestrated a revolutionary concept together with the *Gas for Climate* coalition resulting in a broadly accepted vision, by stakeholders, for a low carbon gas sector.

We have current models ready to be deployed that will allow for the greatest possible efficiency for EGI over the limited number of months available.

	WHY GUIDEHOUSE	VALUE TO EGI		WHY GUIDEHOUSE	VALUE TO EGI
llhh	Proven experience in developing quantitative low carbon scenario models	Pre-established modelling platform and data sources, as well as practical implementation experience to delivery visionary ideas	· ở -	Extensive clean energy supply use case development, including RNG and hydrogen supply initiatives	Incorporates leading industry thinking, knowledge of multi- jurisdictional policy and technical approaches
5	Successful, ongoing working relationships in Ontario	Guidehouse is known and trusted to major stakeholders such as the OEB, the MOE and the IESO, improving our ability to engage and facilitate the discussion	(Specific familiarity with your energy systems and industrial growth sector	Provides increased context to desired outcomes, deliverables, and regulatory needs
	Independent and neutral position in the market	Our analysis is vendor and technology- agnostic, which supports external engagement and offers the Province genuine and pragmatic advise	÷÷÷	Real world successful planning, engineering, and system operations	We have the energy industry experience, deepening our analysis for you and where policy sets the landscape for success

Figure 2. Key Guidehouse Benefits to EGI

1. Approach to Scope of Work

EGI requires an objective analysis of key pathways to Ontario's carbon neutrality. These pathways include both electrification-focused scenarios and scenarios underpinned by the use case of clean gas fuels and the associated resilient, flexible, and affordable infrastructure.

A scenario-based, *Pathways Assessment* is a critical element to build an understanding of the potential roles for gas and the ways that the gas infrastructure can be leveraged to cost-effectively meet the decarbonization objectives of Ontario.

The analysis will identify cost-optimized decarbonization pathways for the broader energy system (both gas and electric) within the constraints defined by the future scenarios, e.g., full electrification of the system or balanced electrification and gas use. *The pathways will articulate the potential timeframes to achieve desired reductions, identify key elements of societal and system costs of implementation, assess the impacts on electric grid demand/capacity and determine the peak demand cost impacts. Our analysis will also describe the risks of stranded assets using quantified modeling of decarbonization measures.*

We envision a study and tool that can help EGI plot a cost-optimized future energy system in Ontario and ensure key insight into how decarbonization goals can be delivered, considering:

- Affordability
- Peak energy demand impacts
- Clear pathways for *hard to electrify* sectors to participate in the future system
- Maintenance of resilience and reliability in the face of changing customer demands and increasing frequency of extreme weather conditions



Our collaborative approach will ensure that EGI receives objective analysis with outcomes linked to your overarching company strategy and addresses a triple bottom line, sustainable approach inclusive of people, planet, and profit.

We understand that the speed and accuracy of the deliverables will be critically important to the success of this project. To address this need, Guidehouse has built a team of dedicated staff with deep skills delivering gas decarbonization strategies across North America and deep expertise of the energy system in Ontario. We have an existing tool, our **Low Carbon Pathways (LCP) model**, that is ideally suited for assessing gas decarbonization pathways and exploring the role of gas supply and transport infrastructure. Our LCP model has proven its value to gas utility clients through recent project work in North America and Europe and can be deployed and adapted to the Ontario energy system very quickly.

1.1 Task 1. Project Initiation

Directly following contract execution, the Guidehouse team will launch the project through the project initiation phase with a kickoff meeting. The project initiation task will encompass the first week of delivery, including a kickoff workshop with the EGI team to ensure that an appropriate future vision for the assignment is established to guide the project through the entirety of the delivery schedule.

	Task 1. Summary & Highlights
Key Questions to be Answered:	 How will two (2) analytic scenarios be defined to capture the range of possible decarbonization pathways for Ontario?
	 What are the end goals/expected outcomes and critical objectives of this study? How is success defined?
	 What input data and assumptions are required by the LCP model? What data will be requested from EGI in order to begin pathway modelling?
	A PowerPoint deck including the following:
Key	 Finalized description of the two (2) scenarios and sensitivities to be included in modeling analysis.
Deliverables	 Summary methodology, modelling approach and LCP modelling configuration for Ontario
	 Detailed list of all input data required, proposed data sources, data gaps (if any), and data request to EGI
Expected EGI Involvement	Participation in a project kickoff workshop to establish the project goals, scenario definitions, key sensitivities, and appropriate communication strategies.

The two key activities in Task 1 include a kickoff meeting with the EGI team and agreement on Guidehouse's proposed modeling configuration of our Low Carbon Pathways (LCP) model for Ontario's energy system.

Kickoff Meeting: The objectives of the meeting will be to review the scope of work, to agree on the process for data collection, to finalize the scenario definitions to be included in the modeling analysis, and to agree on the final timeline for key meetings and submission of deliverables.

Topics to be discussed / decisions to be made at the kickoff meeting:

- Report table of contents (for purpose of Task 5)
- Final agreement around scenario definitions and sensitivities
- Confirmation of Task 2 data collection approach and Task 3 modeling approach
- Expected trends in the Ontario energy system that will be fundamental to the analysis
- Final agreement to timeline of key meetings and deliverable submission

Guidehouse will prepare notes documenting all decisions made in the kickoff meeting and which will be delivered to the Enbridge team within two (2) days following the kickoff meeting.

Pathways Modelling Configuration: Our proposed modelling approach will leverage our inhouse, energy systems **Low Carbon Pathways (LCP)** model to simulate the decarbonization of the energy system in Ontario through 2050. Our LCP model is ideally suited for this project and

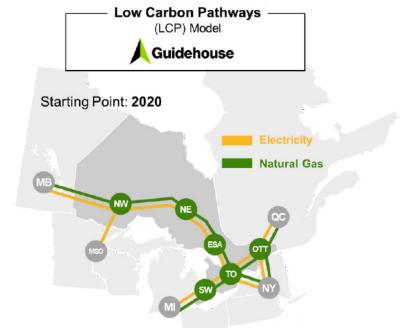
for developing decarbonization pathways for energy utilities. The LCP model is an integrated capacity expansion and dispatch optimisation model used to identify cost-effective pathways to a decarbonized electricity and gas system. A key feature of our modelling approach is that our LCP model enables zonal optimization of electricity and gas supply & transport infrastructure; by doing this it captures supply and demand dynamics across sub-regions.

Our LCP model will be configured to the unique characteristics of Ontario's gas and electricity networks, interconnections with neighboring jurisdictions, and supply-demand conditions. We have developed a conceptual configuration of the LCP model to the Ontario energy system, as illustrated below. This configuration is based on approximately 5-6 Ontario zones and 4-5 neighboring regions –to reflect current-day and future energy imports and exports. As part of a very integrated continental system of natural gas pipelines and markets, the characterization of Ontario's gas sector will need to be carefully considered to provide details and analytic insight, without boiling the ocean.

The final number of zones will be determined based on discussion with EGI and will reflect an agreed aggregation of the IESO's 10 electrical zones. The analysis will model an integrated energy system made up of the existing electricity and methane (natural gas) systems, along with an emerging hydrogen system in the future. The analysis timeframe stretches from 2020 to 2050, with 10-year intervals – e.g., 2020, 2030, 2040, and 2050.

Proposed Low Carbon Pathways (LCP) Model Configuration for the Ontario Energy System

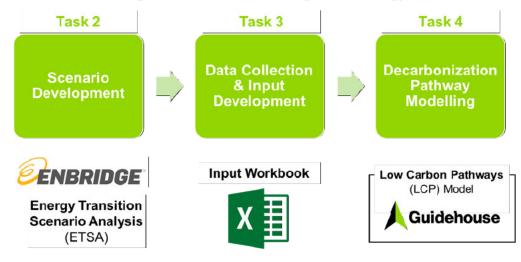
- Geographic Scope: 5-6 Ontario zones + 4-5 neighboring regions
- Energy Systems: Electricity, Natural Gas, RNG and Hydrogen
- Interconnections:
 - Existing <u>electricity</u> and <u>natural</u> <u>gas</u> interconnections within ON and with neighboring regions.
 - <u>Hydrogen</u>: Option to repurpose methane interconnections or build new hydrogen interconnection.
- Modelled Years: 2020, 2030, 2040 and 2050
- Intra-Annual Temporal Resolution: 5 representative days (4 seasons and a winter peak-day)



The kickoff meeting will include a detailed presentation of our modelling approach, our proposed process for leveraging EGI's existing ETSA scenarios, data needs and the sources of data we propose to use, key modelling boundaries and considerations we believe to be essential for successful calibration of the LCP model. We will provide an initial view on high-profile / high-impact sensitivities. These individual elements are discussed in detail in the following sections:

- Task 2 (Scenario Development)
- Task 3 (Data Collection & Input Development)
- Task 4 (Decarbonization Pathway Modelling)

Figure 3: Overall Modelling Methodology



1.2 Task 2. Scenario Development

During Task 2, Guidehouse will work with EGI to define and characterize the scenarios to be analysed. The main objectives of this task include:

- 1. Review of existing scenarios emerging from EGI's Energy Transition Scenario Analysis (ETSA) and development of a plan to consider and align with the LCP analysis.
- 2. Determining the suitability and alignment of the ETSA's Electric Pathway and Diversified Pathway as the basis and foundation for the scenarios used in this study; and
- Proposing modifications and adjustments to the ETSA scenarios (if needed) to develop this study's Electric and Diversified scenarios and their associated 2025-2050 forecasts of gas (and electricity) demand.

	Task 2. Summary & Highlights
Key Questions	 What input data and assumptions are available to understand prior characterisation of ETSA pathways?
to be Answered:	 How can the ETSA pathways be leveraged to define the two (2) analytical scenarios for this study and what modifications will be required?
	 What is the high-level definition of each of the two (2) pathways to be modeled in this study?

Key Deliverables	 A PowerPoint deck including the following: Finalized description of the two (2) scenarios and sensitivities to be included in modeling analysis. Summary of modifications / differences between ETSA scenarios and the two (2) scenarios for this study
Expected EGI Involvement	Participation in a scenario characterization workshop to develop a common understanding of how to leverage the ETSAs. This will include providing Guidehouse with relevant identified data from EGI.

Based on our current understanding of EGI's ETSA, we expect the existing *Electric* and *Diversified Pathways* scenarios to align with leading practice in decarbonization pathway thinking. In general, we assume the ETSA scenarios to align relatively well with common trends found in traditional 'high electrification' and 'balanced' scenarios. Some of these common elements are described below:

- Electric Pathway: High electrification scenarios are generally characterized by continued decarbonization of electric generation and high levels of electrification across buildings, industry, and (particularly) transportation. Natural gas, blended with RNG and combusted with carbon capture and storage (CCS), is limited to high temperature industrial end-uses. RNG and hydrogen are used as industrial feedstocks while biofuels play a major role meeting non-electrified heavy transportation demand, with minimal role for RNG and hydrogen.
- Diversified Pathway: Balanced or Diversified scenarios are generally characterized by complete decarbonization of electric generation, along with more moderate levels of electrification, focusing primarily in cost-effective building and industrial heating, and light- and medium- transportation applications. Low carbon fuels, including RNG and hydrogen, play a more prominent role in buildings, transport, and industry, leveraging existing or upgraded gas infrastructure investments. Biofuels play a more limited role in meeting demand for medium- and heavy-duty transportation.



The scenarios outlined in the RFP, and in this proposal, are generally congruent with our standard approach to define scenarios for LCP analysis.

You will see similar scenarios with regional tailoring in our <u>Gas for Climate</u> (follow link), inclusive of the European Hydrogen Backbone work in the EU, as well as a soon to be released public report examining pathways to achieve the New York Climate Act.

Alignment between this study and the ETSA project will be critical for a highly impactful and strategic study. Our understanding is that the ETSA scenarios are – at the provincial level – inherently consistent with Ontario's economy-wide 2050 GHG reduction targets, Ontario's interim target of 28% reduction by 2025, and EGI's own clean energy and emissions reductions targets.

Regionalization: Based on our proposed modelling approach – adopting 5-6 Ontario zones – and our understanding of how important the regional / zonal dimensionality is to EGI, we will map the regions used in the ETSA scenarios to the 5-6 Ontario regions we have proposed (or agree to during project initiation). If ETSA scenarios already incorporate some regionalization, we will work with EGI to align our analysis to these definitions where possible. We will work with EGI to agree on the number of Ontario regions used in this study and the geographic scope of each of those regions. A proposed approach for regionalization is presented in Figure 4.

If the ETSA scenarios are not regionalized but rather only defined at the Ontario-level, we will propose a regionalization approach to define electricity and gas demand for individual economic sectors across regions. If this is needed, we will propose to use proxies for each demand sector (e.g., population for the buildings sector, transit hubs for the transport sector, etc.) as well as leverage previous analyses (such as the IESO conservation Achievable Potential study, which Guidehouse also conducted).

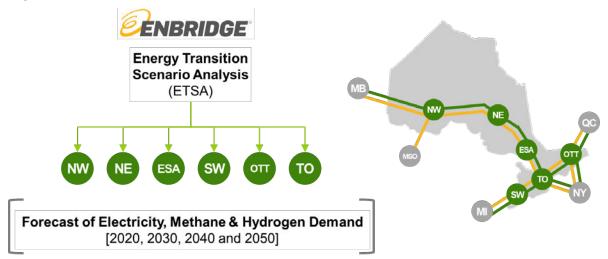


Figure 4: Possible Breakdown of EGI's ETSA Scenarios into Individual Ontario Zones

The final product of the regionalization exercise will be a transformation of the ETSA demand forecasts of electricity, methane, and hydrogen demand (2020-2050) into regional forecast of demand for each individual zone based on the economic and customer characteristics of each zone. Figure 5 shows what this will ultimately look like: a 2020-2050 forecast of electricity, hydrogen and methane demand for each region.

The importance of "regionalizing" demand is that this will serve as the basis for determining whether electricity and gas transmission infrastructure will have to be expanded in the future, or in the case of hydrogen, where gas transmission pipelines will have to be repurposed to accommodate hydrogen.

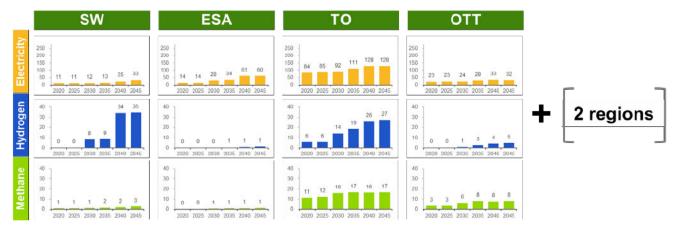


Figure 5: Illustrative 2020-2050 Forecast of Electricity, Hydrogen and Methane Demand

A workshop will be facilitated with the objective of generating a rich discussion of the decarbonization technologies incorporated in the ETSA scenarios and the role of RNG and hydrogen in buildings, transport, and industry.

Scenario Characterization Workshop: During the model characterization workshop, the Guidehouse team will lead the EGI team through an exercise to "deep dive" into each of the relevant ETSA scenarios, challenge underlying drivers and building a common understanding of how each scenario was developed and considerations as part of this Decarbonization Pathways study. This detail on the scenarios will be important to the Guidehouse team's ability to replicate the ETSA scenarios as closely as appropriate in this work.

1.3 Task 3. Data Collection & Input Development

Immediately following initiation and aligning on the scenario definitions, Guidehouse's team will begin the process of data collection to inform the LCP modeling. This process will be led in close collaboration with the EGI team to discuss and vet all of the model inputs and ensure common understanding of the impacts to final modeling results.

	Task 3. Summary & Highlights
	• What does the Ontario energy system look like today? What is the existing electricity supply mix? What are the energy export/import dynamics in Ontario?
Key Questions to	• What electricity and gas transmission capacity is available today within Ontario regions? And with neighboring regions?
be Answered:	What investments in electricity / gas supply and transport infrastructure are expected in the future in Ontario? And in neighboring regions?
	How much RNG supply potential is available in Ontario? What are the future potential sources of hydrogen in Ontario and neighboring regions?
	• A PowerPoint deck presenting all major data inputs and assumption including:
Key	 Techno-economic parameters for electricity/gas supply technologies and transport infrastructure costs.
Deliverables	 Existing and forecast electricity supply capacity, transmission capacity, interconnection capacity between Ontario regions and with neighboring regions.

	Task 3. Summary & Highlights
Expected EGI Involvement	Participation in a scenario data and design workshop to agree on data sources. This will include providing Guidehouse with relevant identified data from EGI.

Given on our past experience performing decarbonization pathway analyses, we have established a structured and streamlined process for data collection. We have a standardized Excel-based "input workbook" that gathers all inputs and assumptions required for the pathway's analysis.

The Guidehouse team that will support EGI in this engagement has extensive experience in decarbonization pathway projects, as well as with the Ontario energy sector and the critical data required to deliver this project. Key system and demand data will be drawn from EGI, as well as other publicly available sources such as:

- IESO Annual Planning Outlook
- Ontario's Integrated Achievable Potentials Study (completed by Guidehouse)
- Planning Outlooks & Historical Electricity Demand (Hydro Quebec, NYISO and MISO)
- Natural Gas Transmission & Distribution Expansion Projects (EGI and Union)
- Historical Gas Demand (ON and neighboring regions)
- Statistic Canada Data Sets

We will be able to get a head-start in data collection by leveraging an extensive dataset of techno-economic assumptions for electricity / gas supply and transport infrastructure from past projects (e.g., costs for electrolysers, SMR+CCS, RNG via anaerobic digestion, biomass gasification, new and repurposed hydrogen transmission pipelines).

In addition to techno-economic parameters for energy technologies, the input workbook also collects inputs to characterize the current state of the Ontario electricity and gas system, as well as planned / expected developments in the energy technology mix up to 2050.

The structure of the input workbook and the scope of data required is summarized by Table 1.

		Table 1. Data Needs from LCP input workbook	
Category	Tab #	Input Data	Energy Carrier
Demand	1.1	 2030, 2040, 2050 forecast of demand [by region] Electricity demand [2020, 2030, 2040, 2050] Methane demand [2020, 2030, 2040, 2050] Hydrogen demand [2020, 2030, 2040, 2050] 	Elec., CH4, H2
Demand	1.2	 Hourly demand profiles by sector & network load profiles Hourly profiles for each season [x4] and a winter/summer- peak day. 	Elec., CH ₄ , H ₂
Supply	2.1	 Existing supply capacity 2020 Electricity Supply Mix 2020 Gas Supply Mix [e.g., imports, domestic biogas production via anaerobic digestion, etc.) 	Elec., CH₄
Supply	2.2	 Planned new capacity {2030, 2040, and 2050] IESO Planned Capacity Additions 	Elec., CH ₄
Supply	2.3.	 Planned capacity retirements [2030, 2040, and 2050] IESO Planned Capacity Retirements 	Elec., CH ₄
Supply	2.4	 RNG & Hydrogen Supply Potential [2030, 2040, and 2050] Define max limit on RNG supply via anaerobic digestion Define max limit on RNG supply via biomass gasification Define max limit on blue and green hydrogen supply Define max limit on hydrogen storage capacity (salt caverns, aquafers, etc.) 	CH4, H2
Supply	2.5	 Techno-economic parameters for supply technologies [CAPEX, OPEX, FOM, VOM; 2030, 2040 and 2050] <u>Electricity</u>: Onshore wind, hydrogen-fired CCGT / OCGT, RNG-fired CCGT / OCGT, battery storage, etc. <u>Hydrogen</u>: Blue H2 (SMR + CCS) and green H2 (dedicated vs. curtailed renewables), H2 storage (salt caverns, aquafers, etc.) <u>Methane:</u> Anaerobic digestion, biomass gasification 	Elec., CH4, H2
Infrastructure	3.1	 Existing Interconnection capacities [2020] In-between Ontario zones [GW] In-between Ontario and neighboring regions [GW] 	Elec., CH4
Infrastructure	3.2	 Planned interconnection capacities [2030, 2040, and 2050] In-between Ontario zones [GW] In-between Ontario and neighboring regions [GW] 	Elec., CH4
Infrastructure	3.3	 Techno-economic parameters new transmission lines Overhead AC, Underground/Overhead HVDC 	Elec.
Infrastructure	3.4	 Techno-economic parameters new / retrofit pipelines [20, 36 and 48-inch pipelines] Underground / above-ground new methane pipelines Underground / above-ground new hydrogen pipelines Repurposed hydrogen pipelines Hydrogen compression stations 	CH4, H2
General	4.1	Economic parameters (WACC, carbon prices)	n/a

Table 1: Data Needs from LCP Input Workbook

With our previous experience developing decarbonization pathways for gas utilities, we have developed an extensive dataset of techno-economic parameters for hydrogen and RNG production technologies. We plan to get a kickstart the data collection process by leveraging techno-economic parameters developed in previous projects. For example, Table 2 shows cost assumptions (from 2025 to 2045) for green and blue hydrogen (via electrolysers and SMR+CCS) and for RNG (via AD and biomass gasification).

Table 2: Example of Techno-Economic Parameters for Supply Technologies

Kick-Starting Data Collection: Hydrogen & RNG Supply Technologies

Hydrogen:

- Electrolysers
- SMR+CCS

RNG:

- Anaerobic Digestion
- Biomass Gasification (BioSNG)

Year	Cost Component	Unit	Electrolysers	SMR + CCS
2025	CAPEX	[kEUR/MW]	600	1530
	Fixed O&M	[kEUR/MW/y]	12	45.9
	Variable O&M	[kEUR/MWh]	0	5.5
	Lifetime	[year]	25	25
	Efficiency (LHV)	[96]	67	69
2035	CAPEX	[kEUR/MW]	400	1340
	Fixed O&M	[kEUR/MW/y]	8	40.2
	Variable O&M	[kEUR/MWh]	0	5.5
	Lifetime	[year]	25	25
	Net Efficiency	[%]	70	69
2045	CAPEX	[kEUR/MW]	300	1300
	Fixed O&M	[kEUR/MW/y]	6	39
	Variable O&M	[kEUR/MWh]	0	5.5
	Lifetime		25	25
	Net Efficiency	[96]	73	69

Year	Cost Component	Unit	Anaerobic Digestion	Biomass Gasification
	CAPEX	[kEUR/MW]	2165	2595
2025	Fixed O&M	[kEUR/MW/y]	216	265
2025	Variable O&M	[kEUR/MWh]	43	52
	Lifetime	[year]	25	20
	CAPEX	[kEUR/MW]	2049	2119
2035	Fixed O&M	[kEUR/MW/y]	178	227
2035	Variable O&M	[kEUR/MWh]	38	47
	Lifetime	[year]	25	20
	CAPEX	[kEUR/MW]	1934	1642
2045	Fixed O&M	[kEUR/MW/y]	141	190
2045	Variable O&M	[kEUR/MWh]	33	42
	Lifetime	[year]	25	20

Based on the LCP input workbook needs presented above, we have already identified the specific gaps in data that must be bridged before we can begin pathway modelling. Table 3 below lists out the subset of input data that Enbridge can help us with to fill those gaps; this includes five specific areas of EGI input.

For all other data needs required for the LCP input workbook, we have already identified publicly available data resources from the IESO, OEB, the Government and past studies to be used. As described above, we also bring an extensive dataset of techno-economic parameters for electricity, hydrogen and methane supply and transport infrastructure investments.

Table 3: Preliminary Data Request for Enbridge



Category	Tab #	Input Data	EGI Source / Data Need
Demand	1.1	2030, 2040, 2050 forecast of electricity, CH4 and H2 demand	EGI ETSA Scenarios
Demand	1.2	2019/2020 hourly gas demand profiles by sector & total network	Ontario 2019/20 Hourly Gas Demand
Supply	2.1	Existing gas supply capacity (imports, RNG, etc.)	Ontario 2019/20 RNG supply capacity
Infrastructure	3.1	Existing gas interconnection capacities	2020 Gas Regional interconnection Capacities
Infrastructure	3.2	Planned gas interconnection capacities	Planned Regional Interconnection Expansion

Guidehouse's well-vetted process for collaborative data collection and analysis will ensure that the model outcomes are credible and provide meaningful insights. Our data collection process is both iterative and collaborative, relying on a series of client workshops, to ensure that our LCP model incorporates the most appropriate inputs for Ontario and neighboring regions and those are reviewed / approved by EGI.

The deliverable from Task 3 will be a PPT deck presenting all major data inputs and assumption listed above. Figure 6 shows a recent LCP data collection PPT deck produced for a consortium of gas utility clients.

Figure 6: Illustrative LCP Data Collection & Input Development PPT Deliverable

LCP Data Collection & Input Development PPT

Supply Supply Cap	pacity	(Exi	sting	& Planne	ed) Two	ed Electricity Supply Capacity anned electricity supply capacity is the the TriADTOR National Tende so el capacity in 2000 and 2000 Capacity is additive three 2000 to 2000 Car	nario capacity is used as the automous in 2010 are assure	basinine for ad-	Shonal and with	Ŀ.	Gas Netwo Ireland	d			
kinting Electricity Supply	Capacity for	N			the pla	By additions from 2000 to 2040. Our m annext capacity shown in the table betw ch modeled year.									
No eventing supply installed o opply capacities are the initial secting supply capacities are suitid for the installed supply outce: GB + NE UK give CU ROL E2B Networks (AB ENTROE Transpo	alled capacities i vinet as a tare capacity RES Chapter 5	in of 2020 a reput for (sumsize	n NI GR. Ne model.	Supply	y							mutu	al e	ne	ergy(
	- E+					luar									
			10.0	Hydrogen Sup					methane Suppl	y Potential	RCI Diogen Resonances 2020 2020				
Iffed Dishire	1402	12723	4275	supply polenila	imeach of he is	golies in G8 and ROI are determine." impective reports (solar FV, ovroffalt									
Wind Offshure		9671	- 25			an Hydrogen Backbone ([HB study]									
Solar PV	333	13013				onhai Fort-dedicated renewables is i ability: enumeritar regulations, pu	Supply								
Hydra Run of River	11	1004	276	This analysis in	as performed to	the EHB analysis and lead to the hy			-						
Hydro Pumped Storage		5966	585	Source Europe	an Hydrogen Ba	cabone study (Dualehouse 2021) 🕻	Supply T	echno	-Econd	omic F	arameters				
Notes		4923	٠	112.1		TE Supply Personal (1985)	General Supply Technol								
Foxial Float Thermat (Coak Peak, OR)	411	1014	2616			2000 2546 255	The examenia parameter								
OCQT - CHA		2293	116	G8 Onee		66 104 34C	Operation and Maintenan Sources for Wind, Sol			Contraction of the	ten te ron-ren to reaction	Hydrogen Infrastructure Costs			
0007-10				Bive	Amounced	45			acces:	- 2	Infrastructure	Hydrogen Infrastructure Costs	for New 36-Inch and 20-I	inch Figeline	
		315.06	4110	ROI Gree	n	35 139 25	ENTSO-E/G (2026) La					Cont Component	No. Partie	State Parality	
CCGT - DHA	1029						RENA (2019) Ltd.			0	Interconnection Costs (2 of 2)	Capacity EMIO 3040	47	12	
	1029														
CCGT-H2	0 153	0 7301	8	Hydrogen Su					1.00			Pipeline Costs Million Chr.	4 22	5.5	and an
CCGT-H2 Biotaco		0 7381 900	8 20 8	Hydrogen pro	duction costs an	e determined assuming that hydro, on/offshore wind). Advance electro	West Destaura	104	(m)	10.0	3. Hydrogen Transmission Pipelines	Pipeline Costs (Million Che Compression Costs (Million Che		15	Note: Cost extendes for reported 20
CCGT-H2 Biotaco	0 153			Mydrogen pro renewable so energy source	duction costs an unces (solar PV, ns to produce he	ovioffshore wind). Advance electrical drogen. The wind and solar capaci-	Wind Drafway	FOM	EM/Cynal	21.609	The hydrogen infrashucture costs used in our analysis reflect the cost of either (1)		4 0.32		repurptioned 36-mich gang 25- thick paperline are affect according from the Dorth
CCGT-H2 Biotaco	0 153			Hydrogen pro renewable so energy source considered, le	duction costs an urces (solar PV, es to produce hy rading to country	on/offshore wind). Alkaline-electric	Wind Drahara	FOM VOM CONE	EMIT year EMITS	20.00 30.600	The hydrogen infrashructure costs used in our analysis reflect the cost of either (1) repurposing exoting natural gas ppetires OR (2) the cost of balding new 24-inch or	Compression Costs (Million Kiter	4 9.32 4 2.52	0.09	repurposed 36-mut and 20 Published and affici
CCGT - H2 Bontano	0 153			Hydrogen pro renewable so energy source considents, le Bue hydrogen Source, Europ	duction costs an orces (solar PV is to produce hy adding to country in costs are inger pean Hydrogen T	ovioffshore wend) Alkähre electrol drogen. The wind and solar capaci- r specific green hydrogen productio cited to range from 48 - 60 CMMIh Backborne study (Ouderhouse 2021		CONE	EMR year EMR year EMR year	ENL NO	The hydrogen inflashucture cests used in our analysis reliect the cost of either (1) repurposing exciting natural gas specienes CR (2) the cast of badges ever 24-anch or 16-anch pipelines. These costs are extramed based on the European Mattogen Backbore report (2)(4), 4/42 (201) which were sourced and whiled by a large group.	Compression Costs (Million Khor Tutal Costs (Million Khor	N 9.32 N 2.12	0.09	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
DOST - DHA COOT - HO Bernass Bathery Shrange	0 153			Hydrogen pro renewable so energy source considents, le Bue hydrogen Source, Europ	duction costs an unces (solar PV, es to produce hy adding to country in costs are expe- pean Hydrogen 1 PRESC database	onroffshore wind) Alkaline electric drogen. The wind and solar capaci- r parcific green hydrogen andoctic and to range from 48 - 60 CMAth Backborne study (Ouderhouse 2021 e. Latik	Wind Dashaw	VOM CONE FOM	EMIC year Chirth EMIC year EMIC year		The hydrogen infleet/nuclare costs used in our analysis relact the cost of either (1) resparpoints excising related gas spatieness CR (2) the cost of balding new 24 such or tal-acts posteriors. These costs are astrantiat balance on the European Hydrogen discloser report (EHR), July 2021) which were sourced and writing by a large group of Castgean gas 150s.	Compression Costs (Million Chr. Tural Costs (Million Chr. Normalised Costs (Million Ch.	ni 0.12 ni 2.12 revani <u>534</u> nch and 20-inch Pipelin	0.09	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT-H2 Biotaco	0 153			Hydrogen pro renewable so energy source considents, le Bue hydrogen Source, Europ	duction costs an orces (solar PV, es to produce hy adding to country in costs are expe- prian Hydrogen I PRESIO databas	ovodthore west) Adalete elicito drogen. The west and outer capaci topochic grown hydrogen productio clind to range from 41 – 60 CAMAh licitores study (Cudehnouse 2021 el Lok H3 Cout (CAMA)		VOM CONE FOM VOM	EMRysai CAIN EMRysai EMRysai CAIN	850.000 80.758	The hybright infletionative cosh used in our analysis relief of the cosh of either (1) meruprover another network any spectres OR (2) the cosh of having may alk-link the tak-th popules. These coshs are estimated based on the £uropean hybright disclober engo(10H), alky 2021 which were sourced and writed by a large group of £uropean gas TSOs. The DHI' exposed powells cosh faures for mere represented 36-inch and 30-inch the follower provides cosh faures for mere and represented 36-inch and 30-inch	Compression Costs (Million Chu Turial Costs (Million Chu Normalised Costs (Million Ch	N 0.22 N 2.12 MY Anij 531 meh and 25-inch Pipelin Incs	0.09	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT-H2 Biotaco	0 153			hipdrogen pro- renewable so energy source considered. It Blue hydrogen Source: Europ ENSI	duction costs an orces (solar PV is to produce hy ading to country in costs are expe- point Hydrogen I PRESO database	on/off-long-west). Advalance selectric drogen. The wend and solar capaci- tipsochic preen hydrogen productic cell do range from 48 – 40 CAMM Biochtome study (Could-House 2021 er Lonk 10 Count (CAMM) 2048 205	Wed Offician	VOM COME FOM VOM COME	EMR year EMRN EMR year EMR year EMR year EMR year	86.998 86.758 9.106.886	The hydrogen infleet/nuclare costs used in our analysis relact the cost of either (1) resparpoints excising related gas spatieness CR (2) the cost of balding new 24 such or tal-acts posteriors. These costs are astrantiat balance on the European Hydrogen discloser report (EHR), July 2021) which were sourced and writing by a large group of campean gas 150%.	Compression Corm (Million City) Tunal Courls (Million City) Normalised Courts (Million City) Hormalised Courts for 34-1 Hormalised Courts for 34-1	N 0.2 1 2.2 m Ang 52 mch and 20-inch Pipelin ives	019 1.55 1.37	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT-H2 Bonass	0 153			Hydrogen pro mnewdde so energy source onsadenol. Ie Blue tydroge Source. Europ ENG	duction costs an unces (solar PV, is to produce hy adding to costs are expe- prior Hydrogen 1 PRESO database INEESO database S0	on/off-loops wind). Advallme elinistica dirigen. The wind and online capacy is possible, green hydrogene pandactic and to range term 41 - 60 CAMMH Backborne study (Combiniouse 2021 et Linit HIZ Cam (CAMMH) 2648 255 61 25		VOM CONE FOM VOM CONE FOM	EMR year EMRN EMR year EMR year EMR year EMR year	850.000 80.758	The hydrogen inflamburs cash used in our analysis stifled the cost of ether (1) reversioning uniting instancing parameters O(1) (2) the cost of building new 24 kinks in this start, popularies. These cashs are extinated based on the £ surposes Arganges Baseborn engl (2016), dby 2011, which were sourced and writed by a large group the DB and the start of the surpose of the surpose and resources the start of the start of the The DH most provide cost (groups for mere and resources) db and with the hydrogen projects. Starts date of the surpose gas interconstructs are 24-exh. We	Compression Contr. SMillion CAN Trate Contr. SAlition CAN Recentition Control. SMillion CA Normalised Costs for 34-1 New and Repurposed Piper	n(0.32 n(2.12 nr Ang 33 nr Ang 20-inch Pipelin Inco CAACE CAACE	0.09 1.53 1.53 1.53 1.53 1.54 1.54 1.54 1.54 1.54 1.54 1.54 1.54	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT-H2 Bonass	0 153			hipdrogen pro- renewable so energy source considered. It Blue hydrogen Source: Europ ENSI	duction costs an orces (solar PV is to produce hy ading to country in costs are expe- point Hydrogen I PRESO database	on/off-long-west). Advalance selectric drogen. The wend and solar capaci- tipsochic preen hydrogen productic cell do range from 48 – 40 CAMM Biochtome study (Could-House 2021 er Lonk 10 Count (CAMM) 2048 205	Wed Offician	VOM CONE FOM VOM CONE FOM VOM	EMR year EMR year EMR year EMR year EMR year EMR year EMR year EMR year	86.998 86.798 1,106.000 59.209	The hydrogen inflaministic term on the week in our week is maded to be cost of water (1) the mean energy and the strate parameters (16.0). The next of hudrogen are 2 kers for that not patients. These is any is a strategistic based on the <i>Language Mathematical Mathematical Cost</i> (16.0) and the strategistic based on the parameter of the strategistic based on the strategistic ba	Compression Corm (Million City) Tunal Courls (Million City) Normalised Courts (Million City) Hormalised Courts for 34-1 Hormalised Courts for 34-1	N 0.2 1 2.2 m Ang 52 mch and 20-inch Pipelin ives	0.09 1.55 1.50 1.50 1.50 1.50 1.50 0.04 1.50 0.04 1.50 0.04 1.50 0.04 1.50 0.04 1.50 0.04 1.50 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT-H2 Biotaco	0 153			Hydrogen pro mnewdde so energy source onsadenol. Ie Blue tydroge Source. Europ ENG	duction costs an unces (solar PV, is to produce hy adding to costs are expe- prior Hydrogen 1 PRESO database INEESO database S0	on/off-loops wind). Advallme elinistica dirigen. The wind and online capacy is possible, green hydrogene pandactic and to range term 41 - 60 CAMMH Backborne study (Combiniouse 2021 et Linit HIZ Cam (CAMMH) 2648 255 61 25	Wind Offichare Solar PV	VOM COME POM VOM COME POM VOM COME	EMR year EMRN EMR year EMR year EMR year EMR year	84.598 84.598 1.186.686 19.288	The hydrogen effective cases is used in our analysis reflect the cost of white (T) the topology of white (T) the topology of white (T) the topology of the to	Compression Control Million (An Tradi Control Million (An Normalised Control Million (An Normalised Control Million (An Normalised Control Normalised New York (Normalised Control Normalised New York (Normalised Control Normalised Control Normalised Control Normalised Control Normalised (Normalised Control Normalised	N 0.22 N 2.12 M Ang 25-Inch Algelin Ince CAlific I Calific I S30	0.09 1.53 1.53 1.53 1.53 1.54 1.54 1.54 1.54 1.54 1.54 1.54 1.54	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT-H2 Biotaco	0 153			Hydrogen pro mnewdde so energy source onsadenol, le Biur tydroge Source, Europ ENG	duction costs an unces (solar PV, is to produce hy adding to costs are expe- prior Hydrogen 1 PRESO database INEESO database S0	on/off-loops wind). Advallme elinistica dirigen. The wind and online capacy is possible, green hydrogene pandactic and to range term 41 - 60 CAMMH Backborne study (Combiniouse 2021 et Linit HIZ Cam (CAMMH) 2648 255 61 25	Wed Offician	VOM CONE FOM VOM CONE FOM VOM	LMD year CMDN LMDN year LMD year CMDN LMD year CMDN LMD year LMD year	86.998 86.798 1,106.000 59.209	The hydrogen inflaministic term on the week in our week is maded to be cost of water (1) the mean energy and the strate parameters (16.0). The next of hudrogen are 2 kers for that not patients. These is any is a strategistic based on the <i>Language Mathematical Mathematical Cost</i> (16.0) and the strategistic based on the parameter of the strategistic based on the strategistic ba	Compression Costs (Million Kur Tand Costs (Million Kur Normalised Costs (Million Kur Normalised Costs for 34-4 Print and Repurposed Paper New Xi-In Rep 21-in	N 0.32 N 2.52 Inch and 20-inch Pipelin Inch and 20-inch Pipelin Inch and 20-inch Pipelin Inch 20-inch Pipelin Inch 20-inch Pipelin Inch 20-inch Pipelin	0.09 1.59 1.59 1.59 1.59 1.59 1.59 1.59 1.5	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT - H2 Bontano	0 153			Hydrogen pro mnewdde so energy source onsadenol, le Biur tydroge Source, Europ ENG	duction costs an unces (solar PV, is to produce hy adding to costs are expe- prior Hydrogen 1 PRESO database INEESO database S0	on/off-loops wind). Advallme elinistica dirigen. The wind and online capacy is possible, green hydrogene pandactic and to range term 41 - 60 CAMMH Backborne study (Combiniouse 2021 et Linit HIZ Cam (CAMMH) 2648 255 61 25	Wind Offichare Solar PV	VOM CONE POM VOM CONE POM CONE FOM	CMR year CMRh year CMRh year CMRh year CMRh year CMRh year CMRh year CMRh year CMRh year	80.000 80.758 1.5560 53.200 425.500 11.000	The highlight extends takes can be used in our analysis which the cost of a left of means on the second or and a paralised on CD fits out of a hadge one CD fits on the cost of a left of the cost of of t	Compression Costs (Million 4 Au Tradi Costs, (Million 4 Costs) Normalised Costs, (Million 4 Au Million 4 Au Million 4 Au Normalised Costs, for Al- New and Physicspoon Physics New York New York Repurption 4 Au	1 0.12 1 2.12 1 2.12 1 3.19 moth and 25-inch Pipelin ives 1 4.16 1 4.15 1 5	0.09 1.59 1.305 1.50 1.50 1.50 1.50 1.50 1.50 1.50 1.	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT - HE Bonase	0 153			Hydrogen pro mnewdde so energy source onsadenol, le Biur tydroge Source, Europ ENG	duction costs an unces (solar PV, is to produce hy adding to costs are expe- point Hydrogen 1 PRESO database INEESO database S0	on/off-loops wind). Advallme elinistica dirigen. The wind and online capacy is possible, green hydrogene pandactic and to range term 41 - 60 CAMMH Backborne study (Combiniouse 2021 et Linit HIZ Cam (CAMMH) 2648 255 61 25	Wind Offichare Solar PV	VOM COME FOM VOM COME FOM VOM COME FOM VOM	CMPA year CMPA year	84.888 86.758 1.156.686 15.288 	The independent elements are entropy of the number where the could element to the memory of the second entropy of the could element	Comparements Control Million 450 Total Control Million 450 Million	10 0.22 10 2.12 10 2.12 10 2.12 10 10 10 10 1	0.09 1.55 1.50 1.50 1.50 1.50 1.50 1.50 1.50	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT - HE Bonase	0 153			Hydrogen pro mnewdde so energy source onsadenol, le Biur tydroge Source, Europ ENG	duction costs an unces (solar PV, is to produce hy adding to costs are expe- point Hydrogen 1 PRESO database INEESO database S0	on/off-loops wind). Advallme elinistica dirigen. The wind and online capacy is possible, green hydrogene pandactic and to range term 41 - 60 CAMMH Backborne study (Combiniouse 2021 et Linit HIZ Cam (CAMMH) 2648 255 61 25	Und Offdase Saler PV 0007 - CHAND	VOM CONE FOM VOM FOM VOM CONE FOM VOM CONE	UMR year OMRh OMRh year OMRh year OMRh OMRh year OMRh year OMRh year OMRh year OMRh year OMRh year	86.750 86.750 11.0600 10.000 425.000 11.000 14.4 374.000	An independent effective consist in our analyses which the const of each of the processing of the const of each of the processing of the const of each of the processing of the const of each of the const	Compression Costs (Million 4 Au Tradi Costs, (Million 4 Costs) Normalised Costs, (Million 4 Au Million 4 Au Million 4 Au Normalised Costs, for Al- New and Physicspoon Physics New York New York Repurption 4 Au	N 0.22 N 0.22 N 0.22 N 0.25 N 0.55 N 0.55	0.09 1.55 1.50 1.50 1.50 1.50 1.50 1.50 1.50	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT - H2 Bontano	0 153			Hydrogen pro mnewdde so energy source onsadenol, le Biur tydroge Source, Europ ENG	duction costs an unces (solar PV, is to produce hy adding to costs are expe- point Hydrogen 1 PRESO database INEESO database S0	on/off-loops wind). Advallme elinistica dirigen. The wind and online capacy is possible, green hydrogene pandactic and to range term 41 - 60 CAMMH Backborne study (Combiniouse 2021 et Linit HIZ Cam (CAMMH) 2648 255 61 25	Und Offdase Saler PV 0007 - CHAND	VOM CONE FOM VOM FOM VOM CONE FOM VOM CONE FOM	CMR year CMRh CMRh year CMRh year	862,986 862,986 91,996 93,208 94,208 94,208 94,208 94,208 94,208 94,208 94,208	An implying interflueture consist in our angeling in the Court of a feet (T_1) and T_2)	Compression Comp. Mother US: Trace Cours. Million: US: Non-atticuter Cours. Million: Cours. Non-atticate Cours. Million: Cours. Non-attic Cours. Million: Cours. Non-attic Cours. Non-Attic Non-attic Cours. Non-Attic Non-attic Cours. Non-Attic Programmed Direct. Non-attic Cours. In: PAI- Network and Education II-Attic Network II-Attic Netw	N 0 42 N 2 12 N 2 1	0 09 1 55 1.57 1.57 0.07 1.57 0.07 1.57 1	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT - H2 Bontano	0 153			Hydrogen pro mnewdde so energy source onsadenol, le Biur tydroge Source, Europ ENG	duction costs an unces (solar PV, is to produce hy adding to costs are expe- point Hydrogen 1 PRESO database INEESO database S0	on/off-loops wind). Advallme elinistic dirigom. The wind and online capacy is possible, grown hydrogene pandactic and to range them 41 - 60 CAMMH Backborne study (Combiniouse 2021 et Linit HIZ Cam (CAMMH) 2648 285 61 25	Und Offdase Saler PV 0007 - CHAND	VOM CONE FOM VOM CONE FOM VOM CONE FOM CONE FOM VOM	EMR year CMRN EMRN year EMR year CMRN EMR year CMRN year CMRN year CMRN year CMRN year CMRN year CMRN year CMRN year	84,554 84,554 1,556,666 19,298 425,588 11,096 14, 354,666 12,758 14	An independent when the strength of the streng	Comparements Care Miller UN Trace Care Miller UN Normalised Cores In PAI Normalised Cores In PAI Normalised Cores In PAI Normalised Cores In PAI Normalised Core In PAI Normalised Cores In PAI Normalised Cores In PAI	N 0 22 N 102 N 102	0 09 1.55 1.59 0.001 0 002 155 155 155 155 155 155 155 15	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT-H2 Biotaco	0 153			Hydrogen pro mnewdde so energy source onsadenol, le Biur tydroge Source, Europ ENG	duction costs an unces (solar PV, is to produce hy adding to costs are expe- point Hydrogen 1 PRESO database INEESO database S0	on/off-loops wind). Advallme elinistic dirigom. The wind and online capacy is possible, grown hydrogene pandactic and to range them 41 - 60 CAMMH Backborne study (Combiniouse 2021 et Linit HIZ Cam (CAMMH) 2648 285 61 25	Und Offdase Saler PV 0007 - CHAND	VOM CONE FOM VOM CONE FOM VOM CONE FOM CONE FOM VOM	EMR year CMRN EMRN year EMR year CMRN EMR year CMRN year CMRN year CMRN year CMRN year CMRN year CMRN year CMRN year	84,554 84,554 1,556,666 19,298 425,588 11,096 14, 354,666 12,758 14	An inclusion of the inclusion of the straight of the four of a definit of the inclusion of	Compression Comp. Mathew 15: Trace Cours. Million 4: The Resonance Cours. Million 4: The Normalized Cours. Million 4: The Normalized Cours. Million 4: The Normalized Cours. Million Normalized Cours. Million Normalized Cours. Million Resonance Cou	1 0.22 1 1.22 with and 20-least Reputer 1.53 solar and 20-least Reputer 1.94 solar and 20-least Reputer 1.94 1.33 1.95 solar and 10-least Reputer 1.94 1.33 1.95 solar and 10-least Reputer 1.94 1.95 1.95 solar and 10-least Reputer 1.94 1.97 1.94	0 09 1.55 1.59 1	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT-H2 Biotaco	0 153			Hydrogen pro mnewdde so energy source onsadenol, le Biur tydroge Source, Europ ENG	duction costs an unces (solar PV, is to produce hy adding to costs are expe- point Hydrogen 1 PRESO database INEESO database S0	on/off-loops wind). Advallme elinistic dirigom. The wind and online capacy is possible, grown hydrogene pandactic and to range them 41 - 60 CAMMH Backborne study (Combiniouse 2021 et Linit HIZ Cam (CAMMH) 2648 285 61 25	Und Offdase Saler PV 0007 - CHAND	VOM CONE FOM VOM CONE FOM VOM CONE FOM CONE FOM VOM	EMR year CMRN EMRN year EMR year CMRN EMR year CMRN year CMRN year CMRN year CMRN year CMRN year CMRN year CMRN year	84,554 84,554 1,556,666 19,298 425,588 11,096 14, 354,666 12,758 14	An independent when the strength of the streng	Compression Control Million Che Tranz Contro Million Che Million C	1 0 22 1 2 2 1 2 2	0.09 1.55 0.221 es (ELR) 0.001 1% 1% 1% es (CEP) 0.0021 1%	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported
CCGT-H2 Bonass	0 153			Hydrogen pro mnewdde so energy source onsadenol, le Biur tydroge Source, Europ ENG	duction costs an unces (solar PV, is to produce hy adding to costs are expe- point Hydrogen 1 PRESO database INEESO database S0	on/off-loops wind). Advallme elinistic dirigom. The wind and online capacy is possible, grown hydrogene pandactic and to range them 41 - 60 CAMMH Backborne study (Combiniouse 2021 et Linit HIZ Cam (CAMMH) 2648 285 61 25	Und Offdase Saler PV 0007 - CHAND	VOM CONE FOM VOM CONE FOM VOM CONE FOM CONE FOM VOM	EMR year CMRN EMRN year EMR year CMRN EMR year CMRN year CMRN year CMRN year CMRN year CMRN year CMRN year CMRN year	84,554 84,554 1,556,666 19,298 425,588 11,096 14, 354,666 12,758 14	An independent when the strength of the streng	Compression Comp. Mathew 15: Trace Cours. Million 4: The Resonance Cours. Million 4: The Normalized Cours. Million 4: The Normalized Cours. Million 4: The Normalized Cours. Million Normalized Cours. Million Normalized Cours. Million Resonance Cou	1 0.22 1 1.22 with and 20-least Reputer 1.53 solar and 20-least Reputer 1.94 solar and 20-least Reputer 1.94 1.33 1.95 solar and 10-least Reputer 1.94 1.33 1.95 solar and 10-least Reputer 1.94 1.95 1.95 solar and 10-least Reputer 1.94 1.97 1.94	0 09 1.55 1.59 1	reputpenset 36-mith and 20- mith papalities are after provident from the Cold shafe, bud are not reported

1.4 Task 4. Decarbonization Pathways Modelling

In Task 4, we will use Guidehouse's LCP model to develop cost optimized decarbonization pathways for Ontario's energy system between 2020 and 2050 based on two scenarios: Electric Pathway and Diversified Pathway. We also propose to analyze decarbonization pathways based on 2-3 high-impact sensitivities.

We will quantitatively and qualitatively describe the two resulting pathway scenarios deriving insights by comparing the pathways and focusing on the contributions that can be made by an integrated electricity and gas energy system to meet Ontario's GHG reduction goals

	Task 4. Summary & Highlights					
	 What is the cost optimized decarbonization pathway for each of the two scenarios? 					
Key Questions to be Answered:	• What are the key societal cost considerations of each of the two pathways by 2050 and test the cost competitiveness of each scenario for key milestone years?					
	 What are the opportunities and feasibility of RNG, hydrogen, and other low carbon fuels to support Ontario's energy needs while achieving GHG emission reduction targets? 					
	• Quantitative and qualitative summary of the cost optimized pathways, preliminary results prepared for preliminary results workshop and final results for final results workshop; for main scenarios and sensitivity scenarios.					
	 Gas & Electricity Supply Mix [2030, 2040, 2050] – e.g., RNG, hydrogen, wind, solar, etc. 					
Key Deliverables	 Gas & Electricity Transmission Infrastructure [2030, 2040, 2050] – e.g., repurposed new / pipelines, transmission line, etc. 					
	Total Gas & Electricity Network Investment Costs [2030, 2040, 2050]					
	Hourly Energy Demand & Peak Demand [2030, 2040, 2050]					
	Pathway risks, challenges, opportunities, low-regret investments & actions					
	Databook of all modeling results					
Expected Enbridge Involvement	Day-to-day review and discussion of modeling interim modeling results. Participation in a half-day workshop to review preliminary results and half-day workshop to review final modeling results					

Guidehouse proposes to use our LCP model to develop cost optimized decarbonization pathways for each scenario and sensitivity. The LCP model will enable us to provide unparalleled insight into the role of low carbon gas and gas system infrastructure in Ontario.

The configuration of the LCP model to the Ontario energy system will be defined based a selection of 5-6 Ontario regions and 4-5 neighboring regions. The model will capture changing supply and demand over time from 2020 to 2050 in each region. This regional configuration will enable us to model the optimized buildout of interconnection infrastructure between regions – whether electricity transmission lines or methane / hydrogen transmission pipelines. The hourly balancing of supply and demand is optimized on an hour-to-hour basis by using 4 representative seasonal days (x4) and summer and winter peak days (x2).

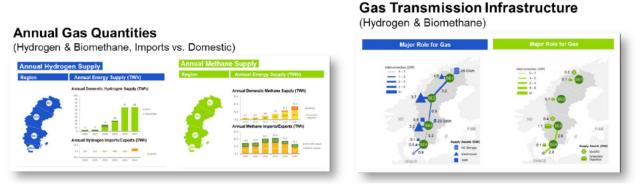
Guidehouse will configure the LCP model and complete an initial modeling run, providing preliminary results. These preliminary results will be reviewed in a half-day workshop with the Enbridge team. As is always the case with these types of modeling challenges, questions will arise following the preliminary data results review. Guidehouse will adjust and rerun the models to provide final pathways results.

Table 4: LCP Key Model Outputs

LCP Key Model Outputs

Our LCP model produces all major pathway outputs required by EGI:

- Low-carbon and renewable gas quantities over time (e.g., green hydrogen, blue hydrogen, AD biomethane, biomass gasification, etc.)
- · Energy system costs including gas and electricity network investments:
 - Supply capacity (e.g., onshore/offshore wind, electrolysers, SMR, etc.)
 - Transmission interconnections (e.g., transmission lines, new/retrofit pipelines, etc.)
 - Storage assets (e.g., hydrogen storage, battery storage, etc.).
- Timeline of investments (2020, 2030, 2040, and 2050)



Gas Supply & Infrastructure Cost

(Hydrogen & RNG)



Sensitivity Scenarios: In addition to the main demand scenarios, we will also determine pathways for a set of three (3) sensitivity scenarios. We will define the set of sensitivities analysed after discussion with EGI, however, the following are potential candidate sensitivities to consider:

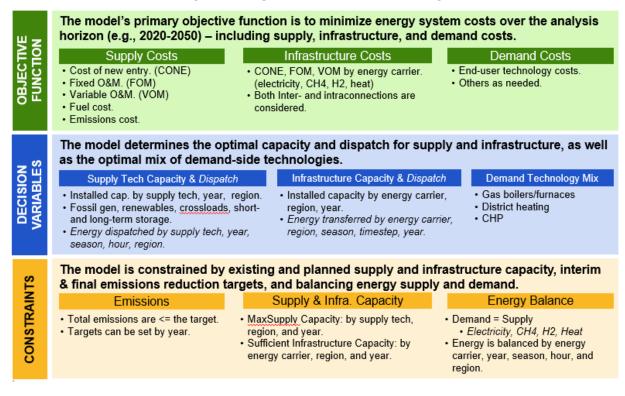
- Electricity infrastructure and supply Capital Cost Risk: Assess the impacts of varying degrees of capital cost escalation for new electric capacity and related system assets.
- Low Electrolyser and H₂ Infrastructure Costs: Assess the impact of low electrolyser cost and low transmission pipeline costs on the development gas infrastructure.
- **Ontario as a H**₂ **Exporter:** Assess the impact of Ontario acting as a hydrogen exporting regions to neighboring regions on the development of gas infrastructure.
- Low Cost of H₂ Imports into Ontario: Assess the impact of low-cost hydrogen supply from neighboring regions (e.g., Quebec utilising its hydro fleet for hydrogen production) on the development of gas infrastructure.

Overview of Guidehouse's LCP Model: Guidehouse's LCP model is a pathways analysis tool built to analyze how a future state develops. The model uses linear optimization to calculate the cost optimal pathway to decarbonize Ontario's energy system. Cost optimization in this case refers to the lowest likely societal cost, i.e., focusing on the total costs and benefits for society to achieve full energy system decarbonization and the critical system, equipment and stranded costs that will have the greatest impact on cost to Ontarians. Figure 7 provides an overview of the LCP model design.

The LCP model includes:

- The possibility to assess various scenarios to deliver a fully decarbonized energy system. The model enables comparison between different decarbonized end state scenarios across a region's entire energy system based on system-wide production costs. This enables us to identify the societal value of achieving a carbon neutral energy system with a (growing) role for low carbon gases in combination with electricity.
- A multi-year cost optimized pathway analysis to deliver intermediate (2030, 2040) and end state (2050) objectives. The LCP model also enables testing of sensitivities and alternative pathway options.

Figure 7: High-Level LCP Model Design



The LCP model's primary objective function is to minimize energy system costs over the analysis horizon (e.g., 2025-2050) – including supply, infrastructure, and demand costs. The cost-objective function optimizes overall system costs but can be configured to optimize for any subset of costs including network/grid costs, or cost to end users for equipment with known cost curves.

The cost analysis is based on societal cost considerations of the pathways, representative of the total cost of achieving pathway outcomes (GHG abatement) to Ontarians as a whole assuming reasonable market development and market access. The LCP model considers cost in three broad categories on an annual basis:

- **Supply costs** including upfront costs, generation costs, ongoing fixed costs, ongoing variable costs, fuel costs, and emissions costs
- Infrastructure costs capture the cost of transmission and distribution (T&D) infrastructure across the power and gas sectors. Guidehouse's team has also developed an approach to estimate the system cost of <u>stranding infrastructure</u> and supply investments that can result from non-integrated policy and investment decision making.
- Demand costs can capture the cost of end-user equipment including heating systems in buildings, insulation, and industrial equipment. These components of incremental societal cost will be captured based on materiality and in alignment with our past approaches to cost analyses.

The model determines the optimal capacity and dispatch for supply and infrastructure to meet electricity, methane and hydrogen demand. Individual supply technologies or transmission infrastructure options can be 'turned' up or down and 'switched' on or off depending on scenario parameters. The model is constrained by existing and planned supply and infrastructure capacity, interim and final GHG emissions reduction targets, and balancing energy supply and demand.

To illustrate some of the key outputs from the LCP pathways modelling, Figure 8 shows a hypothetical hydrogen infrastructure pathway for Ontario from 2030 to 2050. Our analysis will produce 2030, 2040 and 2050 snapshots of the development of hydrogen infrastructure across Ontario – including GW of installed electrolyser and SMR capacity, GWh of hydrogen storage required, repurposed and/or new hydrogen transmission pipelines, etc. All of these results will be produced for each individual Ontario region.

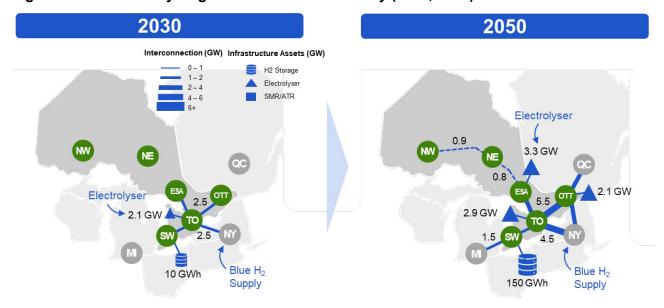


Figure 8: Illustrative Hydrogen Infrastructure Pathway (2030, 2050) for Ontario

Our understanding is that one of EGI's main interests is in the development of supply and infrastructure costs for each of the pathways analysed (whether scenarios or sensitivities). Our analysis will produce pathway costs figures, like the ones presented below by Figure 9 and Figure 10.

This figure shows the hydrogen infrastructure pathway costs developed for a group of gas transmission and distribution companies in a recent engagement.

Figure 9: Example Hydrogen Infrastructure Investments

Investment Costs for Hydrogen Infrastructure Development (2025-2045)

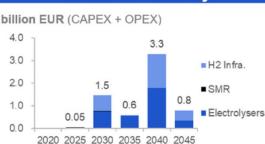
The figures show the hydrogen infrastructure investment determined in a recent project for group of gas transmission and distribution companies. Two decarbonization scenarios were assessed; both in the same context as EGI's Diversified and Electric pathway scenarios.

The tables below show the investment required to scale up hydrogen infrastructure from 2025 to 2045. Investments include CAPEX and OPEX of electrolysers, SMR+CCS and hydrogen transmission pipelines.

- Our analysis determined the Diversified scenario required the buildout of 36-inch hydrogen pipelines across c.1,400km; for a total investment of EUR 3.3. billion.
- In comparison, the Electric scenario required 20-inch pipelines over 1,000km and 36-inch • pipelines over 400km; a total investment of EUR 2.6 billion.



Hydrogen Infrastructure Investment (Billion €)



Electric Pathway

Hydro	ogen l	nvest	ment	(billior	EUR))
	2025	2030	2035	2040	2045	1

1.2

0.3

1.3

2.2

14

2.7

0.6

0.9

0.9

Тс

4.

0.

3.

8.

0.9

0.1

07

1.2

2025

0.05

0.05

Electrolyser

SMR

Total

H2 Infra.

Hydrogen Investment (billion EUR)

	2025	2030	2035	2040	2045	Tot
Electrolyser		0.7	0.6	1.8	0.4	3.5
SMR	0.05	0.1	-	-		0.1
H2 Infra.	Ξ.	0.7	0.0	1.5	0.4	2.6
Total	0.05	1.5	0.6	3.3	0.8	6.2

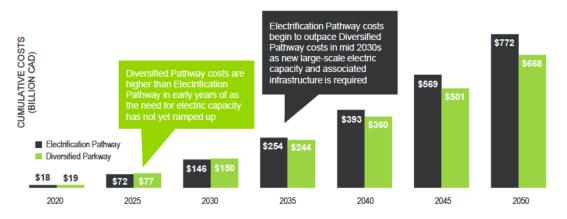
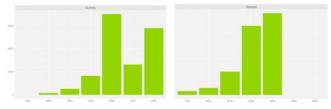


Figure 10: Example Pathway Cumulative Costs

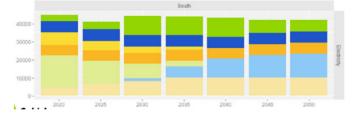
An additional set of illustrative outputs of the LCP model are presented below in **Figure 11** and **Figure 12**.

Figure 11: Illustrative Example Model Outputs

Infrastructure build-out by energy carrier, region, and year



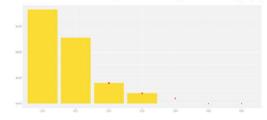
Supply capacity mix (e.g., generation, storage, crossload) by energy carrier and region



Granular view of costs over time



Carbon emissions by source compared to target(s)



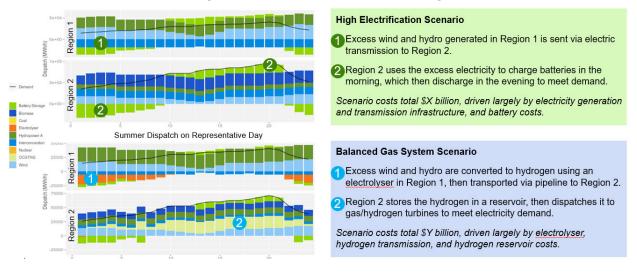


Figure 12: Illustrative Scenario Insights

1.5 Task 5. Reporting

Guidehouse is providing two reporting options for EGI's consideration.

Option 1: Draft Report in PPT format and Final Report in Word format.

Guidehouse will prepare a PPT report to the November 1st deadline. The report will be structured to facilitate internal and external feedback sessions which will be completed by EGI. Guidehouse's experience is that PPT format is more conducive to focusing feedback on important conceptual elements of the project methodology, inputs, scenarios, risks, and conclusions. A Word formatted report tends to elicit significant editorial and formatting comments/feedback. Guidehouse followed the PPT report format during its project with FortisBC. The executive of FortisBC appreciated the short time commitment required to review the report and the ability to have a focused discussion on key concepts and conclusions when the PPT report was presented to them.

Guidehouse will prepare a draft final report in Word format within 10 days of receiving EGI's comments from the stakeholdering process that EGI will conduct in November and early December. EGI will need to provide a concise and organized set of stakeholder comments to Guidehouse.

EGI will provide its comments to the draft final report by December 20th. Guidehouse will create a next-to-final report for EGI's review, for editorial and formatting purposes only, before the end of December. Guidehouse will incorporate EGI's editorial and formatting comments in the final report for delivery on January 4th. Guidehouse would typically encourage multiple drafts and comments stages but limited time between when the stakeholdering process is completed and when the final report is due dictates a well-structured process and somewhat rigid timeline.

In order to meet for EGI and Guidehouse to meet final deadline of January 4th, each partner will need to commit to prompt review and turnarounds.

Option 2: Draft and Final Reports in Word format.

Guidehouse will prepare a Word formatted draft report for November 1st.

Guidehouse will prepare a draft final report in Word format within 10 days of receiving EGI's comments from the stakeholdering process that EGI will conduct in November and early December. EGI will need to provide a concise and organized set of stakeholder comments to Guidehouse.

EGI will provide its comments to the draft final report by December 20th. Guidehouse will create a next-to-final report for EGI's review, for editorial and formatting purposes only, before the end of December. Guidehouse will incorporate EGI's editorial and formatting comments in the final report for delivery on January 4th.

In order to meet for EGI and Guidehouse to meet final deadline of January 4th, each partner will need to commit to prompt review and turnarounds.

Option 1 vs. Option 2

The price and schedule for each of the two options is the same. EGI can choose either of the two options at any time up until early October or EGI and Guidehouse can agree to a hybrid option based on how the project unfolds.

Proposed Final Report Outline (estimated to be 60-80 pages total)

In the remainder of this section, we present a proposed outline for the final deliverable report which will be updated based on input from Enbridge during the project initiation phase. Should EGI choose Option 1 from above, the PPT format draft report will include summary slides for all aspects of the proposed outline except perhaps for Appendix B – Detailed Model Inputs.

- Executive Summary (2-3 pages)
 - Recommendation of the least cost option to reach net-zero emissions
 - Summary of the most critical implications to Enbridge business and questions that remain to be explored
- Introduction (1-2 pages)
 - What critical questions did this work address?
 - Considerations for how the data should be used
 - Scenario definitions
- Outcomes of the Pathways Assessment (6-9 pages)
 - Electrification
 - Diversified
 - For each scenario a graphic description will be provided that describes the optimal pathway modeled through the Pathways Assessment and the following details will be provided:

- Total CAPEX costs for the owner and total societal costs, for achieving target by 2050 (short-term 2030 and long-term 2050)
- Impacts on electric grid demand / capacity
- Risks of stranded assets (loss of gas demand and changing customer segments served)
- Abatement potential from baseline year
- Pathway opportunities and risks
- System Reliability opportunities, challenges and limitations
- Implications of the Pathways Assessment to Enbridge' Gas Business and Ontario's broader Energy System (10-12 pages)
 - Review of current energy system and policy framework in Ontario
 - Policy framework that would be needed to implement optimal pathway
 - Identification and characterization of critical drivers that will be required to drive either pathway
 - Opportunities and feasibility of H2, RNG and other low carbon fuels
 - Review of energy imports/exports and expected changes or implications of pathways
 - Pathways ability to adjust to sudden or extreme weather conditions
 - Evidence to support the role of both the electricity and gas systems in achieving low cost decarbonization in Ontario
 - High level commentary on the possible environmental impacts/benefits, including to land, water, waste management (including nuclear waste), associated with each scenario.
- Conclusions (3-4 pages)
 - o Recommendation of the least cost option to reach net-zero emissions
 - Summary of the implications in Ontario
 - Key questions that remain unanswered or were identified for further investigation through the course of the analysis
 - How Enbridge should use the information from this study
- Appendix A: Methodology (8-12 pages)
 - Detailed description of the methodology used to provide the documented results, including a description of the LCP model
- Appendix B: Detailed Model Inputs (8-12 Pages)
 - Documentation of all analysis inputs and links to data sources

1.6 Task 6. Stakeholder Engagement (if necessary)

We have a specifically designed team of senior thought leaders and experienced facilitation and strategy consultants to support any stakeholder engagement which occurs following the study. Andrea Roszell (Director-in-Charge) has recently supported stakeholdering of the FortisBC Pathways study with multiple organizations across BC and North America including the BCUC, BC Hydro and the NWGA.

Guidehouse proposes to leverage the Transformation Readiness and Strategic Vision (TSV) Model[™] to develop internal and external alignment on the study results and key outcomes. The model leverages facilitated discussion across and around the organization to determine the critical areas of strategic focus that are required for decarbonization. TSV is based on three core principles:

- 1. **Multiple and comprehensive points of view** includes opportunity for senior leadership, management and staff layers of the organization to contribute ideas
- 2. **Focused Discussion** through interview and workshop instruments, we focus discussion on key trends and conversations that matter
- 3. **Strategic Alignment** aligns outcomes with provincial policy, corporate strategic direction and integrated energy system views

TSV™			EXERNAL	SYNTHESIS
PREPARATION	EXECUTIVE INTERVIEWS	MANAGEMENT WORKSHOPS	STAKEHOLDER	STRATEGIC ALIGNMENT
 With broad organizational and stakeholder engagement, it is critical to plan robustly Communicate effectively Develop tools, mechanisms and engagement goals early 	 Assess key factors and emerging challenges Discuss opportunities and risks for integrated energy system Determine strategic vision alignment 	 Directors Workshop Managers Workshop Obtain broad input from across the organization Identify key areas of alignment with executive and areas of divergence Build up common understanding and buy-in for change 	 Engage external stakeholders leveraging Enbridge and Guidehouse networks Broad stakeholder engagement on pathways results, Ontario needs to meet Decarbonization targets, Opportunities and Risks 	 Develop report to summarize areas of focus for Ontario, benefits of optimal pathway and risks Simplify the variety and complexity of input and views Identify enabling tech, business, and policy mechanisms

2. Project Schedule and Deliverables

The proposed schedule ensures that the defined scope of work is delivered on time and within budget. Our project management approach combines detailed project planning, scheduled client communications, and detailed reviews.

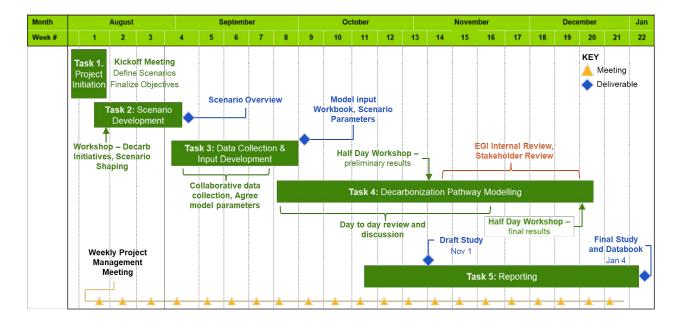


Table 5. Proposed Project Schedule

2.1 Assumptions

The key assumptions made in the proposed project schedule are listed below.

- Guidehouse's project schedule is based on EGI's start date indicated in the RFP. A delay in project start could affect the schedule as shown. We will work with you to amend the schedule and extend delivery dates as appropriate.
- This proposal's project schedule assumes EGI's timely review and approval of any project materials provided by Guidehouse. For this defined scope of work, timely review is defined as no more than 3 business days.
- All data used in the development of scenarios for analysis will either be publicly verifiable or agreed to for use as part of the analysis by both parties, should any public report be required.

3. Our Team

Guidehouse has assembled a team of highly qualified and experienced professionals who can complete a decarbonization pathways study that EGI can be confident will support EGI's business planning activities and external stakeholder discussions. To effectively manage this assignment and establish a project governance, control and quality assurance mechanism, Guidehouse will implement the following team and approach.

The Guidehouse team will be overseen by Craig Sabine, who leads Guidehouse's Canadian energy practice and who has extensive low carbon economy modeling and pathways experience, going back to 2003 during development of Canada's initial climate change policy and emissions pricing policy platforms. Craig will work closely with the Director-In-Charge and the team as a SME, offering guidance, project facilitation and QA/QC.

Andrea Roszell, a Director in Guidehouse's Canadian practice, will serve as engagement manager and Director in Charge for this effort. Andrea will be available to EGI at any time to address strategic direction of the project, quality, performance and concerns and issues as they arise. Andrea led Guidehouse's low carbon pathways engagement with FortisBC.

Alvaro Lara will serve as the project manager. He will be the key point of contact for the EGI team. Alvaro will establish communications and schedule regular and strategic meetings, as required, working closely with the EGI program manager to ensure the project stays on schedule, within the proposed budget and achieves critical deliverables. Alvaro's decarbonization pathway experience includes engagements with gas transmission and distribution companies in the UK and mainland Europe. Alvaro is very familiar with the context of the Ontario energy system as he has supported engagements with most major Ontario energy stakeholders.

Our team organization in Figure 13 ensures that the right level of resources is deployed to meet the completion deadline. This structure leverages highly skilled experts to span the capability sets required for this scope of work. Biographical sketches for key team members follow in Craig Sabine and Dixon Grant, who have both been involved in five other engagements, summarized in Appendix A, with EGI over the last twelve months, will provide continuity with those projects and an understanding of EGI's strategy and operations.

Table 6. Professional resumes for the senior team members are attached with our submission as a separate document.

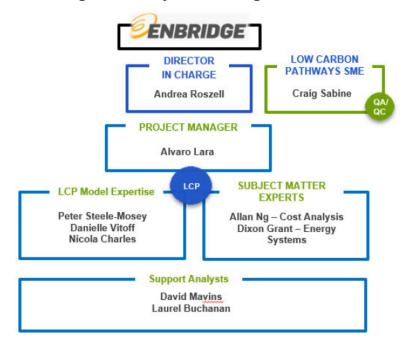


Figure 13: Project Team Organization

Craig Sabine and Dixon Grant, who have both been involved in five other engagements, summarized in Appendix A, with EGI over the last twelve months, will provide continuity with those projects and an understanding of EGI's strategy and operations.

Consultant Title Project Role	Education	Qualifications and Experience
Craig Sabine Director Toronto	 MBA, Queens, Smith School of Business BES, Environment and 	19 years of experience that includes: Low carbon economy modelling, pathways analysis and GHG mitigation abatement curves
Project Role:	Resource, University of Waterloo	Policy analysis of market-based emission reduction mechanisms, energy efficiency programs and clean supply standards
		Regulatory support and utility corporate strategy Transactions support and M&A for over \$40 billion in
		power and natural gas assets Integrated resources planning initiatives for nearly every major provincial utility in Canada
		Economic analysis and BCA

Table 6. Expertise and Experience of Key Team Members

Consultant Title Project Role	Education	Qualifications and Experience
Andrea Roszell Director Toronto Project Role: Director in Charge	 Master of Science, Chemical Engineering (Queen's University) B.S., Honours, Chemical Engineering (University of Waterloo) 	 15 years of experience that includes: Low carbon economy modelling and pathways analysis Transportation Electrification EE and DSM program planning and evaluation Microgrid and renewable energy project assessments Business case development and market assessment of emerging energy technologies Financial analysis and asset valuation
Danielle Vitoff Associate Director Project Role: Decarbonization Pathways Strategy	 BA, Environmental Design, Architectural Program, Montana State University BA, Liberal Studies, Environmental Studies Option, Montana State University 	 10+ years of experience that includes: Sustainability, decarbonization, and strategic planning for utilities, corporations and governments. Led the delivery of the recently completed AGF Resilience Study. Led teams, as the project manager, to support decarbonization plans for multiple natural gas utilities including, GHG assessments, decarbonization roadmaps, and evaluating business impacts to support rate case filings. Led teams in delivering climate risk and sustainability strategies for utilities, Fortune 100 companies, and top 10 U.S. cities.
Alvaro Lara Managing Consultant Utrecht Project Role: Project Manager	 MSc. Climate Change, Management and Finance (Imperial College Business School, UK) BEng. Mechanical Engineering (University of Toronto) 	7+ years of experience that includes: Electricity and gas network decarbonization and energy system analyses Grid modernization strategy, long-term investment plans, cost-benefit analyses Demand-side management (energy efficiency) planning, strategy, and long-term forecasting Electric mobility adoption, strategy, data analysis
Allan Ng Managing Consultant Toronto Project Role: SME – Cost Analysis	 MBA, Smith School of Business, Queens CPA, Canada B.Comm COOP in Accounting, University of Calgary 	 12 years of experience that includes: Asset life-cycle modelling for energy transition Financial and utility revenue requirement modelling to determine customer rate impact under low carbon scenarios Developed stranded asset methodology and modelling for FortisBC low carbon pathway Lead development of electric transportation business cases and economic analysis Leads North America transaction advisory in supporting investors and large corporate in acquisitions focused in energy transition

Consultant Title Project Role	Education	Qualifications and Experience
Dixon Grant Managing Consultant Toronto Project Role: SME – Energy Systems	 BComm, Queen's University BSc., Biology, Queen's University 	5 years of experience that includes: Development of clean growth pathways for natural gas utilities, including the assessment of GHG reduction potential and costs of low carbon technologies (RNG, transportation, heat pumps, energy efficiency, etc.) Canadian market lead for wholesale energy market modelling and price forecasts Financial due diligence and valuation for large infrastructure projects and M&A Electricity load forecasting GHG accounting and assessment for industrials
Peter Steele-Mosey	 BA (H), Queen's 	14 years of experience that includes:
Associate Director Toronto	 University MA, Economics – Applied Econometrics, University of Guelph 	 Development of the Ontario Fuels Technical report for the Ontario Ministry of Energy., a scenario analysis of potential approaches for decarbonizing Ontario's combustible fuel sector.
Project Role: LCP Model SME		 Development of two consecutive (in 2016 and 2019) scenario analyses for FortisBC to explore the consequences of significant structural changes in load drivers on the existing reference forecast of load.
		 Load forecasting and load forecast support for Canadian, US, and Middle Eastern utilities.
		 Econometric impact evaluation of price pilots, time- differentiated tariffs, demand response and energy efficiency programs.
Nicola Charles Senior Consultant Toronto	 Bachelor of Engineering, Applied Mathematics and Mechanical Engineering, Queen's University 	 3 years of experience that includes: Econometric evaluation of energy efficiency and demand response programs across North America Measure characterization and modeling for EE and DSM potential studies
Project Role: Support		 Program design and BCA for EE programs Adoption, traffic and charging station site modelling using advanced optimization and GIS to support electric transportation business cases and economic analysis for utilities
David Mavins	BASc, Queen's	2 years of experience that includes:
Consultant Toronto	University	 EU Hydrogen Backbone decarbonization scenarios analysis
		BC Hydro electric vehicle fast charger rate design
Project Role:		Industry decarbonization pathways
Support		 Forecasting hydrogen system development Strategy with respect to distributed energy resources

Consultant Title Project Role	Education	Qualifications and Experience
Laurel Buchanan	BASc, Queen's	2 years of experience that includes:
Consultant	University	 Regulatory filing support on a variety of topics
Toronto		including EVSE ownership and natural gas demand forecasting
Project Role:		 GHG accounting and target setting for corporates
Support	 Power asset valuations and clean energy due diligence 	
		 Energy market research and analysis
		 Survey development and analysis and stakeholder interviews

4. Pricing

Guidehouse will complete the scope of work detailed in this proposal for a fixed fee of

Guidehouse will complete any additional work at rates and/or fixed fees to be agreed between Guidehouse and EGI.

Assumptions:

- In order to meet the January 4, 2022 deadline for a final report, EGI will have two opportunities to provide input to the draft report. Once after EGI completes its stakeholdering process and once after Guidehouse provides an updated report based on EGI's stakeholder-based comments.
- This proposal is valid for 90 days from date of submittal.
- This project will be executed under the Consulting Agreement between Enbridge Gas Inc and Guidehouse signed January 28, 2021.
- EGI will be responsible to schedule their employees to attend all meetings, workshops, and interviews.
- When Guidehouse personnel are working onsite, EGI will provide workspace (e.g., conference rooms, individual spaces) and internet access as needed.
- It is assumed currently that stakeholder engagement will be performed by EGI. Should Guidehouse be required for stakeholder engagement and public facing report necessary, incremental fees may apply.

Appendix A. Qualifications

Our relevant experience, which is highlighted below, allows us to start fast and become productive immediately. In addition to quick startup, the lessons we have learned through a series of recent decarbonization strategy engagements will allow our team to offer deeper insights and more comprehensive results.

A.1 EGI Experience

We understand the Ontario energy context, policy environment and both the electricity and natural gas systems in the province. We have extensive decarbonization analysis experience across major jurisdictions and gas utility service territories, and we will proceed with this important work with a keen understanding of the EGI context having current and recent project work experience supporting the organization's planned 2022 rebasing application. Our work with EGI has included the following projects and we encourage your team to gauge our rigorous and collaborative consulting approach and team-based delivery style with your colleagues, who *include Jason Gillet, Steve Dantzer, John Gillis, Safi Junaid, Hulya Sayyan, Elena Chang* and *Briana Hamilton.*

Project	Gas Storage Blind RFP	Gas Supply Planning Approach Benchmarking	Avoided Costs Calculation	Load Forecast Approach Benchmarking	Corporate Share Service Cost Allocation Review
Brief Summary	Developed a process to independently procure gas storage at Dawn via RFP	Comparative analysis of industry practices related to weather and risk assumptions for gas supply planning, incl. utility best practices for design day demand modeling.	Reviewed current DSM avoided cost assumptions, methodologies, and input and provided best practice/jurisdictional review.	Examined leading practices applied by gas utilities in approaches and procedures for load forecasting	Independent review of reasonableness and appropriateness of corporate shared services cost allocation methodology

These projects have been conducted, or are in the process of being completed, by various Guidehouse teams, demonstrating our breadth of experience, knowledge of key aspects of EGI's operations and our deep capacity to deliver. Strong continuity exists with our proposed approach, with Craig Sabine and Dixon Grant having been involved in nearly all EGI work over the past 12 months.

A.2 Low Carbon Pathways Modelling

FortisBC Energy Vision 2050 Low Carbon Pathway. (2019-2020). Challenged by a highly progressive policy landscape focused on meeting Paris-aligned GHG targets for the province, FortisBC has been lobbying for natural gas to be considered as part of the solution to climate change. Guidehouse supported the utility to analyse deep carbon reduction scenarios and identify unique pathways to achieve 80% reduction targets by 2050. Pathways include a role for the reliable and low-cost natural gas system. Guidehouse partnered with whatlf?, an economy and energy modelling team, to develop and analyse comprehensive low carbon scenarios.

First, a pathway that aligns with current government policy initiatives designed to incent high electrification was examined. Secondly, a series of renewable and alternative fuels and built environment initiatives were defined and modelled to provide an optimized gas scenario. Key conclusions from the study include:

- The Electrification and Diversified Pathways both achieve significant domestic GHG reductions in-line with the provincial government's 2050 targets.
- The Diversified Pathway uses gas infrastructure and saves in excess of \$100 billion by 2050

FIGURE 10. BRITISH COLUMBIA EMISSIONS REDUCTIONS UNDER ENERGY VISION PATHWAYS Oil & Gas (O&G) sector emissions attributable to exports are excluded from both the Reference Case emissions and 70 Pathway emissions 60 ² EMISSIONS EGATONNES) 50 Both pathways achieve roughly 40 the same level of emissions Reference 30 reductions by 2050 Reference without Export O&G 20 Electrification Pathway (ME ŝ +13 10 **Diversified Pathway** 0 2018 2020 2022 2024 2026 2028 2030 2032 2034 2036 2038 2040 2042 2044 2046 2048 2050

A public copy of Guidehouse's report can be found at this link.

National Fuel Gas Company (NFGDC) – Guidehouse completed a scenario analysis for New York's Climate Leadership and Community Protection Act (CLCPA).

In 2019, New York State adopted the Climate Leadership and Community Protection Act (CLCPA), with the ambitious target of 85% reduction in GHG emissions by 2050 (relative to 1990). NFGDC, a natural gas utility, wanted to understand how this policy will affect different sectors' demand for natural gas and customers' annual energy costs. In particular, NFGDC was curious whether the displacement of natural gas by low-carbon alternatives fuels would improve customer energy costs

Guidehouse used our low carbon pathways model to conduct a scenario-based analysis, comparing the potential outcomes of an electrification-focused scenario to a scenario that facilitates alternative fuel development. We assessed the various GHG reduction technologies that would need to be deployed and the associated CAPEX that would be required to meet the overall goal of the CLCPA and the various requirements that the law sets out for the power sector. We also constructed representative rate models to estimate how decarbonization policies will impact customers' energy bills in Upstate and Downstate New York.

The Result: We provided an objective analysis that highlights the value of considering gas within the decarbonization portfolio to meet the CLCPA targets. Continuing to use the gas system and transitioning to low-carbon gas substitutes will reduce the cost of decarbonization for NY customers.

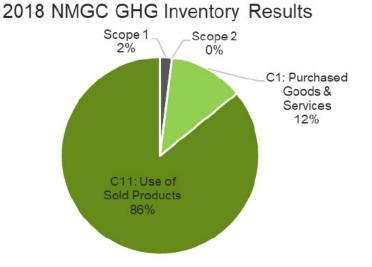
NFGDC Scenarios

	Business as Usual	Selective Electrification	Electrification Only
Achievement of GHG Reduction Target (CLCPA)	CLCPA 2050 target is not met	Yes, CLCPA target and potentially more aggressive targets are met.	Yes, CLCPA target and potentially more aggressive targets are met.
Customer Choice / Benefit	Customers continue to maintain fuel and system choice	Customers will continue to maintain some choice	Customer choice will be restricted to all-electric systems
Leveraging Existing Infrastructure	Existing infrastructure is used to the fullest extent	Much of existing infrastructure can continue to be used	Most natural gas infrastructure will be retired and extensive build out of electric infrastructure will be required.
Inherent System Resiliency / Reliability	Resiliency and reliability of current operations is maintained and potentially increased	System resiliency / reliability will be similar to the business as usual case	More costly to maintain system resiliency and reliability given the intermittent production of renewables
System Cost	Lowest system cost of the scenarios considered.	More costly than business as usual scenario, but less costly that full electrification	Significant cost for the build out of infrastructure including systems and conversion of existing systems

New Mexico Gas Company Low Carbon Pathways Roadmap – In early 2019, the Governor of New Mexico committed the State to meeting the goals of the Paris Agreement and reducing the state's GHG emissions 45% by 2030, relative to 2005. New Mexico Gas Company (NMGC) needed to understand the associated challenges and opportunities for their business and develop a new paradigm for low-carbon operation and investments.

Guidehouse led the NMGC team through three phases of work, including:

- Development of a GHG inventory by evaluating NMGC's total emissions in 2018, the trend since 2010, and portion of the State's emissions that is related to NMGC.
- Review of decarbonization goals and pathways, including best practices being pursued by peer utilities and clarification of the pathway to achieve the Paris Climate Agreement.
- Development of a low-carbon roadmap, which assesses NMGC's opportunities to reduce emissions across all emissions categories identified in the GHG inventory.



The decarbonization roadmap will be included as an appendix document in NMGC's upcoming rate case, where NMGC will present the preliminary framework for their transition to low-carbon operation and the necessary investments to get there.

Nordion Energi (TSO) & Gas Distribution Companies – Gas Infrastructure Pathways for a Net-Zero Swedish Energy System –

Sweden has set ambitious net-zero target to decarbonize its economy by 2045, along with interim 2030 and 2040 targets. SwedeGas was looking to understand the role and value of gas supply and gas infrastructure in meeting these climate targets, as well how energy networks in individual regions will transition from today to 2045

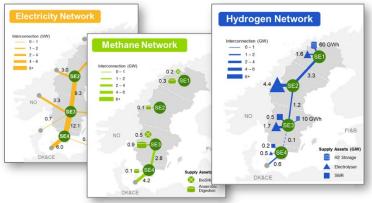
Guidehouse used its Low Carbon Pathways (LCP) model to optimize 2020-2045 decarbonization pathways for the Swedish energy system to understand the buildout of electricity, hydrogen and methane supply capacity, and associated transmission infrastructure within Swedish regions and with neighbouring regions.

Major modelling considerations included:

• Integrated capacity expansion and dispatch optimization

REGIONAL FOCUS

- Our modelling approach was configured to 4 Swedish regions corresponding to the existing electricity bidding zones (SE1, SE2, SE3 and SE4), and 3 neighboring regions: Denmark and Central Europe (DK&CE), Finland & the Baltics (FI&B), and Norway (NO)
- For each region, we determined a **regional cost-optimal buildout of supply capacity and interconnection infrastructure** for the electricity, hydrogen and methane networks from 2020 to 2045.
- Optimisation of generation, storage, and interconnections (electricity, CH4 and H2) with emissions targets
- Intra-annual temporal resolution: representative days by season
- Geographical resolution: 4 regional nodes with interconnections



Guidehouse's report was endorsed and publicised by Nordion Energi (TSO) and the 5 Swedish Gas DNOs and distributed to Swedish policymakers and politicians.

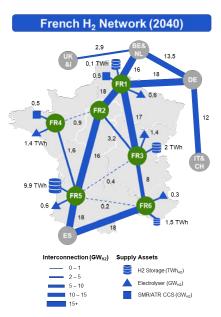
GRT Gaz & Consortium – Hydrogen Transport and

Storage Infrastructure in France – Our client needed an analysis-based assessment of the role of hydrogen transportation and storage infrastructure in the context of France's hydrogen strategy and the broader European context.

Guidehouse completed a data gathering and scenario development exercise across 4 scenarios: On-site H2 production, Ecosystèmes territoriaux, Ecosystèmes européens, and hybrid.

Guidehouse used its Low Carbon Pathways (LCP) model to calculate the costs and benefits of each scenario including investment requirements, costs of H2 delivered, cost of green H2 delivered, quantification of security of supply and annual Co2 saved.

Guidehouse developed a narrative through objective and factbased approach to bring coherence to the complex subject.



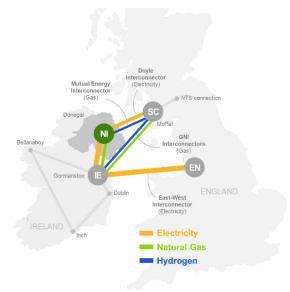
The Result:

- An analysis-based assessment of four hydrogen demand, supply, transportation, and storage scenarios to meet France's goal of 6.5GW of production by 2030
- A clear rationale on the role of hydrogen transportation and storage infrastructure and the benefits for France (investment, security, avoided CO2, societal cost saving)
- An analysis-based report with clear conclusions and assumptions presented to the CSF.

Gas Networks Ireland & Mutual Energy – Gas Networks Pathways to a Net-Zero 2050 – The Northern Ireland (NI) Government is developing an energy strategy to facilitate NI's contribution to the UK Net Zero 2050 strategy. As part of this the gas network operators of Northern Ireland (TSOs and DNOs) have been asked to develop a credible pathway to net zero for their sector.

Guidehouse used its Low Carbon Pathways (LCP) model to optimize 2020-2050 decarbonization pathways for the NI energy system.

- Geographic Scope: 3 zones; NI and neighbouring regions (ROI and GB)
- Energy carriers: Electricity, hydrogen, and methane
- Interconnections: Existing electricity and methane interconnections, and option to repurpose / build new hydrogen interconnections
- Modelled years: 2020, 2030, 2040 and 2050



Pathway outputs from the LCP model were used to develop a high-level implementation plan of near-term (2030) and long-term (2040-2050) supply and infrastructure investments by the NI gas networks

The Result: The project is underway and is expected to be completed by Q3-2021. Our report will serve as a foundation for the NI gas networks' decarbonization plans and investments over their next regulatory period (2022-2026).

Gas for Climate 2050 – Pathway to a Net-Zero Emission Energy System – Policy strategies to decarbonize the energy system to meet climate change targets often focus on electricity and the value of gas and gas infrastructure is not equally appreciated. The (renewable) gas sector needs a consistent and credible vision on the future of gas and get policy endorsement to ensure a license to operate. Guidehouse supported the Gas for Climate consortium with scenario-analysis and vision development on the future role of gas alongside electricity.

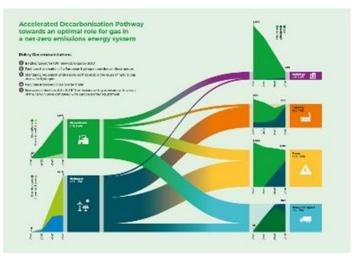
Guidehouse estimated the potential for renewable gas using innovative approaches such as Biogasdoneright to avoid competition with food crops and to guarantee a GHGemission reduction by 95% compared to 1990.

The system costs of two scenarios were compared: an electrification scenario and an electrification scenario with renewable gas. The renewable gas was distributed to sectors based on the largest marginal value of the gas.

Guidehouse provided recommendations regarding the design of the future energy system which is both sustainable and costefficient.

The Result: CEO statement supporting a target to achieve net zero greenhouse gas emissions by 2050. Two scenario modelling studies published in 2018 and 2019, compared optimized gas with a minimal gas 2050 scenarios. A pathway study 2020-2050 was published in 2020 and outlined several roads to achieve 2050 targets. 2030 Action Plan: A to-do list that was presented by the CEOs of Gas for Climate members to European Energy and Climate Commissioner Arias Cañete





European Pipeline Consortium: European Hydrogen Backbone.

Guidehouse supported a consortium of 23 gas infrastructure companies across 21 countries to create a vision of a European Hydrogen Backbone – a dedicated hydrogen pipeline transport network spanning ten European countries. The Report "Extending the European Hydrogen Backbone" was released in April of 2021 and is an update to a report Guidehouse published in 2020. Guidehouse developed hydrogen infrastructure maps for 2030, 2035 and 2040. A copy of the report, which has successfully spurred the conversation around the role of hydrogen in the future European energy system, can be found at this link.

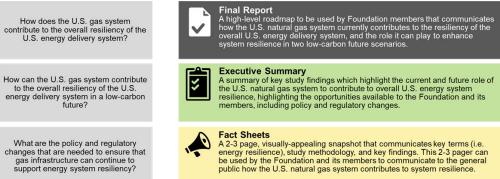


American Gas Foundation (AGF) – Energy System Resilience Whitepaper – Driven by the increasing frequency and severity of disruption events (i.e., extreme weather, cybersecurity), energy system resilience has arisen as a key priority in policy making discussions, particularly in discussions that aim to achieve decarbonization goals. The AGF wanted to understand the role that the U.S. natural gas system plays in contributing to overall energy system resilience today, and in a near-term decarbonized future.

Guidehouse is working to define the current and near-term energy system states, including defining resilience and the characteristics on which it can be evaluated. Guidehouse is evaluating the state of the regulatory and policy landscape to provide recommendations of issues and policies that must be addressed to ensure resiliency in the energy system transformation.

Project Deliverables

Key Questions to Be Answered

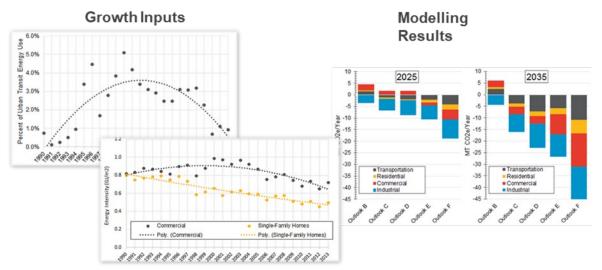


Guidehouse will provide clarity that gas infrastructure not only supports current energy system resilience, but also future energy system resilience. Guidehouse will also provide the Foundation with recommendations of issues/policies to be addressed to support the natural gas industry's role in a resilient future ES, along with a roadmap to be used by Foundation Members

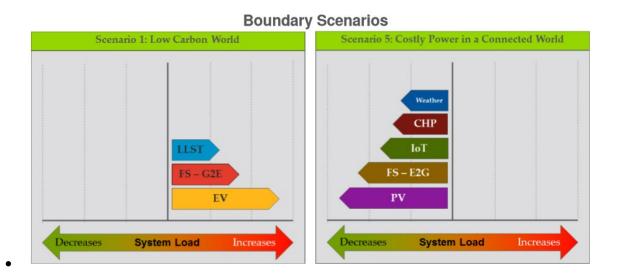
with external stakeholders to communicate how gas provides resiliency support today and in a decarbonized future.

A.3 Related Low Carbon, Scenario Analysis and Pathways Projects

Ontario MOE Fuels Technical Report & Decarbonization Analysis (2017) – Guidehouse supported the development of a technical report providing a comprehensive overview of the combustible fuels sector in Ontario since 2005, along with an examination of a set of outlooks to 2035 that capture opportunities for electrification of the economy and decarbonization of fuel supplies. Key input assumptions were developed in consultation with the IESO, and members of the Fuels Sector Working Group. These were applied to the CanESS integrated energy systems model to develop a set of possible future levels of fuels demand and combustion related GHG emissions. Under the most aggressive assumptions regarding electrification, incremental natural gas conservation and the adoption of alternative fuels (biofuels and less carbon intensive fossil fuels), the modelling predicted a 40% decrease in GHGs in 2035 compared to the Business As Usual (BAU). Following publication of the report, Guidehouse took part in a cross-province consultation process in support of the Ontario Long-Term Energy Plan, presenting a summary of the technical report's findings in 17 communities across Ontario.



Fortis BC Long Term Load Forecast Scenario Analysis (2016) - Guidehouse was engaged by FortisBC to develop a set of five future load scenarios to allow FortisBC to explore the implications for its long-term electric resource planning of significant structural shifts in load drivers. The study examined eight load drivers of interest: integrated photovoltaic storage systems (IPSS), electric vehicles (EVs), fuel switching (gas to electric and vice versa), climate change provoked weather shifts, large load sector transformation, the internet of things, and combined heat and power. Working closely with a large group of internal FortisBC stakeholders, Guidehouse built five projected scenarios designed to test the impact of possibilities that were "reasonable extremes", i.e., scenarios of combined uptake across load drivers that a qualitative risk assessment would indicate are in the long tails of the probability distribution, but still within the realm of the possible.



Confidential Client Heat Pump Deep Dive (2020-2021). Given the impact of Heat Pumps on electric peak demand, Guidehouse supported a deeper dive analysis focused on refining results from an earlier analysis with real world performance data and greater variety in Heat Pump types. This analysis incorporated more robust and detailed information regarding electric, gas and dual fuel heat pump performance and how a deeper understanding of implementation in different parts of the clients' service territory would impact the scenarios' results. The team analyzed the thermal loads applied to and efficiency of heat pumps in different climate zones within the service territory and analyze differences in thermal loads by various housing structures. To characterize the heat pumps, Guidehouse developed the following:

- Summary of climate zones and customer segmentation and resultant use types detailing the number of customers in each segment and climate zone
- Heat Pump Performance Characteristics for each applicable combination of customer segments and climate zones and heat pumps (COP, annual and peak energy demand, capacity delivered at different temperatures)
- Daily load profiles for each combination of segment, climate zone and heat pump type that reflects a 1 in 2, a 1 in 10 and a 1 in 20-year cold day
- Total installed costs for each Heat Pump and customer type at different equipment sizing levels

The Heat Pump characterization was then incorporated into a broader GHG reduction modelling exercise to determine the impact on energy, peak and total costs.

Ontario Teachers' Pension Plan Low Carbon Economy Investment Framework -

Guidehouse led one of the world's largest funds through a series of workshops to develop three principle analytic underpinnings, including carbon futures scenarios, economic performance indicators and a change management model. We developed a new strategic framework to transform the Fund's approach to identify opportunities in the shift to a low carbon economy and the catalysts and tipping points likely to result in positive carbon mitigation. Three core future scenarios highlighting the likely actions, economic and policy activity, technology innovation

levels, consumer behaviour and capital flows in futures with differing carbon emission levels and climate change impacts. The assignment prioritized a large set of possible economic indicators of a shift towards a lower carbon economy, Navigant and the fund defined a short list of key KPIs offering insight on the scale, intensity, and pace of the shift.

Wien Energie City of Vienna Decarbonization Study (2017) – Guidehouse presented a decarbonization study for the City of Vienna (Austria) which was completed for Wien Energie, the local utility of Vienna. The concluding full-day program included multiple presentations to the Energie CEO, to Wien Energie employees, and a panel discussion in the evening with 120 participants and journalists. In the evening, the study was formally presented to Wien Energie's CEO. The study developed a decarbonization scenario for the city of Wien. It identified necessary measures in the sectors of power, heat, and transportation to reach these significant emission reductions, and provided a detailed view on the future composition of end-use energy in those sectors. It also estimated necessary investments and defined required regulatory framework conditions. Based on this study, we derived key business model options for Wien Energie to succeed in the transformation.

EHI, EU Pathways to a Decarbonized Building Sector (2016) - A scenario evaluation of the European residential heating sector by considering developments of low carbon technologies as well as current sales numbers in order to consider all relevant heating systems that will be available in the market by 2030. The scenario results are set in relation to the carbon dioxide emission targets of the EU "Roadmap for moving to a competitive low carbon economy in 2050.

BC Electric and Gas Conservation Potential (2017) - The group of electric and gas utilities in the province of British Columbia (BC Hydro, FortisBC Electric, FortisBC Gas, and Pacific Natural Gas [PNG]) engaged Guidehouse to prepare a dual-fuel (electric and gas) conservation potential review (CPR) and to quantify the technical, economic, and achievable energy efficiency potential for the entire province. For this province-wide assessment, Guidehouse used its proprietary and state-of-the-art DSMSim[™] potential model. DSMSim is a bottom-up technology diffusion and stock-tracking model implemented using a System Dynamics framework and built on the Analytica software. Guidehouse customized its DSMSim model in order to model fuel-switching potential from multiple fuel types to electric and gas, and the adoption of alternative transportation fuels including electric vehicles. Guidehouse DRSim[™] was also used to assess the Demand Response (DR) potential across the entire province.

Portfolio of the Future SoCalGas SDG&E (2016) - Faced with increasingly stringent goals for reducing future natural gas consumption, as well as the maturity of many traditional energy efficiency measures, SoCalGas needed assistance in accelerating the commercial acceptance of emerging energy efficient technologies. Guidehouse conducted an exhaustive search of emerging energy efficient natural gas technologies in the residential, commercial, and industrial sectors. We identified the most promising technologies and designed & implemented demonstrations, market tests, and market development efforts to accelerate the readiness of these technologies for inclusion in future utility energy efficiency programs. We conducted market development activities for 14 different technologies, many of which will now be included in SoCalGas' future programs. Based on the results of this effort, SoCalGas' sister company SDG&E asked Guidehouse conducted an exhaustive search of emerging energy efficient natural gas technologies in the residential sectors. We identified the most promising technologies, many of which will now be included in SoCalGas' future programs. Based on the results of this effort, SoCalGas' sister company SDG&E asked Guidehouse conducted an exhaustive search of emerging energy efficient natural gas technologies in the residential, commercial, and industrial sectors. We identified the

most promising technologies and designed & implemented demonstrations, market tests, and market development efforts to accelerate the readiness of these technologies for inclusion in future utility energy efficiency programs. We conducted market development activities for 14 different technologies, many of which will now be included in SoCalGas' future programs. Based on the results of this effort, SoCalGas' sister company SDG&E asked Guidehouse to complete a similar effort for their electric efficiency technologies.

City of Hamburg, Germany: Low Carbon Building Strategy (2017) - Guidehouse consulted for the City of Hamburg (Germany) in various projects related to the development a low carbon building stock (heating demand and heat supply). The following projects were implemented by Guidehouse:

- Support to foster networking and accelerate transformation process by showing how to achieve sustainable development
- GIS based inventory of the complete building stock of Hamburg providing information on relevant energy parameters
- Development of urban heat concepts for two districts in Hamburg
- Development of a detailed energy concept and scenario for a typical brick district in Hamburg

The following results were achieved as part of this project:

- GIS based tool to present the energy information of Hamburg's building stock
- Study in the context of the EU project "Transform" including social data to the technical information of buildings and heat supply
- Development of an energy and urban retrofitting concept on district level

Electric Vehicle Analysis and Modelling, Large Investor-Owned Utility (2017) - The client tasked Guidehouse with analysing the market penetration and impacts of the growth of electric vehicles in its service territory. The company requested that Guidehouse find the expected growth of electric vehicles across and within the service territory, when and where charging will occur, and the impacts of the expected charging. To complete the requested analysis, Guidehouse modelled projected electric vehicle penetration across the service territory at a zip code level and developed two penetration scenarios (base and alternative), analysed the charging locations and charging levels of existing infrastructure, and analysed the load profiles to determine system impacts (energy capacity) based on the charging location, time, and level. Guidehouse presented the results, via a dynamic web visualisation tool, to the client in the first quarter of 2018.

Enbridge Natural Gas Energy Efficiency Potential Study - Enbridge Gas Distribution retained Guidehouse to assess the technical, economic, and achievable potential for natural gas energy efficiency in its Ontario service territory. Guidehouse developed a base case forecast for natural gas sales and cost, savings, density, and other characterization data for approximately 90 efficiency measures. Guidehouse estimated the avoided downstream costs applicable to Enbridge's distribution territory to be used in conjunction with upstream avoided costs

(commodity, storage, and transportation) for cost-effectiveness testing. Guidehouse developed forecasts of both technical and economic potential, by measure, disaggregated by sector, sub sector and end use by franchise strata. Guidehouse generated the overall benefit/cost ratio (TRC) for the forecasts and an economic potential forecast for six (6) achievable potential scenarios. To ensure stakeholder acceptance of the study results, workshops for each of the residential, commercial, and industrial sectors were held at various stages of the project.

Orange & Rockland, RNG Potential Analysis (2019-2020) - Orange & Rockland Utilities (O&R) was approached by large food processor who planned to connect an anaerobic digestor to O&R's gas network. O&R wanted to understand whether there was significant opportunity for RNG development in the region to support NYS' environmental goals. Guidehouse conducted a forecasting analysis to evaluate the RNG potential in O&R's service territory and surrounding region. Activities included:

- Collecting county-level data on feedstock availability for agricultural products, food/animal wastes, and other resources.
- Estimating RNG production potentials by feedstock, county, and region.
- Developing RNG production cost estimates and comparing these to forecasted gas prices
- Evaluating GHG emissions impacts by feedstock.
- Assessing current and future policies that support RNG development

The analysis provided O&R with a realistic projection for regional RNG potential considering local constraints and will support future planning activities and discussions with RNG developers. O&R submitted project findings as part of their rate case filing under PSC Proceeding 18-G-0068 (Link). RNG report can be downloaded here: Link

Electric Vehicle Analysis and Modelling, Large Investor-Owned Utility (2017) - The client tasked Guidehouse with analysing the market penetration and impacts of the growth of electric vehicles in its service territory. The company requested that Guidehouse find the expected growth of electric vehicles across and within the service territory, when and where charging will occur, and the impacts of the expected charging. To complete the requested analysis, Guidehouse modelled projected electric vehicle penetration across the service territory at a zip code level and developed two penetration scenarios (base and alternative), analysed the charging locations and charging levels of existing infrastructure, and analysed the load profiles to determine system impacts (energy capacity) based on the charging location, time, and level. Guidehouse presented the results, via a dynamic web visualisation tool, to the client in the first quarter of 2018.

Natural Resources Canada: Market Transformation Roadmap for Space Heating, Water Heating, and Window Products – Guidehouse was the technical advisor to Natural Resources Canada as it undertook a series of regular workshops with stakeholders of specific products in the space heating, water heating and windows markets to discuss R&D ad technology deployment barriers that must be overcome to move these markets towards greater energy performance. For each product category, NRCan invited stakeholders along the product supply chain, utility companies, other levels of government, etc., to participate in a series of workshops aimed at developing a roadmap for that product to guide government and industry energy efficiency activities over the next decade. Participants were organized into several working groups, each tasked with a specific product/technology. Working group discussions occurred in a series of workshops and covered topics including: setting R&D priorities, addressing barriers to market deployment, laying out the road map, and identifying key performance indicators to track progress.

European Heat Pump Association, Heat Pump Implementation Scenarios (2013) - We set up scenario calculations for different implementation paths of heat pumps until 2030, based on an analysis of current policies and possible future policy implementation supporting the use of heat pumps. The focus was on the key markets Germany, Sweden, Spain, France, Italy, The United Kingdom, Switzerland, and Austria. We investigated the application of heat pumps for space heating and domestic hot water purposes in residential buildings (differentiated by singleand multi-family buildings) and commercial buildings (such as offices, retail, and administration buildings) both for new buildings and retrofit situations.

Low Carbon Economy Strategic Framework for Confidential Pension Fund Client (2017) -

Guidehouse supported a client in developing a new strategic framework for one of the world's largest pension plans to transform its approach identifying opportunities in the shift to a low carbon economy and the catalysts and tipping points likely to result in positive carbon mitigation. Guidehouse led the fund through a series of workshops to develop three principle analytic underpinnings, including carbon futures scenarios, economic performance indicators and a change management framework. Prioritizing a large set of possible economic indicators of a shift towards a lower carbon economy, Guidehouse and the fund defined a short list of key KPIs offering insight on the *scale, intensity,* and *pace* of the shift. Three core future scenarios highlighting the likely actions, economic and policy activity, technology innovation levels, consumer behaviour and capital flows in worlds with differing carbon emission levels and climate change impacts. Performance indicators frameworks monitoring detailed level activities in the economy across a range of catalyst areas. A new way of thinking about macro drivers of a shifting world economy and set of signals to explore for new investment opportunities and current portfolio risk.

Climate Change – Scenario Analysis Air Emissions Under the Canadian Regulatory Framework (2011) – A member of the Guidehouse team led a team employed by the CEA and its members, including all major generating utilities across Canada, to aggregate and analyze electricity sector futures outlooks. While managing the project and facilitating sessions aimed at developing an analysis and approach to lobby the federal government, the team was challenged to address a broad range of sensitivities affecting different power companies across the country. The project was taken on to develop a comprehensive database of current and forecasted electric generating fleet operations and inform the development of alternative approaches to regulating the sector in terms of GHGs and air pollutants. The analysis assessed the changes in compliance flexibility, fuel switching, new and emerging technology development and credit purchasing across a broad range of regulatory scenarios. The analysis investigated the opportunities and barriers for capital stock turnover, culminating in a lower emitting national power sector and the relevant and realistic timeframes in which this may be feasible.

Ontario Ministry of Energy Independent Review of Long-Term Demand Forecast -

Guidehouse was retained by the Ministry to conduct a review of the Ontario Power Authority's long-term demand and energy forecast used as the basis for updating the Long-term Energy Plan. The objectives of the review was to assess the reasonableness of the forecast of Ontario gross (i.e. before conservation and demand management initiatives) and net (i.e. after

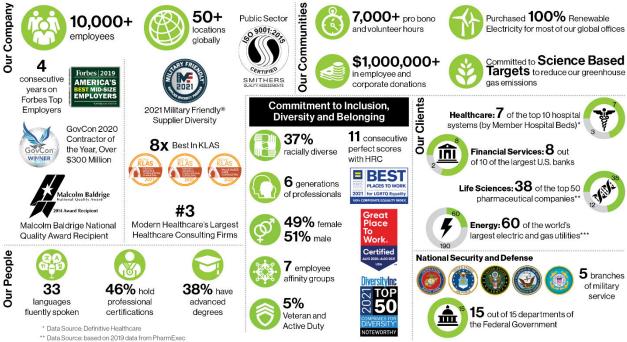
conservation and demand management initiative) peak demand and energy consumption, identify critical assumptions, and establish whether critical assumptions are reasonable and consistent with broader trends.

City of Madison, Wisconsin: 100% Renewable Energy and Net Zero Strategy (2016) - The City of Madison, WI retained Guidehouse and local engineering partner Sustainable Engineering Group LLC to develop strategies and analysis to achieve their goal of 100% renewable energy and net-zero carbon for city operations and to continue their leadership role for the larger community. The approach included identifying demand and supply-side options for facilities, operations and fleet/transit, stakeholder engagement, development of model timelines and financial/environmental analysis for cost comparisons.

Appendix B. Guidehouse Overview

Guiding with Confidence. Navigating Futures Forward. Guidehouse is a leading global provider of consulting services to the public and commercial markets with broad capabilities in management, technology, and risk consulting. We help clients address their toughest challenges and navigate significant regulatory pressures with a focus on transformational change, business resiliency, and technology-driven innovation. Across a range of advisory, consulting, outsourcing, and digital services, we create scalable, innovative solutions that prepare our clients for future growth and success. Headquartered in McLean, VA., the company has more than 8,000 professionals in over 50 locations globally. Guidehouse is a Veritas Capital portfolio company, led by seasoned professionals with proven and diverse expertise in traditional and emerging technologies, markets, and agenda-setting issues driving national and global economies. For more information, please visit: www.guidehouse.com.

Guidehouse-at-a-Glance



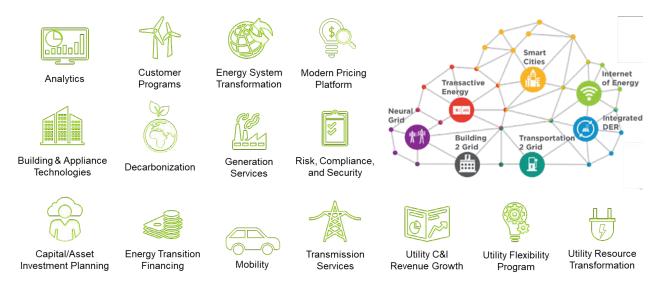
GH-022-MP GH At-A-Glance-2021 001r

*** Data Source: 2019 S&P Global Platts Top 250 Global Energy Company Rankings®

Energy, Sustainability, and Infrastructure. With over 700 consultants, our global Energy, Sustainability, and Infrastructure segment is the strongest in the industry. We are:



Our Solutions Evolve Around the Energy Cloud. These solutions focus your most pressing needs to help you thrive in the rapidly changing environment.



Core Capabilities. Our core capabilities support our solution offerings and organized through Communities of Practice.

ENERGY	✓ Market Research
贫	 ✓ Organizational Transformation
	✓ Carbon Pricing De
SUSTAINABILITY	 ✓ Customer Engager Solutions
×	✓ Data Analytics & M

- esign
- ement
- Data Analytics & Modeling
- ✓ Design Thinking
- ✓ Energy Systems Modernization
- ✓ Enterprise Risk Management & Security

- ✓ Emerging Technology Program Support
- ✓ Generation Strategy & Advisory
- ✓ R&D Program Planning & Evaluation
- ✓ Corporate Climate Plan Advisory
- ✓ Policy & Regulation Advisory ✓ Utility Strategy Development
- ✓ Regulatory Support Services

- ✓ Renewables Integration
- ✓ Clean Energy Programs Design & Evaluation
- ✓ Procurement Strategy Planning
- ✓ Large-Scale Program Management
- ✓ Wholesale Market Analysis

INFRASTRUCTURE

Cody Wood

From:	Decker Ringo <decker.ringo@guidehouse.com></decker.ringo@guidehouse.com>
Sent:	Thursday, December 16, 2021 3:43 PM
To:	Cara-Lynne Wade; Cody Wood; Jennifer Murphy
Cc:	Alvaro Lara; Andrea Roszell
Subject:	[External] Enbridge-Guidehouse Scope of Work Extension
Importance:	High

CAUTION: EXTERNAL EMAIL

This email originated from outside Enbridge and could be a phish. Criminals can pretend to be anyone. Do not interact with the email unless you are 100% certain it is legitimate. Report any suspicious emails.

Hello Cara, Cody, and Jennifer,

Below is the description of an extension to our scope of work that Cara requested on our call today. Please let me know if you have any questions.

Enbridge requested that Guidehouse adjust the decarbonization scenarios and sensitivity cases under study in the Enbridge Decarbonization Study. The Enbridge team would like our report to include sufficient information to draw conclusions about the impacts of hybrid heating systems. Specifically, Enbridge wants to know how the adoption of hybrid heating systems would impact gas & electricity consumption, peak demand, and total costs. In an older version of results (Nov 15 version), Guidehouse modeled a demand forecast assuming very low adoptions of hybrid heating systems. For our most recent draft results (Nov 30 version), Guidehouse used a demand forecast that includes hybrid heating in 20% of homes in the Diversified scenario and 0% of homes in the Electric scenario. We understand the Pan-Canadian Framework's goal is for all heating equipment installed post-2035 to have heating efficiency greater than 100%. So, for the Electric and Diversified scenarios, Guidehouse will reallocate any homes with "low-carbon gas furnace" heating equipment post-2035 to gas HPs or to hybrid heating systems. Guidehouse will consider product lifetimes and natural replace-on-failure turnover when modeling the hybrid heating adoption curve.

We expect that Enbridge will want the report to investigate and report on the value of hybrid systems in terms of their peak reduction and cost benefits. Our team recommends that we pursue this by comparing a case with low/minimal HH adoption to a case with high adoption of hybrid heating.

Our team proposes the following steps to update the Enbridge Decarbonization Pathways analysis:

- Revert the Diversified pathway back to a no-hybrid-heating assumption to match the ETSA demand forecast. This provides an apples-to-apples comparison with the Electric pathway, since the Electric pathway does not include HH. To comply with Pan-Canadian goals, any gas-powered heating systems installed post-2035 will be changed to gas heat pumps.
- 2. Model a fourth sensitivity case to examine the impacts of adopting hybrid heating, where X percent of homes are equipped with hybrid heating. For a standard single-family residence, a hybrid heating system comprises a high efficiency gas furnace and a moderate-capacity (e.g., 3 tons) moderate efficiency (e.g., 16 SEER) electric heat pump. This will help Enbridge to understand the impact of the "first X percent of hybrid heating," which could be useful for justifying hybrid heating investments.
- 3. Revise the near-final draft report (work in progress) to revert the Diversified demand forecast and to revert sensitivity cases 1 to 3 back to a no-hybrid-heating baseline.
- 4. Add the new sensitivity case #4 for hybrid heating to the report, and update the report's discussion and results accordingly.

Following this approach, the revised final report would have the following outputs:

REDACTED Filed: 2023-03-08 EB-2022-0200 Exhibit I.1.2-CCC-3, Attachment 2, Page 119 of 221

- Demand, consumption, emissions, and cost forecast for Electric pathway (unchanged)
- Demand, consumption, emissions, and cost forecast for Diversified pathway (reverted to an assumption of no hybrid heating)
- 4 sensitivities for each of these two pathways. For the first 3 sensitivities, the only change is that base-case Diversified pathway is reverted to no hybrid heating. The fourth sensitivity is new.
 - Sens 1: End use costs for distributed generation equipment (e.g., rooftop solar and home batteries) decrease faster than forecast. (Expected outcome: Cost of Electric scenario decreases, but Electric scenario is still much more expensive than Diversified scenario)
 - Sens 2: Limit investment in gas projects so that total energy system spending is less than the total Energy System Costs projected for the Diversified scenario. (Expected outcome: Net-zero target is not met)
 - Sens 3: Costs of hydrogen infrastructure costs less than forecast. (Expected outcome: The total Energy System Cost decreases for both scenarios, maybe the cost gap between scenarios gets a bit smaller.)
 - Sens 4: Hybrid heating deployed in Ontario along a projected adoption curve suggested by Enbridge. (Expected outcome: end user costs and electric system costs are lower for hybrid heating case.)

Deliverables:

Guidehouse will deliver a **revised draft final report** that incorporates these changes by **January 31, 2022**. Guidehouse will invite an additional round of revisions from Enbridge, with **comments requested by February 11, 2022**. Guidehouse will deliver a revised final report on **February 18, 2022**.

Budget:

The work described above involves effort beyond the original scope of our Guidehouse's contract with Enbridge. **The** cost of this additional scope is

Thanks,

<u>J. DECKER RINGO</u> | Associate Director Energy, Sustainabilty & Infrastructure | Guidehouse 1200 19th St. NW | Suite 700 | Washington DC 20036 | USA 202.973.3170 Direct | <u>decker.ringo@guidehouse.com</u> guidehouse.com

Cody Wood

From:	Decker Ringo <decker.ringo@guidehouse.com></decker.ringo@guidehouse.com>
Sent:	Wednesday, March 9, 2022 2:08 PM
To:	Cody Wood; Jennifer Murphy
Subject:	[External] Enbridge-Guidehouse Scope of Work Extension #2
Importance:	High

CAUTION: EXTERNAL EMAIL

This email originated from outside Enbridge and could be a phish. Criminals can pretend to be anyone. Do not interact with the email unless you are 100% certain it is legitimate. Report any suspicious emails.

Hello Cody and Jennifer,

Below is the description of an extension to our scope of work that you requested on our call Monday. Please let me know if you have any questions.

Enbridge requested that Guidehouse adjust the decarbonization scenarios and sensitivity cases under study in the Enbridge Decarbonization Study. The Enbridge team would like our analysis and report to include assumptions regarding significant uptake of geothermal heating systems. Specifically, Enbridge wants include the adoption of geothermal heating systems in the Diversified and Electrified scenarios, and include assumptions about geothermal systems in projections of gas & electricity consumption, peak demand, and total costs. Prior versions of the pathways analysis used energy demand forecasts based on Enbridge's ETSA study, which assumed minimal adoption of geothermal heat pumps. We understand that Enbridge is considering new opportunities in the geothermal space and would like to model a lowcarbon future that assumes a significant role for geothermal energy systems.

Our team proposes the following steps to update the Enbridge Decarbonization Pathways analysis to include geothermal technologies.

- 1. With EGI input, define the types of geothermal systems to be included in the revised analysis (e.g., singlebuilding scale, neighborhood-scale, and/or utility scale geothermal)
- 2. With EGI input develop reasonable assumptions regarding the potential uptake of geothermal heating over time through 2050.
- 3. Adjust the ETSA demand forecast used as the starting point for this analysis to include assumptions regarding geothermal uptake.
- 4. Locate and input a load shape profile for geothermal heating systems in northern climates, reflecting that due to their efficiency, individual geothermal systems will typically result in lower peak load growth compared to conventional air-source heat pumps.
- 5. Locate and input assumptions regarding end user costs for geothermal heating equipment installation.
- 6. Re-run Low Carbon Pathways model to model two scenarios and four sensitivities (as defined previously in 17 Feb 2022 draft report version)
- 7. Re-populate figures and tables in the draft report. Revise report language to reflect updated results.
- 8. Add discussion of geothermal technologies and assumptions to the report.

Following this approach, the revised final report would have charts and formats similar to the 17 Feb 2022 draft report version, but would include enhanced assumptions and discussion regarding geothermal technologies.

Guidehouse also sees this model update as an opportunity to incorporate supply-side assumptions around nuclear small modular reactors (SMRs), a topic on which Enbridge recently expressed interest. If requested by Enbridge, Guidehouse

will update supply-side modeling assumptions to add nuclear SMR as an available technology for the capacity expansion modeling, and add discussion of SMRs to the revised report.

Deliverables:

Guidehouse will deliver a **revised draft final report** that incorporates these changes by **April 6, 2022**. Guidehouse will invite an additional round of revisions from Enbridge, with **comments requested by April 15, 2022**. Guidehouse then will deliver a revised final report on **April 22, 2022**.

Budget:

The work described above involves effort beyond the original scope of our Guidehouse's contract with Enbridge. **The** cost of this additional scope is

Thanks,

<u>J. DECKER RINGO</u> | Associate Director Energy, Sustainabilty & Infrastructure | Guidehouse 1200 19th St. NW | Suite 700 | Washington DC 20036 | USA 202.973.3170 Direct | <u>decker.ringo@guidehouse.com</u> guidehouse.com

NOTICE: This communication is from Guidehouse Inc. or one of its subsidiaries. The details of the sender are listed above. This email, including any attachments, is meant only for the intended recipient of the transmission and may contain confidential and/or privileged material. If you received this email in error, any review, distribution, dissemination or other use of this information is strictly prohibited. Please notify the sender immediately by return email and delete the messages from your systems. In addition, this communication is subject to, and incorporates by reference, additional disclaimers found in the "Disclaimers" section at www.guidehouse.com.

High-Level Cost Estimate for Creating a New Scenario based on the Diversified Portfolio Scenario

Project: Energy Transition Scenario Analysis (ETSA)
Re: Estimated cost range to create a new scenario by adjusting some Critical Drivers in the Diversified Portfolio scenario
Submitted to: Jennifer Murphy, Enbridge
Submitted by: Alex Tiessen & Erika Aruja, Posterity Group
Version: 1
Date Submitted: 10 June 2021

This memo provides a rough estimate of the cost to develop a new scenario for EGI based on revising some settings for select Critical Drivers currently used in the Diversified Portfolio scenario to achieve deeper GHG reductions. Depending on the Critical Drivers adjusted and the number of rounds of revisions, we expect the cost to range between the cost estimate reflects a lower and upper range and can be revised to be more precise when more details of the scope of work become available.

The Task

- Create a new scenario that achieves further GHG reductions beyond what the Diversified Portfolio scenario is currenting forecasting by adjusting some Critical Driver settings.
- This will likely be by adjusting Critical Drivers that EGI can control: RNG, hydrogen, CCS and DSM budget.

Assumptions:

- The new scenario will be created using the Critical Drivers established for the ETSA project; no new Critical Drivers will be developed.
- The current models will be used (i.e., model structure is maintained)

Activity	Narrower Scope/Lower Level of Effort Description	Broader Scope/High Level of Effort Description
Identify which Critical Drivers should be adjusted	 EGI defines which Drivers should be adjusted and discusses with PG. Drivers adjusted do not require additional research and analysis from PG to develop inputs such as RNG, H2, NGT, CCS and DSM budget. 	 EGI and PG work collaboratively to define which Drivers should be adjusted. Drivers adjusted require additional research and analysis from PG to develop inputs such as C&S, non-price driven fuel switching, and climate change.
Develop & define settings for the Critical Drivers that deviate from the current settings	 EGI provides setting values for Drivers and they are in the same format as previous inputs. PG reviews and intakes new data. 	 PG conducts research and analysis to develop inputs/settings for Drivers. Or, EGI provides settings for Drivers in a different format than previous inputs. PG reviews and processes data to use in the model.
Model the new scenario	 PG constructs a new scenario and runs the model. A DSM budget-solver model run is not required. 	 PG constructs a new scenario and runs the model. A DSM budget-solver model run is required.
Review the results and revise if necessary	PG and EGI review resultsMinimal or no revisions are required.	PG and EGI review resultsMajor revisions are required.
Documentation of the scenario inputs and results	 PG writes concise memo to document inputs and results 	 PG writes small report explaining the scenario, the process to develop inputs, details the inputs and discusses the results in comparison to the other scenarios.
Update the PowerBI data visualization dashboard.	 Update the PowerBI data visualization dashboard with the new scenario using the existing format. 	 Update the PowerBI data visualization platform with the new scenario.

Activity	Narrower Scope/Lower Level of Effort Description	Broader Scope/High Level of Effort Description
		• Add additional exhibits not previously included in the dashboard.
Project Management	 On-going communication, budget updates, meetings, etc. 	 On-going communication, budget updates, meetings, etc.
Cost Estimate		

Alternative Approaches:

- GHG target goal seeking: If EGI wants to reach a GHG reduction target in a specific year, PG can see what volumes of RNG and H2 would be required to meet that target. This would likely be an iterative process where multiple model runs are conducted until the GHG target is reached.
 - We could also explore various combinations of RNG and H2 required to meet the target.

ETSA Planning Scenario Updates Proposal

Project: Energy Transition Scenario Analysis Re: Updating the RNG forecast used in the Planning scenario Submitted to: Enbridge Gas Date Submitted: June 29, 2022 Version: 1

This proposal provides an estimated level of effort and elapsed time required to update the RNG forecast and name for the Planning scenario, and reflect the updates in the data visualization platform and report.

1 Scope of Work

Posterity Group (PG) understand the following tasks are required:

- Revise the RNG forecast in the Planning scenario model using the newest RNG forecast provided by Enbridge Gas. This task will require PG to rerun the sector-models to achieve the new RNG targets and then rerun the DSM module as the new RNG volume will affect DSM savings.
- Revise the name of the Planning scenario
- Update the data visualization platform with the new model output and scenario name
- Update the scenario report

2 Level of Effort, Budget & Invoicing

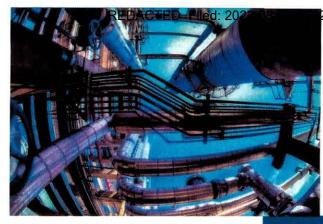
The table below shows the estimated number of hours per task. With an hourly rate of the budget cap is exclusive of tax. We propose to employ a "time and expense to a cap" structure with invoicing monthly. Enbridge Gas can contract through the PO previously established for the ETSA project if that is most convenient.

Task	<mark>Hours</mark>
Revise Planning scenario models	
<mark>and name</mark>	
Update data visualization	
<mark>platform</mark>	_
Update report	
TOTAL	

3 Timeline

PG expects it will take four to six weeks to complete the work upon receiving the new RNG forecast and revised scenario name from Enbridge Gas.

2022-0200 Exhibit I.1.2-CCC-3, Attachment 2, Page 126 of 221



Proposal to Assess the Future Utilization for the Dawn Parkway System

October 26, 2021

Submitted to: Max Hagerman Enbridge Gas Inc.

Submitted by: ICF Resources, LLC 9300 Lee Hwy Fairfax, VA 22031





Mr. Max Hagerman Enbridge Gas Inc.

RE: Assessment of Future Utilization for Dawn Parkway System

Dear Max:

ICF is pleased to offer to Enbridge Gas, Inc. this proposal to provide an assessment of future utilization for Dawn Parkway System.

Enbridge currently has contracts on Dawn Parkway System and wants to assess the market to understand the risk of de-contracting on the Dawn Parkway system in the future. ICF understands that the assessment will be used by Enbridge to evaluate the future utilization of Dawn Parkway system for the next rebasing term (2024-2028) and slightly beyond (until 2034). This study will be used to understand the risk of turnback on the system over that timeframe. The study will focus on examining the current contracts and looking at the supply and demand balance to forecast the utilization of Dawn Parkway system until 2034. The study will be based on the most recent ICF gas market base case outlook. The results of the study will be documented in a short memo/report suitable for filing with the OEB. ICF will provide this study for the

ICF will also provide oral testimony on behalf of Enbridge as an independent consultant before the OEB, as well as other regulatory support as requested. The oral testimony and other regulatory support will be provided on a Time & Materials (T&M) basis. As Subject Matter Experts,

ICF proposes to complete the work based on the terms and conditions specified in the existing contract between ICF and Enbridge dated June 15, 2020. To authorize this work, please sign the authorization and e-mail a PDF of the signed authorization to <u>Michael.sloan@icf.com</u>.

If you have any questions, please call me at 703-403-7569.

We look forward to the opportunity to work with you on this assignment.

Sincerely,

Mahl Ifran

Michael Sloan Managing Director, Natural Gas and Liquids Advisory Services





Authorization to Proceed

I hereby authorize ICF to proceed according to the scope of work described in this proposal under the terms and conditions in the contract between ICF and Enbridge dated June 15, 2020.

Accepted for:	Accepted for:
Enbridge	ICF Resources, LLC
Signed: Mat Hagnumn -	Signed: Joseph S McGrath
Name (printed):	Name (printed):
MAY HAGERMAN	
in the second	JS McGrath
Title:	Title:
MGR, CAPACITY MANAgement	Sr Dir Contracts
Date:	Date:
Nov. 22/2021.	Nov 22 2021



Page 2



PSA Number (A)	32090	Enbridge BU Number (B)	
SOW Project Name (C)	Finance Advisory	SOW Project Number (D)	
	Services		
Contract Number	[Enter as (A)-(B)-(C)-(D)]	

Enbridge	Enbridge Gas Inc. , a company incorporated in Toronto having its registered office at 500 Consumers Rd, Toronto ON M2J 1P8 (" Enbridge "); and
Service Provider	Ernst and Young , a company incorporated in Toronto having its registered office at One London Place, Suite 1800, 255 Queens Ave., P.O. Box 5332, London ON N6A 5S7 (the "Service Provider").
Commencement Date	February 1, 2019
Completion Date	January 31, 2020

THIS STATEMENT OF WORK ("SOW") IS ENTERED INTO BETWEEN ENBRIDGE AND SERVICE PROVIDER AS OF THE COMMENCEMENT DATE, AND IS SUBJECT TO THE PROFESSIONAL SERVICES AGREEMENT BETWEEN ENBRIDGE AND THE SERVICE PROVIDER DATED 1 NOVEMBER 2018 (THE "PSA"). ANY CAPITALIZED TERM USED IN THIS SOW BUT NOT DEFINED SHALL THE MEANING ASCRIBED TO SUCH CAPITALIZED TERM IN THE PSA

The Service Provider will provide Services to Enbridge on the terms set out below:

1) Description of Work

The Service Provider shall provide to Enbridge the following:

In support of the amalgamation between Enbridge Gas Distribution (EGD) and Union Gas (UG) to create Enbridge Gas Inc. (EGI), we understand you would like assistance as finance alignment activities continue to progress. Some examples of activities that can be provided include, but are not limited to:

- Process Improvement
 - Identifying business requirements and efficiencies as it relates to processes, systems, reports etc.
 - o Identifying risks and mitigation strategies
- Documentation
 - o Conduct or facilitate discussions (as required) to document aligned EGI processes
 - Creation/update and management of process related documentation for the EGI Finance department as required.



PSA Number (A)	32090	Enbridge BU Number (B)	
SOW Project Name (C)	Finance Advisory	SOW Project Number (D)	
	Services		
Contract Number	[Enter as (A)-(B)-(C)-(D)]		

- Project Management
 - o Assist with management of execution work streams as required.
 - Project management over finance initiatives as required.
- Third Party Studies
 - Prepare and conduct third party studies for the purpose of gathering benchmarking information to support Enbridge's OEB driven processes.
 - o Pull together external and internal data sources to obtain required study results.
 - Respond to interrogatories and undertakings. Appear as a witness in proceedings as required.
- Provide assistance with day to day responsibilities to facilitate the participation of EGI Finance team members in amalgamation activities
- Provide subject matter resources to support project(s) as required
- Other work as identified by Enbridge Finance management

2) SOW Representatives

Each Party shall appoint a Representative in this SOW who shall be available on a dedicated basis and act as the single point of contact for the other Party, and who will be responsible for co-coordinating, overseeing and ensuring the timely performance by such Party's obligations under this PSA.

	Enbridge	Service Provider
Name	Tanya Ferguson	Andrew Grainger
Address	500 Consumers Rd.	One London Place, Suite 1800, 255 Queens
		Ave, PO Box 5332
City	Toronto	London
State / Province	Ontario	Ontario
Phone	416 495 5754	519 646 5567
Email	tanya.ferguson@enbridge.com	Andrew.Grainger@ca.ey.com
Fax		

3) Location of Work

The Work shall be provided by the Service Provider at the following location(s):

- Enbridge Gas Distribution, 500 Consumers Rd., North York, Ontario
- Union Gas, 50 Keil Dr N., Chatham, Ontario
- 4) SOW Project Schedule



Contract Number [Enter as (A)-(B)-(C)-(D)]

The Service Provider shall ensure that Service Provider's Key Personnel adhere to the following Project schedule and Project Milestone Dates

This scope of work will span a 12-month period and will consistent of multiple smaller projects. Prior to the onset of a new project covered by this SOW, a detailed project schedule and estimate of fees will be created and agreed upon between Enbridge and the Service Provider.

5) Key Personnel

The Service Provider agrees that the following Key Personnel of Service Provider shall be dedicated to the performance of the Services under this SOW:

Key Personnel	Title
Andrew Grainger	Partner

Andrew will work with Enbridge Finance management for each individual assignment to determine the additional resources to be used, dependent on the specific scope of work agreed upon.

6) Permitted Subcontractor

This section is not applicable as no subcontractor will be utilized.

7) Currency

Payments for this SOW will be in CAD.

8) Staffing Model and Rates

Based on the agreed upon scope of work, the services outlined in this SOW will cover the period beginning on February 1, 2019 and ending on January 31, 2020. The fees are estimated to be approximately Though a range of fees for the services has been provided, the amount for the services may be less if the projected level of effort is not as high as expected or if EGI decides to decrease the scope of the project. If, during the term of this Agreement, the Service Provider determines that the fee estimate will be significantly exceeded they will promptly contact Enbridge to discuss any adjustments to the scope of our work or our fees.



PSA Number (A)	32090	Enbridge BU Number (B)	
SOW Project Name (C)	Finance Advisory Services	SOW Project Number (D)	
Contract Number	[Enter as (A)-(B)-(C)-(D)]	

The estimated fees is based on the following rate card that is outlined in the Professional Services Agreement dated November 1, 2018 :

Role	Location	Unit Rate (\$/Hr.)
Partner	Toronto	
Senior Manager	Toronto	
Manager	Toronto	
Senior	Toronto	

9) Travel, Hospitability and Other Pass Through Expenses

Enbridge will only pay or reimburse Service Provider for pre-approved Travel, Hospitability and Other Pass Through Expenses ("Expenses") as listed below:

- All reasonable out-of-pocket expenses for items such as travel, meals, accommodation and other matters specifically related to your engagement will be invoiced at their cost, consistent with Enbridge travel and expense policies. Pre-approval will be sought for any travel beyond the contemplated to-and-from the Chatham, Ontario and North York worksites.

Unless otherwise set out in this Statement of Work or in a Change Order, Pass Through Expenses may not exceed:

i) 10% of professional fees

10) Invoicing Instructions

In order to support prompt payment please reference the following when submitting all invoices related to this SOW ensure all invoices contain the following information:

- Enbridge Gas Inc. purchase order number created to support this SOW
- GST Number;
- GST amounts identified as a separate line item;
- All taxes identified as separate line items (or clearly indicate how included); and
- Correct Service Provider corporate name (including numbered companies).



PSA Number (A)	32090	Enbridge BU Number (B)	
SOW Project Name (C)	Finance Advisory	SOW Project Number (D)	
	Services		
Contract Number	[Enter as (A)-(B)-(C)-(D)]	

• A line item breakdown of total expenses for each of the Finance initiatives being managed for the invoicing period under this SOW.

All supporting documentation associated with the invoice including, but not limited to:

- Alignment of resource hours for work streams within each Finance initiative that shows up as a line item on the invoice.
- Detailed back-up provided for all cost reimbursable expenses in accordance with the Agreement; and
- Other required documents as may be specific to the SOW or an Enbridge Representative.

All invoices must be billed to:

Enbridge Gas Inc.

Attention: Accounts Payable

50 Keil Drive North, Chatham ON N7M 5M1

Alternatively, the Contractor may submit its invoices relating to this Work Order via e-mail to apcaeastinvoices@uniongas.com.

11) Special Conditions to this SOW

The Parties have agreed to the following Special Conditions, which are permitted modifications and/or supplements to the terms of the Statement of Work:

a) Limitations on Scope

EY will not identify, address or correct any errors or defects in Enbridge's computer systems, other devices or components thereof ("Systems"), whether or not due to imprecise or ambiguous entry, storage, interpretation, processing or reporting of data. EY will not be



PSA Number (A)	32090	Enbridge BU Number (B)	
SOW Project Name (C)	Finance Advisory	SOW Project Number (D)	
	Services		
Contract Number	[Enter as (A)-(B)-(C)-(D)]		

responsible for any defect or problem arising out of or related to data processing in any Systems.

b) Enbridge's Specific Obligations

Enbridge will not, and will not permit others to, quote or refer to the Reports, any portion, summary or abstract thereof, or to EY or any other EY Firm, in any document filed or distributed in connection with (i) a purchase or sale of securities to which the United States or state securities laws ("Securities Laws") are applicable, or (ii) periodic reporting obligations under Securities Laws. You will not contend that any provisions of Securities Laws could invalidate any provision of this Agreement.

Enbridge shall assign a qualified person to oversee the Services. Enbridge is responsible for all management decisions relating to the Services, the use or implementation of the output of the Services and for determining whether the Services are appropriate for your purposes.

c) Special Additional Terms and Conditions

The Services are advisory in nature. EY will not render an assurance report or opinion under the Agreement, nor will the Services constitute an audit, review, examination, or other form of attestation as those terms are defined by the American Institute of Certified Public Accountants. None of the Services or any Reports will constitute any legal opinion or advice. EY will not conduct a review to detect fraud or illegal acts.

Notwithstanding anything to the contrary in the Agreement or this SOW, EY does not assume any responsibility for any third-party products, programs or services, their performance or compliance with your specifications or otherwise.

EY will base any comments or recommendations as to the functional or technical capabilities of any products in use or being considered by Enbridge solely on information provided by Enbridge's vendors, directly or through Enbridge. EY is not responsible for the completeness or accuracy of any such information or for confirming any of it.



PSA Number (A)	32090	Enbridge BU Number (B)	
SOW Project Name (C)	Finance Advisory	SOW Project Number (D)	
	Services		
Contract Number	[Enter as (A)-(B)-(C)-(D)]		

This Statement of Work, the General Terms, its Attachments and any other documents referred to in the Statement of Work constitute the entire agreement between the Parties with respect to the subject matter of the Statement of Work and (to the extent permissible by law) supersedes all prior representations or oral or written agreements between the Parties with respect to that subject matter, provided that neither Party is attempting to exclude any liability for fraudulent misrepresentations. No conflicting or additional terms or conditions endorsed on, delivered with or contained in any Service Provider quotation, acknowledgement of order, delivery note, invoice or other Service Provider document shall form part of the Statement of Work and all such conflicting or additional terms are hereby rejected by the Enbridge. The Statement of Work may be entered into in any number of counterparts.

Enbridge Gas Distribution, Inc.

Per:

Name: Wendy Zelond

Title: Vice President Finance

Ernst & Young LLP

Per:

Name: Andrew Grainger

Title: Partner*

*Andrew Grainger is an incorporated limited partner of Ernst & Young LP that provides services to Ernst & Young LLP



Ernst & Young LLP Ernst & Young Tower 100 Adelaide Street West, P.O. Box 1 Toronto, Ontario M5H 0B3 Tel: 416 864 1234 Fax: 416 864 1174 ey.com/ca

Ms. Wendie Brodie Lumley Enbridge Gas Inc. 500 Consumers Rd North York, Ontario M2J 1P8 30 May 2019

Dear Wendie:

Re: Scope Expansion – Finance Advisory Services Statement of Work

As you know, Enbridge Gas Inc. ("you" or the "Client") engaged the Canadian firm of Ernst & Young LLP ("EY" or "we") to provide certain Finance Advisory Services pursuant to the Finance Advisory Services Statement of Work (the "SOW") commencing February 1, 2019.

This letter is to confirm our agreement to expand the scope of EY's engagement to include additional services. Specifically, the following services are being added to the scope of the SOW:

Under this Scope Expansion, we will provide accounting and financial reporting assistance in connection with Enbridge Gas Inc.'s review of overhead capitalization rates and provide observations and recommendations to management as a result of our procedures performed (these services are referred to as the "Accounting Services").

At your direction, we will:

- Interview Enbridge Gas Distribution Inc. and Union Gas Inc. employees to better understand the nature of costs incurred and their respective drivers
- Discuss historical costs incurred and existing capitalization approaches
- Evaluate the nature of costs incurred, cost drivers and existing overhead rates against benchmark data to provide our observations and recommendations regarding the overhead rate and capitalization approach; and
- Based on information gathered, recommend amendments, as necessary:
 - o To your existing regulatory and accounting policies;
 - o To your existing overhead capitalization approach; and
 - To your existing business processes related to the capitalization of overhead.
- Assist Regulatory in identifying changes which may impact the OEB mandated deferral account
- Assist you in the design of internal controls in response to changes in the new approach

We will provide you with the following written Report:



 A report detailing the procedures performed, the results of the benchmarking analysis, observations related to your existing overhead capitalization approach and capitalization rates and comments on your accounting and regulatory policy for overhead capitalization.

Our Report is meant to assist management in its conclusion regarding a reasonable overhead capitalization rate for the purposes of Enbridge Gas Inc.'s future regulatory filings.

Upon request, EY may act as an expert witness in a regulatory hearing regarding Enbridge Gas Inc.'s capitalization of overhead as it pertains to the results of the procedures performed under this SOW. We understand that as a witness, we may be asked to participate in the stakeholder engagement and hearing process, which may include:

- Presentation of the results of the review to stakeholders
- Preparation of a written report to be filed with the Ontario Energy Board ("OEB")
- Responding to interrogatories and undertakings
- Appearing as a witness in future regulatory proceedings

We may engage in discussions with your personnel, including officers and employees, and outside consultants, as determined by you. We may also read documentation, including contracts and memoranda, as specified by you. Further, we may identify factors or considerations that are relevant to your analysis of identified accounting and financial reporting matters.

We may assist you in interpreting the relevant accounting and reporting literature based on your general circumstances, and provide our views on those factors (including your characteristics and structure) which may influence the choice of your accounting policy. We will not conclude on the appropriate accounting treatment based on specific facts or recommend which accounting policy/treatment you should select/adopt. Any observations we provide are intended to assist you as you reach, document and implement your own conclusions and will not constitute our concurrence with, or support of, your proposed accounting or reporting.

We may provide certain observations as to our understanding of the views of your independent auditor or the staff of the Ontario Securities Commission, Securities and Exchange Commission, or the Ontario Energy Board. We may provide such observations without having any prior discussion with your independent auditor or the staff of the Ontario Securities Commission, Securities and Exchange Commission, or the Ontario Back and Exchange Commission, or the Ontario and Exchange Commission, or the Ontario and Exchange Commission, or the Ontario Securities and Exchange Commission, or the Ontario Back and Exchange Commission, or the Ontario Back and accordingly, their actual views on a particular topic or issue may differ.

We may, upon your written request, assist you in documenting the conclusions you have reached or positions you have taken on accounting and reporting matters, including the accounting policies you select.

You will be responsible for implementing and further customizing these Reports, and for your use thereof and their effectiveness. We will have no obligation with respect thereto.



We will not test, verify or otherwise confirm the accuracy and completeness of any information, statements or data that is provided to us by you or on your behalf, including information provided by your advisors, customers or vendors.

You alone are responsible for any decisions to implement actions identified in the Services, including as necessary to apply US Generally Accepted Accounting Principles ("US GAAP") appropriately and for compliance with applicable regulatory requirements, including the determination of your accounting policies. You are solely responsible for the preparation of your financial statements, including making all of the judgments inherent in preparing them.

You are responsible for notifying your independent auditor of the performance of the Accounting Services and consulting with them on the application of accounting principles and your related accounting policies. You agree that we may make inquiries of your independent auditor in connection with the performance of the Accounting Services.

EY will not render an assurance report or opinion under the Agreement, nor will the Services constitute an audit, review, examination, or other form of attestation, as those terms are defined by Chartered Professional Accountants of Canada ("CPA Canada"), the American Institute of Certified Public Accountants ("AICPA") or the Public Company Accounting Oversight Board. Accordingly, we will not express any form of assurance on accounting matters, financial statements, any financial or other information or internal controls as part of the Services.

We will not provide a professional opinion on the application of accounting principles pursuant to CPA Canada's standards for Reports on the Application of Accounting Principles (as set out in section 7600 of the CPA Canada Handbook) (as amended and interpreted) or pursuant to analogous AICPA standards. None of the Services or any Reports will constitute any legal opinion or legal advice. We will not conduct a review to detect fraud or illegal acts.

Any observations or comments with respect to your internal control matters will provide no assurance with respect to their effectiveness or their compliance with applicable laws and regulations. You alone are responsible for establishing and maintaining adequate internal control over financial reporting and the Services do not replace your responsibility for establishing the effectiveness of internal controls. In addition, you may not rely on us to draw to your attention matters that may be relevant as to whether or not your system of internal control is effective.

These changes are effective as of May 30, 2019. With the exception of these changes, the SOW remains in full force and effect and governs all services provided pursuant to the SOW. This letter shall be governed by and construed in accordance with the laws of the Province of Ontario.



To confirm your agreement, please sign a copy of this letter where indicated below and return to Fred Clifford, <u>Fred.E.Clifford@ca.ey.com</u>. If you have any questions concerning these changes or the terms of our engagement, please contact Fred Clifford or Abbas Lakha, <u>Abbas.Lakha@ca.ey.com</u>.

Very truly yours,

Ernst + young LLP

Chartered Professional Accountants Licensed Public Accountants

per Fred Clifford

Agreed:

Enbridge Gas Inc.

6 Blanley

by_

Name: Wendie Brodie Lumley Title: Director, Business Support



500 Consumers Rd North York ON M2J 1P8 Hulya Sayyan, Senior Advisor Demand Forecasting & Analysis Tel: 416-495-6332 Email: hulya.sayyan@enbridge.com

January 28, 2021

.

GUIDEHOUSE CANADA LTD. 100 King Street West, Suite 4950 Toronto Ontario M5X 1B1

Dear Sir / Madam,

RE: Consulting Agreement with Enbridge Gas Inc.

Attached please find for signature our Consulting Agreement. Kindly arrange to have the Agreement and the attached Schedule signed. Please ensure you read and understand all of the terms and conditions of the Agreement, as well as the enclosed Statement on Business Conduct and Lifesaving Rules.

We will also require the following:

 A current clearance certificate or letter of exemption from the Ontario Workplace Safety and Insurance Board ("WSIB"). If your employees are in a jurisdiction other than Ontario, please provide equivalent proof of coverage, and new proof of coverage must be filed with us upon expiry/renewal of such proof of coverage.

Please return the applicable WSIB document noted above, together with a signed copy of the Consulting Agreement and a signed copy of the Schedule, promptly following receipt of this letter. Upon receipt of all the documents in our office, we will execute the Agreement and a PDF copy of the Agreement will be returned to you for your records.

If you have any questions, please contact me at the above-noted telephone number.

Sincerely,

Hulya Sayyan Senior Advisor Demand Forecasting & Analysis

Encls.

CONSULTING AGREEMENT

THIS AGREEMENT made effective January 18, 2021.

BETWEEN:

ENBRIDGE GAS INC.

("Enbridge")

- and -

GUIDEHOUSE CANADA LTD.

(the "Consultant")

WITNESSES THAT in consideration of the mutual covenants and agreements herein contained, the parties hereto covenant and agree as follows:

1. Scope of Services

- (a) During the term hereof (as hereinafter defined), the Consultant shall provide consulting services (the "Services") to Enbridge, on the terms and conditions set forth below.
- (b) The scope of work for specific projects to be undertaken by the Consultant at the request of Enbridge will be described in separate schedules referencing this Agreement, each of which shall become effective, be incorporated by reference and form an integral part of this Agreement upon the execution of each such schedule by Enbridge and the Consultant. The schedule for each project will specify the names of key individuals, scope of Services, deliverables, commencement and completion dates, rate of compensation and payment terms applicable to such project. Each schedule described above shall be prepared using a form similar to the attached Schedule "A".

2. Compensation

In consideration of the Services and deliverables to be provided by the Consultant hereunder, and provided that the Consultant is not in default of its obligations hereunder, Enbridge shall remit to the Consultant all amounts required to be paid in accordance with the applicable schedule.

Consultant shall be responsible for charging, collecting and remitting all applicable federal and provincial sales, use and value-added taxes in respect of the fees paid or payable to Consultant and, in particular, the goods and services tax ("GST") and harmonized sales tax ("HST") imposed under Part IX of the Excise Tax Act (the "ETA"), the Quebec sales tax ("QST") imposed under an Act respecting the Quebec Sales Tax (the "QSTA") and any provincial sales taxes ("PST"); and such taxes, if applicable, shall be shown separately on all invoices. Where Consultant is required to collect any GST/HST, QST or similar tax, Consultant shall provide Enbridge with the documentary evidence as prescribed pursuant to the ETA or QSTA, any successor provision thereto or any similar provision of any other taxing statute as is required to entitle Enbridge to claim an input tax credit, input tax refund, rebate, refund or any other form of relief in respect of such taxes.

Where the Consultant is a non-resident of Canada for purposes of the Income Tax Act (Canada) (the "ITA"), with respect to the invoice or statement of Fees issued pursuant to any Schedule, the Consultant will identify the location where the Services are provided, separate Services performed in Canada from Services performed outside of Canada, identify the number of days Services were performed in Canada (including travel days to/from Canada) and, for Services performed in Canada, identify the physical location, indicating city and province, where such Services were performed. Where the non-resident Consultant has not obtained and provided to Enbridge a non-resident withholding tax waiver at such time as Enbridge makes any payment to the Consultant for Services, Enbridge shall withhold such percentage

of any payment as mandated under the ITA with respect to the Services provided in Canada or on the full invoice or statement amount where the Consultant has not clearly separated the Services performed in Canada from Services performed outside of Canada. Enbridge shall remit the withheld amount to Canada Revenue Agency, or its successor, in the manner and at the time required by the ITA. For further clarification, it is the Consultant's responsibility to obtain the tax waiver, if available. In the event that Enbridge is assessed for any non-resident withholding taxes payable, the Consultant agrees to forthwith reimburse Enbridge for such amount together with applicable interest and penalties, if any.

3. Term

Subject to earlier termination as provided for herein, the term of this Agreement shall commence on the day set forth above and expire on December 23, 2023 (hereinafter the "Term").

4. Termination

- (a) Enbridge may terminate this Agreement or any schedule to this Agreement for convenience upon giving four (4) weeks written notice to the Consultant.
- (b) Either party may terminate this Agreement in case of a breach by the other party of its obligations hereunder, provided that the breach is not cured within five (5) days of written notification by the non-defaulting party to the defaulting party setting out the particulars of the breach.
- (c) Either party may terminate this Agreement upon written notice to the other party, if: (i) the other party is subject to proceedings in bankruptcy, or insolvency, whether voluntary or involuntary, (ii) a receiver is appointed in respect of all or a substantial portion of the other party's assets; or (iii) the other party assigns its property to its creditors or generally becomes unable to pay its debts as they become due.

Upon any termination of this Agreement, the Consultant shall deliver to Enbridge the results of all Services provided as of the date of termination, including completed or uncompleted deliverables for which payment has been received in accordance with the terms of this Agreement.

5. Facilities

Enbridge shall provide to the Consultant use of such office facilities as may be required by the Consultant, acting reasonably, to perform the Services during the Term.

6. Reimbursement for Expenses

In addition to the payments to be made pursuant to Section 2 hereof, Enbridge shall reimburse the Consultant for all reasonable expenses properly incurred by the Consultant in connection with the Services provided to Enbridge hereunder and that have been pre-approved by Enbridge in writing, including, without limitation, reasonable travel and other costs and expenses in connection therewith. Such pre-approved reasonable expenses incurred by the Consultant in rendering Services shall be reimbursed by Enbridge net of GST/HST. GST/HST shall be charged, where applicable, by the Consultant on the expenses incurred, net of the input tax credits/reimbursements for GST/HST claimed by the Consultant. Concurrently with its delivery of invoices to Enbridge as contemplated by Section 2 hereof, the Consultant shall submit to Enbridge invoices and statements setting out in reasonable detail the nature and amount of the expenses or costs incurred by the Consultant for which the Consultant claims reimbursee the Consultant for all approved invoiced expenses and costs. The Consultant shall provide to Enbridge copies of all documentation in support of invoiced expenses as Enbridge may request from time to time during the Term hereof.

7. Independent Contractor

Notwithstanding anything to the contrary herein contained, the Consultant shall not, for any purpose, be or be deemed to be an employee of Enbridge during the Term or at any time during which the Services described in Section 1 hereof are provided to Enbridge nor shall anything in this Agreement create or be

construed for any purpose as creating any relationship between Enbridge and the Consultant of employer and employee. Except as expressly provided herein, Enbridge shall not be liable to contribute to any employee benefit or pension plan or pay premiums for any policy or form of insurance whatsoever on behalf of the Consultant nor to pay any amounts or premiums on its behalf in respect of the Canada Pension Plan, Ontario Health Insurance Plan, Workplace Safety and Insurance Board or Employment Insurance, nor to deduct or withhold from source any amount from amounts payable by Enbridge to the Consultant hereunder in respect of any income tax obligation or liability payable by the Consultant to the Canada Revenue Agency. The Consultant agrees to indemnify and hold Enbridge harmless from and against any order, penalty, interest or tax that may be assessed or levied against Enbridge as a result of the failure or delay of the Consultant to file any return or information required to be filed by the Consultant by any law, ordinance or regulation relating to the Services performed by the Consultant herein.

8. Confidential Information and Personal Information

- (a) For the purposes of this Section 8, the following definitions will apply:
 - (i) <u>"Confidential Information"</u>, means all information pertaining to the business and affairs of Enbridge, its affiliates and subsidiaries, whether oral or written, furnished by Enbridge to the Consultant, its employees and representatives, whether furnished or prepared before or after the date of this Agreement, and includes all analysis, compilations, data, studies, reports or other documents prepared by the Consultant based upon or including any of the information furnished by Enbridge, but does not include information which:
 - A. is at the time of disclosure or thereafter becomes generally available to the public other than as a result of disclosure by the Consultant or anyone to whom the Consultant transmits the information;
 - B. is at the time of disclosure or thereafter becomes known or available to the Consultant on a non-confidential basis and not in contravention of applicable law from a source other than Enbridge that is entitled to disclose the information; or
 - C. is already in the possession of the Consultant or is lawfully acquired, provided that such information is not subject to another confidentiality agreement with, or obligations of secrecy to Enbridge.
 - (ii) <u>"Person"</u> includes individuals, partnerships, firms and corporations.
- (b) Enbridge is furnishing the Confidential Information to the Consultant solely for the purpose of assisting the Consultant in the performance of Services which the Consultant provides to Enbridge. The Consultant shall not use the Confidential Information for any purpose other than the performance of Services provided to Enbridge.
- (c) The Consultant acknowledges that the Confidential Information is the property of Enbridge, which is confidential and material to the interests, business and affairs of Enbridge and that disclosure thereof would be detrimental to the interests, business and affairs of Enbridge. Accordingly, the Consultant agrees that it shall maintain the confidentiality of the Confidential Information and that it shall not disclose the Confidential Information to any Person for any reason whatsoever except as expressly provided herein.
- (d) The Consultant may disclose Confidential Information to the extent required by a court of competent jurisdiction or other governmental or regulatory authority or otherwise as required by applicable law, provided that the Consultant first give Enbridge prompt written notice (except where the governmental or regulatory authority has expressly ordered that no notice be given) and co-operate with and assist Enbridge in responding to the request or demand for disclosure.
- (e) The Consultant acknowledges and agrees that Enbridge would be irreparably harmed if any provision of this Agreement is not performed by the Consultant in accordance with its terms. Accordingly, Enbridge shall be entitled to an injunction or injunctions to prevent breaches of any of the provisions of this Agreement and may specifically enforce such provisions by an action

instituted in a court having jurisdiction. These specific remedies are in addition to any other remedy to which Enbridge may be entitled at law or equity.

- (f) If in the course of performing Services hereunder, the Consultant obtains or accesses personal information about an individual, including without limitation, a customer, potential customer or employee or contractor of Enbridge ("Personal Information") the Consultant agrees to treat such Personal Information in compliance with all applicable federal or provincial privacy or protection of personal information laws and to use such Personal Information only for purposes of providing the Services hereunder. Furthermore, the Consultant acknowledges and agrees that it will:
 - (i) not otherwise copy, retain, use, modify, manipulate, disclose or make available any Personal Information, except as required by applicable law;
 - (ii) establish or maintain in place appropriate policies and procedures to protect Personal Information from unauthorized collection, use or disclosure;
 - (iii) implement such policies and procedures thoroughly and effectively;
 - (iv) except as required for purposes of providing the Services hereunder, will not develop or derive, for any purpose whatsoever, any products in machine-readable form or otherwise, that incorporates, modifies, or uses in any manner whatsoever, any Personal Information; and
 - (v) upon completion of its Services for or on behalf of Enbridge, will at Enbridge's direction: A. return; or B. destroy all Personal Information and all copies and records thereof in its possession.

9. Indemnification

The Consultant hereby agrees to and shall:

- be liable to Enbridge and its directors, officers and employees, for all claims, liabilities, damages, costs, losses and expenses whatsoever which Enbridge or any of its directors, officers and employees may suffer, sustain or incur;
- (b) indemnify and save harmless Enbridge, Enbridge's affiliated and subsidiary companies, and their directors, officers, agents, employees and representatives from and against any and all liabilities, claims, demands, damages, loss, costs and expenses (including without limitation all applicable solicitors' fees, court costs and disbursements, investigation expenses, adjusters' fees and disbursements) to or which any third party may suffer, sustain or incur, and
- (c) However Consultant will only indemnify Enbridge, Enbridge's affiliated and subsidiary companies, and their directors, officers, agents, employees and representatives for direct damages connected with the liability and indemnity under 9.a. and 9.b. up to a maximum of two times the total Compensation due to Enbridge pursuant to this Agreement, unless caused by the gross negligence or willful misconduct of the Consultant. Notwithstanding any other provision in this clause Consultant shall not in any event be liable for any indirect, consequential, special, lost productivity or punitive damages, even if he has been advised of the possibility of such damages.

in respect of all matters or anything which may arise out of any act or omission directly or indirectly related to any breach of this Agreement by the Consultant, its employees or representatives.

10. Work Product

(a) For the purposes of this Section 10, "Work Product" shall include any of the following, which are developed in the course of or arise from the Services provided by the Consultant to Enbridge hereunder throughout the Term: (i) any deliverables produced under any schedule to this Agreement together with any and all notes, reports, research information, compilations, data specifications, designs, programs, documentation, software (including object code and source)

materials), development tools, products and other materials or things; (ii) any and all knowledge, know-how, techniques, inventions, processes, trade secrets, methodologies, approaches and other intangible intellectual property rights; and (iii) all designs, patent applications, issued patents, industrial design registrations, design patents, trade-mark applications, registered trade-marks and copyright which may relate thereto.

- (b) For the purposes of this Section 10, "Consultant Materials" comprises any of the following, which were developed by the Consultant, at its own cost and expense in advance of and independent of this Agreement and as proven by the Consultant to be the case in the event of a dispute concerning the same: (i) any and all notes, research, information, data, specifications, designs, programs, documentation, software (including object code and source materials), development tools, products and other materials or things; (ii) any and all knowledge, know-how, techniques, inventions, processes, trade secrets, methodologies, approaches and other intangible intellectual property rights; and (iii) all designs, patent applications, registered trade-marks and copyright which may relate thereto.
- (c) All right, title and interest in and to the Work Product shall be the property of Enbridge. The Consultant shall ensure that any agent or employee of the Consultant shall have waived in writing all of his or her moral rights over any such Intellectual Property. During and after the Term of this Agreement, the Consultant shall from time to time as and when requested by Enbridge execute all papers and documents and perform other acts as necessary or appropriate to evidence or further document Enbridge's ownership of the Work Product and the intellectual property rights therein.
- (d) The Consultant retains all right, title and interest in and to the Consultant Materials. The Consultant hereby grants to Enbridge a non-exclusive, perpetual, irrevocable, non-terminable, non-transferable, non-assignable and royalty-free license to copy, disclose, use, operate, maintain, repair, modify, enhance, make derivative works, license, sub-license and otherwise commercially exploit without limitation or restriction those Consultant Materials used in connection with the delivery of the Services or to the extent contained within any Work Product.
- (e) The Consultant agrees to fully indemnify and hold harmless Enbridge from and against any and all: (i) claims, demands and actions; (ii) liabilities, damages or losses awarded by a court of competent jurisdiction or as agreed to as part of a settlement; and (iii) litigation costs and/or expenses (including reasonable legal fees and disbursements) reasonably incurred by Enbridge in connection with any claim that the Services or Work Product provided hereunder infringe any patent, copyright, trade secret or other right of any third party.

11. Representations and Warranties

- (a) The Consultant represents, warrants and covenants with Enbridge that: (i) it will perform all Services in a good and workmanlike manner using reasonable care (at a level that is at least consistent with industry standards for the provision of similar services) and in accordance with the terms of this Agreement; (ii) it possesses the knowledge, skill and experience necessary for the provision and completion of the Services in accordance with the terms of this Agreement; and (iii) any deliverables provided hereunder shall conform to their relevant specifications as described in the applicable schedule.
- (b) The Consultant agrees that under no circumstances will it interface a non-Enbridge computing device (including without limitation desktops, laptops, handheld device) with the Enbridge intranet or internet without obtaining the prior written approval of Enbridge. To the extent the deliverables produced hereunder involve the provision or development of any software application, interface or electronic data, the Consultant shall use commercially reasonable efforts to prevent the introduction of any virus to the hardware and computer systems upon which the application, interface or electronic data are to be installed. During the Term of this Agreement, the Consultant shall implement and run virus prevention and detection control procedures in accordance with industry standards.

(c) In addition to the policies described in Section 25, the Consultant shall ensure that it is familiar with and understands all of Enbridge's current policies, procedures and standards that are pertinent to the activities associated with the Services and which have been provided to the Consultant in advance of the execution of this Agreement.

12. Subcontractors

The Consultant shall not enter into any agreement with any other party to assist in the provision of the Services described in Section 1 hereof (hereinafter described as a "Subcontract") nor shall the Consultant allow any other party to perform such Services or any part thereof without first obtaining the consent in writing of Enbridge, which consent may be withheld by Enbridge, acting reasonably. Notwithstanding any approval or consent that may be provided by Enbridge in connection with any Subcontract, the Consultant shall not be relieved of any of its liabilities and responsibilities hereunder. Any party which enters into a Subcontract with the Consultant shall be required by the terms of such Subcontract to comply with and be bound by the obligations and responsibilities of the Consultant described hereunder and without restricting the generality of the foregoing, any Subcontract which has been entered into without the prior written consent of Enbridge shall be null and void and without force and effect.

13. Insurance

Save and except where Enbridge specifies otherwise in writing, the Consultant shall at its own expense maintain and keep in full force and effect during the Term hereof and for a period of two (2) years following the expiry of the Term or other termination of this Agreement:

- (a) Commercial General Liability insurance having a minimum inclusive coverage limit, including personal injury and property damage, of at least Two Million Dollars (\$2,000,000) per occurrence and in the aggregate. Enbridge Gas Inc. must be listed as the certificate holder and be added as an additional insured in the insurance policy, which should be extended to cover contractual liability, products/completed operations liability, owners'/ contractors' protective liability and must also contain a cross liability clause;
- (b) Automobile Liability insurance on all vehicles used in connection with this Agreement and such insurance shall have a limit of at least Two Million Dollars (\$2,000,000) in respect of bodily injury (including passenger hazard) and property damage inclusive of any one accident;
- (c) Non-Owned Automobile Liability insurance and such insurance shall have a limit of at least Two Million Dollars (\$2,000,000) in respect of bodily injury (including passenger hazard) and property damage, inclusive in any one accident; and
- (d) such other insurance as Enbridge may in its discretion determine to be necessary, including, but not limited to, Professional Liability or Errors and Omissions insurance.

The Consultant shall forthwith after entering into this Agreement, and from time to time thereafter at the request of Enbridge, furnish to Enbridge a memorandum of insurance or an insurance certificate setting out the terms and conditions of each policy of insurance (all such policies of insurance being hereinafter described as the "Insurance Policies") maintained by the Consultant in order to satisfy the requirements of this section. At any time and from time to time at the request of Enbridge, the Consultant shall furnish Enbridge with one or more duly completed insurance certificates in the form requested by Enbridge to evidence the details of all the Insurance Policies. The Insurance Policies shall be arranged with insurers acceptable to Enbridge, acting reasonably, and shall contain such terms and conditions as are reasonably acceptable to Enbridge. The Consultant shall not cancel, terminate or materially alter the terms of any of the Insurance Policies without giving prior notice in writing to Enbridge. The Consultant shall provide Enbridge with 30 days written notice prior to cancellation or other material modification in the policy affecting the requirements of this Agreement. No such cancellation or modification shall affect Consultant's obligation to maintain the insurance coverage required by this Agreement.

14. Compliance with Laws

The Consultant agrees to comply with the Occupational Health and Safety Act (Ontario) and the Workplace Safety and Insurance Act (Ontario) and with all other prevailing federal, provincial and municipal laws and regulations or any other laws or regulations in force in any jurisdiction where the Services are performed (the "Laws") and which are applicable to the Consultant, its subcontractors and the Services provided hereunder, and the Consultant shall familiarize itself and procure all required permits and licenses and pay all charges and fees necessary or incidental to the due and lawful prosecution of this Agreement, and maintain all documentation as may be required by the Laws, and shall indemnify and save harmless Enbridge, its directors, officers, agents and employees thereof against any claim or liability from or based on the violation of any Laws, whether by the Consultant, its officers, employees, subcontractors, representatives or agents. The Consultant shall, from time to time, if requested by Enbridge, furnish Enbridge with evidence of such compliance, and in particular: (i) evidence from the Workplace Safety and Insurance Board, or the equivalent thereof in any jurisdiction where the Services provided hereunder are carried out, that the Consultant and any party with which it has entered into a Subcontract are in compliance with and have paid all assessments and other amounts owing pursuant to the workers' compensation legislation of such jurisdiction; and (ii) evidence of the Consultant's compliance with any training requirements under the Laws including, without limitation, the provision of such statements or certificates pertaining to the Consultant's compliance in the form(s) prescribed by Enbridge from time to time.

Enbridge is committed to compliance with the Accessibility for Ontarians with Disabilities Act, 2005, O.Reg. 429/07 and O.Reg. 191/11, the Enbridge Customer Service Policy for Providing Goods and Services to People with Disabilities and the Enbridge Integrated Accessibility Standards Policy (collectively the "AODA"). The Consultant shall ensure that it is in full compliance with all of its obligations under AODA. Without limiting the generality of the foregoing the Consultant shall ensure that all of its employees, agents, volunteers, or others engaged by the Consultant in the delivery of services under this Agreement receive training in connection with the requirements of the AODA. If requested to do so, the Consultant shall provide Enbridge with copies of its policies, practices, procedures, training materials and training records including the dates on when the training is provided, and the names of the individuals trained, and confirmation the Consultant has reported its compliance to the Ministry of Community and Social Services or such other governmental authority as provided in the AODA.

The Consultant will ensure that any personnel it assigns to work in Canada, where they are not a Canadian citizen or Canadian permanent resident of Canada, will obtain and maintain the lawful ability to engage in commercial activities in Canada through the issuance of the appropriate documentation from Canada Border Services Agency and Citizenship and Immigration Canada. The Consultant's personnel where necessary will obtain lawful work permits to engage in business-related activities as temporary foreign workers and will notify Enbridge if any applications for work permits and work permit renewals are refused. The Consultant will not send personnel to any Enbridge-related work site if they do not possess the necessary lawful permission to work in Canada. The Consultant will take full responsibility to secure the necessary documentation and produce such documentation when entering a Canadian work site of Enbridge.

15. Waiver

Either the Consultant or Enbridge may, in writing, extend the time for performance by the other and waive non-compliance or non-performance by the other of any of the other's obligations, covenants and agreements under this Agreement and any compliance therewith or performance thereof. However, no such extension or waiver shall operate so as to waive, diminish or reduce the scope of or otherwise affect any obligation, covenant or agreement of such other which is not the subject matter of such extension or waiver or, except to the extent of such extension or waiver, of the obligation, covenant and agreement which is the subject matter of such waiver. No act or failure to act of either the Consultant or Enbridge shall be or be deemed to be an extension or waiver of timely or strict performance by the other of the other's obligations, covenants and agreements under this Agreement except to the extent notice thereof is given to the other.

16. Notice

Any notice or other communication to be given under or pursuant to the provisions hereof or in any way concerning this Agreement shall be sufficiently given if reduced to writing and delivered to the person to whom such communication is to be given or sent by facsimile or electronic internet communication, addressed to such person at the address set forth below:

If to Enbridge:

ENBRIDGE GAS INC. 500 Consumers Rd North York ON M2J 1P8 Attention: Hulya Sayyan, Senior Advisor Demand Forecasting & Analysis Phone: 416-495-6332 Email: hulya.sayyan@enbridge.com

With a copy to: Law Department Facsimile: 416-495-5994

If to the Consultant:

GUIDEHOUSE CANADA LTD. 100 King Street West, Suite 4950 Toronto Ontario M5X 1B1 Attention: Craig Sabine, Director Phone: 647-288-5227 Ext. Email: craig.sabine@guidehouse.com

or at such other address as may be specified therefor by proper notice hereunder. A notice or communication shall be deemed to have been sent and received on the day it is delivered personally or by courier or by facsimile or by electronic internet communication. If such day is not a business day or if the notice or communication is received after 5:00 PM (at the place of receipt) on any business day, the notice or communication shall be deemed to have been sent and received on the immediately following business day.

17. Interpretation

This Agreement shall be governed by and construed in accordance with the laws of the Province of Ontario and the laws of Canada applicable therein. Headings used herein are for the convenience of reference only and shall not be considered in construing or interpreting this Agreement. The words "herein", "hereunder", "hereof" and other similar words refer to this Agreement as a whole and not to any particular paragraph. Any provision herein prohibited by law shall to the extent prohibited be ineffective without invalidating any other provisions hereof. All references to amounts of money in this Agreement and any schedule shall mean lawful currency of Canada.

18. Assignment

The Consultant may not assign this Agreement in whole or in part without the express prior consent in writing of Enbridge. This Agreement shall be binding upon and enure to the benefit of the successors and assigns of Enbridge.

19. Use of Enbridge Name and Logo

The Consultant shall not use or display Enbridge's name or any symbols, signs, trademarks and other marks denoting and identifying Enbridge in any manner whatsoever without the prior written authorization of Enbridge.

20. Time of Essence

Time shall be of the essence in the performance of the Services.

21. Survival

All warranties and indemnities contained in this Agreement, and the obligations contained in Section 8, shall survive the termination of this Agreement irrespective of the time of or party responsible for such termination, and such warranties, indemnities and obligations shall remain in full force and effect and be binding on the Contractor notwithstanding such termination.

22. Further Assurances

Each of the parties shall, from the time of the written request of the other party, do all such further acts and execute and deliver or cause to be done, executed or delivered all such further acts, deeds, documents, assurances and things as may be required, acting reasonably, in order to fully perform and to more effectively implement and carry out the terms of this Agreement.

23. Entire Agreement

This Agreement, including any schedules attached hereto, constitutes the entire agreement between the parties with respect to the subject matter set out herein and replaces any prior understandings or agreements, whether written or oral, regarding such subject matter. No change or modification of this Agreement is valid unless it is in writing and signed by both parties. No disclaimers, purchase order documents, invoices or other documents of the Consultant shall be binding upon Enbridge.

24. Audit

The Consultant shall, following no less than seven (7) business days advance notice in writing, provide to such auditors (including external auditors and Enbridge's internal audit staff or agents) as Enbridge may designate in writing, supervised access to the data, records and supporting documentation maintained by the Consultant with respect to the Services solely for the purpose of: (i) performing audits and inspections to enable Enbridge to satisfy applicable regulatory requirements or certify compliance with applicable laws; and (ii) to confirm that the Services are being provided in accordance with the terms of this Agreement. Enbridge and its auditors shall use commercially reasonable efforts to conduct such audits in a manner that will result in a minimum of inconvenience and disruption to the Consultant's business operations. In the event that if any such audit reveals any: (a) errors or deficiencies in the completion of the Services or invoicing of the Services; or (b) overpayments to the Consultant by Enbridge, then the Consultant shall forthwith correct such errors or deficiencies, including if applicable refunding any overpayment to Enbridge. The Consultant shall retain all records for ten (10) years from the date of expiration or earlier termination of this Agreement, or such longer period as Enbridge may require having regard to the nature of the Services.

25. Enbridge Policies

The Consultant acknowledges receipt of a copy of each of Enbridge Inc.'s Statement on Business Conduct for Enbridge Inc. and its Subsidiaries and Lifesaving Rules, each as amended from time to time (the "Policies"). The Consultant agrees to comply with the Policies in connection with its delivery of the Services described in this Agreement, and agrees that, if requested by Enbridge, it will ensure all personnel delivering the Services herein attend training on the Lifesaving Rules.

26. ISNetworld Requirement

If required by Enbridge, the Consultant shall subscribe with ISN Software Corporation as a registrant of ISNetworld ("ISN") or any successor service mandated by Enbridge from time to time, and maintain a performance grading within ISN that is acceptable to Enbridge (the "ISNetworld Requirement") and shall: (a) provide all records and information as required by ISN or Enbridge, including, but not limited to, training and qualification data of the Consultant personnel, including subcontractors and employees, relating to the Services; and (b) maintain compliance with the ISNetworld Requirement during the currency of this Agreement.

[remainder of page intentionally left blank]

27. Counterparts and Execution

This Agreement may be executed by the parties in separate counterparts, each of which when so executed and delivered will be deemed to be an original, and all such counterparts will together constitute one and the same instrument. Delivery of a signature by electronic transmission or by facsimile transmission, including by email delivery of a "portable document format" ("pdf") document, shall create a valid and binding obligation. This Agreement may be executed using electronic signatures.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date first written above.

By:

GUIDEHOUSE CANADA LTD.

By: On Gol

Name: Benjamin Grunfeld Title: Partner

Name: Crafg Sabine Title: Director (Please print name and title of Signing Officer)

Witness:

By:

Name:

(Witness required if Contractor is a Sole Proprietor)

ENBRIDGE GAS INC.

Gilmer Bashualdo Gilmer Bashualdo-Hilario (Feb 4, 2021 15:25 EST)

Name: Gilmer Bashualdo-Hilario Title: Manager Economic Evaluation & Forecast

By: _____ Name: ** Title: *

SCHEDULE A

TO THE CONSULTING AGREEMENT BETWEEN ENBRIDGE GAS INC. AND GUIDEHOUSE CANADA LTD. Dated January 18, 2021

This Schedule is made under the above referenced consulting agreement (the "Agreement") between ENBRIDGE GAS INC. ("Enbridge") and GUIDEHOUSE CANADA LTD. (the "Consultant").

1. SCOPE OF SERVICES

The Consultant will undertake the following Services:

Conduct a comparison of how other comparable North American natural gas utilities forecast their natural gas demand/consumption for their budget, and long-term strategic plans (including weather forecast, normalization, number of customers and average consumption per customer forecast); and collection of information about whether they use deferral accounts or other mechanisms to protect their revenues from the volumetric variances related to their demand, and weather forecast.

Consultant's Services shall include the establishment of a peer / focus group consisting of ten (10 utilities), through appropriate criteria (climate, size of utility, etc.). Consultant shall collect detailed information from such peer/focus group regarding each of the following:

- their weather forecast and normalization methodology;
- their number of customers/new customers forecast;
- their average consumption per customer forecast;
- their total consumption/demand forecast; and
- whether they use deferral accounts or other mechanisms to protect their revenues from the volumetric variances related to their demand and weather forecast.

2. DELIVERABLES

The Consultant will provide the following deliverables:

- A Written Report on Demand Forecast Benchmarking, provide detailed results of the Study in a table format.

- Write evidence and act as a witness in the Ontario Energy Board proceeding - either written, or in-person at the hearing.

3. TERM AND COMMENCEMENT AND COMPLETION DATES

This Schedule shall be effective as of January 18, 2021 and expire December 23, 2023, or such other date as the parties may mutually agree in writing.

4. KEY PERSONNEL

The Consultant will provide the following personnel to deliver the services set out above under Scope of Services:

Craig Sabine, Director in Charge Dixon Grant, Project Manager Peter Steele-Mosey, QA/QC Management & Forecasting SME Judy Simon, Ontario Regulatory SME Laurel Buchanan, Primary Researcher

5. FEES AND PAYMENT TERMS

Fees: As per attached Guidehouse Pricing sheet.

Expenses: N/A

The above fees and expenses cannot be exceeded without prior written approval from Enbridge.

Fees are payable by Enbridge within forty (40) days of receipt from the Consultant of an appropriate invoice setting out in reasonable detail the nature of the services provided.

[Remainder of page intentionally left blank; signature page to follow]

Dated as of January 18, 2021.

GUIDEHOUSE CANADA LTD.

By:

Name: Title: Benjamin Grunfeld Partner

By: USS

ENBRIDGE GAS INC.

Gilmer Bashualdo-Hilario Gilmer Bashualdo-Hilario (Feb 4, 2021 15:25 EST)

By: <u>Gilmer Bashualdo-Hilario (Feb 4, 2021 15:25 EST)</u> Name: Gilmer Bashualdo-Hilario Title: Manager Economic Evaluation & Forecast

____ By: ____ Name: ** Title: *

Name: Craig Sabine Title: Director (Please print name and title of Signing Officer)

Witness:

Name:

(Witness required if Contractor is a Sole Proprietor)

Price Breakdown by Task

Task 1 Initiation Meeting and Work Plan Task 2 Document Current State Task 3 Identify & Prioritize Peer Panel Task 4 Conduct Literature Review Task 5 Interview Guide and Interviews Task 6 Reporting

Price



EGI Demand Forecasting Benchmarking Project Schedule



Guidehouse Task/Deliverable EGI Task/Deliverable Meeting(s)

		Jan	1-21		Fe	b-21		1	Mar	-21		1	Apr	-21		١	May	-21			Jun-	21			Jul-2	21		Aug-	21		Se	p-21
Week Ending	3	15	22	29	\$. 91	19	26	5	3 2 : 2.1	9 25	2	9	1.6	23	30	\mathcal{T}_{i}	14	26 2	8	4	11	25	2	9	36	23 30	161	13 2	Q 23	30	10 I	32 26
Contract Award (Assumed: January 4)																																
Task 1 - Initiation Meeting & Finalize Work Plan														11111												THII						
a Initiation Meeting														IN ET																	a a a a a a a a a a a a a a a a a a a	
b Updated Project Plan (Memo)					TTT																											
Task 2 - Document Current State																																
a Submit data request																																
b Furnish GH with documents																																
c Review forecasting current state																															111	
d Summarize current state (memo)	11														111							111										
e Provide feedback on current state memo																																
d Finalize current state memo																																
Task 3 - Identify & Prioritize Peer Comparators	111																															
a Develop comprehensive long list potential comparators																													1			
b Develop filtering criteria in collaboration w/ EGI																																
c Provide recommendations for targeted 10 utilities																																
d Feedback regarding recommendations																																
e Finalize targeted list of 10 utilities																																
Task 4 - Conduct Literature Review																																
a Gather and review regulatory documents																																
b Summarize findings, identify gaps (memo)																																
c Provide feedback on lit, review memo																														1411		
d Update lit, review memo																													1111	<u>A</u>		
e Provide feedback on draft 2 lit. review memo																																
f Finalize lit. review memo												Ш												LIII I						11 11		
Task 5 - Create Guide & Conduct Interviews																111																
a Develop draft interview guide																																
b Schedule peer utility interviews																													4.11			
c Provide feedback on draft interview guide																																
d Update interview guide															1																	
e Provide feedback on draft 2 of interview guide																															<u>aun</u>	
f Finalize Interview guide																																
g Conduct interviews													Ш																			
h Summarize interview findings (memo)																	1 fi															
i Provide feedback on interview findings											Ш																					
j Update interview findings memo											Ш	40					111		Ш												1111	
k Provide feedback on draft 2 interview findings												111	Ш																			
Finalize interview findings memo												111																		1		
Task 6 - Reporting													1111				ШШ															
a Develop draft report & benchmarking table												444																				
b Provide feedback on draft report and table																	1111		1											4	1111	
c Update report and benchmarking table													1111																			
d Provide feedback on draft 2 report and table												11					11															
e Finalize report and benchmarking table																														1	111	
f Develop final presentation		1																	111	11.												
g Provide feedback on final presentation		111																												4		
h Update final presentation	111	11.											1111				111				444						I			1		di hin
i Provide feedback on draft 2 final presentation		111																												1		
j Finalize final presentation		11.																												444		
k Present final presentation		HI.													111		IIIII		111											1111		autu

SCHEDULE B

TO THE CONSULTING AGREEMENT BETWEEN ENBRIDGE GAS INC. AND GUIDEHOUSE CANADA LTD. Dated January 18, 2021

This Schedule is made under the above referenced consulting agreement (the "Agreement") between ENBRIDGE GAS INC. ("Enbridge") and GUIDEHOUSE CANADA LTD. (the "Consultant"). All capitalized terms used in this Schedule have the meaning given to them in the Agreement.

1. SCOPE OF SERVICES

The Consultant will undertake the following Services, as further described in the Deliverables Section below:

EGI is seeking a comparative analysis of industry practices of relevant Canadian and U.S. LDCs for:

1. Weather and risk assumptions for Gas Supply planning

2. EGI is further seeking a review of utility best practices for design day demand modeling using the suggested design criteria, used for Gas Supply Planning in upstream contract sizing

3. EGI requires comprehensive written reports.

4. Participate at a half-day kickoff meeting at the outset to discuss existing criteria, methodologies, data and assumptions. This meeting will be held remotely.

5. Ongoing consultation to discuss preliminary results; provision of recommended revisions to design weather methodology and assumptions.

6. Assessment of the final results with accompanying presentation.

2. **DELIVERABLES**

The Consultant will provide the following deliverables:

Half-day kickoff meeting

Assessment of Final Results and Accompanying Presentation

Comprehensive Written Report

3. COMMENCEMENT AND COMPLETION DATES

This Schedule shall be effective as of March 8, 2021 and expire May 15, 2021, or such other date as the parties may mutually agree in writing.

4. KEY PERSONNEL

Craig Sabine, Director Paul Moran, Associate Director Peter Steele-Mosey, Associate Director Dixon Grant, Senior Consultant Laurel Buchanan, Consultant

5. FEES AND PAYMENT TERMS

Fees: as per the attached pricing document.

Expenses: N/A

The above fees and expenses cannot be exceeded without the prior written approval of Enbridge.

Remainder of page intentionally left blank



welcome to brighter

Project Initiation Form

The objective of this Project Initiation Form ("PIF") is to confirm the scope of our work and estimated fees for the Enbridge Gas Inc. pension and benefit plans projections for rate recovery application. This PIF is subject to the terms and conditions contained in our existing engagement letter dated March 24, 2014.

Project Details

- 1. Client Name: Enbridge Gas Inc. ("EGI")
- 2. Project name: EGI pension and benefit plans projections for 2022 2024
- 3. Description of Mercer responsibilities:

Refer to the Appendix for a description of the anticipated scope of work.

4. Description of client responsibilities:

Provide all necessary and reasonably requested co-operation to enable Mercer to provide the services.

5. Estimated period of time over which work will be performed: April 1, 2022 to July 31, 2022. The report is to be delivered on May 23, 2022.

.....

Fee Structure

Mercer fees will be based on the billable hours and the hourly rates of the professionals doing the work. Every effort is made to delegate work to the level where the work can be competently and most efficiently performed. Each invoice is set by the billing consultant based on their judgment of the efficiency of the work and the value delivered. Where it is possible to deliver assignments in a more efficient way by leveraging work done on a shared basis across a number of clients, professional fees may reflect this shared development cost. In addition to our fees, Mercer also bills for necessary travel and other expenses related to the services requested. The hourly rate bands on which our fees are based are set out below:

Hourly Rate Bands (\$ Can)

Partner Principal Senior Associate Associate Analyst



Page 2 EGI pension and benefit plan projections

We estimate the total fees for the anticipated scope of work will be within the range This is an estimate only and fees will ultimately be based on the billable hours and hourly rates of the professionals doing the work.

Conclusion

We appreciate your business and look forward to working with you. Please acknowledge your agreement to the assignment terms by sending a confirmation e-mail. If we do not receive a response from you either accepting the terms or noting any concerns about any of the terms within five business days of your receipt of this PIF, we will assume that you have accepted the PIF and will perform the Services described in this PIF on the basis set out above.

MERCER (CANADA) LIMITED

solely in connection with the Services it provides pursuant to a PIF

Name:	Scott Thompson	Date:	April 22, 2022	
	(Please Print)			
Title:	Principal			

Page 3 EGI pension and benefit plan projections

Appendix

Scope of Work

EGI's allocation of the following pension and benefit plans will be included in this work:

- Retirement Plan for Employees of Enbridge Inc. and Affiliates (the "EI RPP")
- Pension Plan for Employees of Enbridge Gas Distribution Inc. and Affiliates (the "EGD RPP")
- Enbridge Supplemental Pension Plan (the "EI SPP")
- Supplementary Executive Retirement Plan of Enbridge Gas Distribution Inc. and Affiliates (the "EGD SERP")
- Supplementary Senior Executive Retirement Plan of Enbridge Gas Distribution Inc. (the "EGD SSERP")
- Pension Choices Plan for Employees of Westcoast Energy Inc. and Affiliated Companies (the "Pension Choices Plan")
- Union Gas Management & Supervisory Pension Plan (the "M&S Plan")
- Union Gas Bargaining Unit Plan (the "Bargaining Unit Plan")
- · Union Gas Pension Plan for Salaried Employees Formerly Employed by Centra Gas Inc. (the "Salaried Plan")
- Union Gas Pension Plan Group One (the "Group One Plan")
- Union Gas Pension Plan Group Three (the "Group Three Plan")
- Supplemental Executive Retirement Plan (the "LSE SERP")
- Hold harmless for all DB participants (the "SEMPL")
- Enbridge Gas Distribution Inc.'s Non-pension Post Retirement Benefit Plan (the "EGD OPEB Plan")
- Spectra Energy Corp's Non-pension Post Retirement Benefit Plan (the "Spectra OPEB Plan")

The following summary is an overview of the anticipated work required for preparing the projections over the three year period from 2022 to 2024.

Project Phase	Scope
Planning	 Initial exploratory discussions Internal planning and project management

Page 4 EGI pension and benefit plan projections

Project Phase	Scope
Assumptions	 Developing applicable assumptions as required based on market conditions at March 31, 2022¹ including: Going concern discount rates Provision for Adverse Deviation (Ontario plans only) Expected return on assets Annuity proxy rates Commuted value interest rate We have assumed that all other assumptions will be consistent with those approved by Enbridge's Pension Committee for filing actuarial funding valuations as at December 31, 2021.
Data	 Preparing EI RPP DC membership data for use with future valuation projections Extracting and reconciling assets from March 31, 2022 Reconciling pending divestiture asset transfers as amount payable as at March 31, 2022 We will rely on census data as at December 31, 2021/ January 1, 2022 used for Enbridge's funding valuations. Assets will be extracted from CIBC Mellon's Nexus portal.
Future Valuations El RPP only	 Preparing <i>future valuation</i> projections on going concern, solvency, and accounting bases for the years ending December 31, 2022 through December 31, 2023 based on revised assumptions as at March 31, 2022¹ Adapting EI RPP funding projections for anticipated transition from Federal to Ontario jurisdiction Extracting projected cash flows at each future valuation increment for use with the full yield curve pension cost calculations Developing projected going concern, solvency and accounting balance sheets at annual increments to December 31, 2023 Developing accumulated other comprehensive income (AOCI) balance reconciliations on corporate books and local books bases at annual increments to December 31, 2023 No new entrants profiles are required since new members must join the defined contribution (DC) component of the EI RPP for first five years.

¹ Or April 30, 2022 if applicable assumptions are available at the time the work is prepared.

Page 5 EGI pension and benefit plan projections

Project Phase	Scope
Valuations All other plans not relying on future valuations	 Preparing valuations on going concern and accounting bases as at December 31, 2021 based on revised assumptions as at March 31, 2022². Extracting projected cash flows for use with the full yield curve pension cost calculations Performing extrapolations to develop projected going concern, solvency and accounting balance sheets at annual increments to December 31, 2023 Developing accumulated other comprehensive income (AOCI) balance reconciliations on corporate books and local books bases at annual increments to December 31, 2023 In 2021, the Enbridge Pension Committee approved to apply to merge the M&S Plan, Bargaining Unit Plan, Salaried Plan, Group One Plan, and Group Three Plan into the EI RPP. As the applications have not yet been filed with the pension regulator, the merger will not be considered for these projections. This should not have a significant impact on the results. The actuaries performing this work may elect not to perform some or all of the funding basis extrapolations if it will not have a significant impact on the valuations.
Projected cash contributions	 Determining estimated DB current service cost and special payment payments for 2023 to 2024 based on minimum funding requirements Anticipating change in funding regulations for EI RPP due to change in jurisdiction Calculating projected defined contribution (DC) requirements for 2023 and 2024 based on existing membership and reflecting assumed decrements Calculating projected DC requirements for 2022 to 2024 based on <i>expected new entrants</i> To the extent a Prior Year Credit Balance or special payment deferral is available, the actuaries performing the work will make a reasonable assumption on whether such a lever may be employed based on Enbridge's existing approach.

² Or April 30, 2022 if applicable assumptions are available at the time the work is prepared.

Page 6 EGI pension and benefit plan projections

Project Phase	Scope					
Projected net periodic benefit costs under US GAAP	 Summarizing the annual net periodic benefit costs under US GAAP for 2022 Determining estimated annual net periodic benefit costs under US GAAP for 2023 to 2024 using the full yield curve approach Calculating estimated accumulated unrecognized actuarial loss/gain amortization amounts under corporate books and local books When there is more than one participating employer in a plan, some components of EGI's net periodic benefit cost are a 					
	proportion of the total. As such, projections must be prepared for the total plans as well as for just EGI's share.					
Sensitivities	No sensitivities or scenario analysis is included in this scope. Mercer and EGI should discuss if such analysis is preferred.					
Results and Report	 Prepare certified actuarial valuation report with all required results including: Projected 2022 to 2024 net periodic benefit costs (on corporate basis) and expected funding contributions Projected accounting balance sheet and AOCI (on corporate basis only) as at December 31, 2021, 2022 and 2023 Include data, assumptions, methods and provisions disclosures so document is standalone One results meeting with EGI to discuss report and projections External to the report, a summary of the estimated AOCI balance as at December 31, 2023 on the local books basis, and the difference from corporate books basis. Provide all results in Excel file format. Actuaries are permitted to reference other external reports in their work in order to simplify disclosures. References to other external reports were used in the 2017 rate applications which the interveners requested copies of. Our objective is to avoid such requests with the report that will be filed this year. We understand this report will be filed with the OEB. 					

The scope outlined in the table above includes the activities where it is anticipated Mercer consultants will be involved. Factors and considerations that may affect the estimated costs for this project include, but are not limited to:

· Any additional assumption changes beyond those anticipated with the data phase could increase costs

Page 7 EGI pension and benefit plan projections

- All data is assumed to be reasonable and appropriate for these valuations. Significant additional data cleaning or manipulation beyond that anticipated in the data phase could increase costs.
- Unforeseen changes to standards of practice or applicable legislation
- · Preparing sensitivity or alternative scenario analysis
- · Preparing results on a stochastic basis
- · Significant changes or additional content required for the report
- Incorporating any unforeseen divestitures or acquisitions
- Incorporating any future plan mergers



welcome to brighter

Kenneth Yung, CFA Partner

120 Bremner Boulevard, Suite 800 Toronto, Ontario Tel. +1 416-868-2563 kenneth.yung@mercer.com

Project Initiation Form (PIF)

August 25, 2021

The objective of this Project Initiation Form (PIF) is to confirm the scope of our work and the compensation agreement for this project.

The terms and conditions of our existing agreement apply. However, with respect to the services described, should there be any difference between existing terms and conditions and those outlined here, the terms and conditions outlined in this PIF will apply.

Details

- 1. Client Name: Enbridge Inc. ("Enbridge")
- 2. Project name or services: Compensation Benchmarking for Regulatory Application
- 3. Description of Mercer responsibilities: Mercer will work with Enbridge to complete the following:

1. Project Planning

- a. Project kick-off meeting with Enbridge and Mercer project teams to align on expectations, deliverables and timelines
- b. Collect and validate necessary data and information related to:
 - i. Overall business, people and compensation strategy
 - ii. Enbridge employee compensation data
 - iii. Additional survey sources that Enbridge has access to (e.g., Willis Towers Watson "WTW" survey with relevant refinements)
- c. Bi-weekly project team updates (assumes 10)
- d. On-going project management (including updating detailed project plan and timeline)

2. Comparator Groups and Target Positioning

- a. Draft comparator groups for non-union and union employees using available surveys
- b. 90-minute consultation with Enbridge project team to discuss preliminary comparator markets and target positioning
- c. Revise as necessary (assumes 1 round of revisions) and confirm

3. Benchmark Matching

- Select ~300 non-union and ~30 union benchmark positions from Enbridge's Ontario, nonexecutive jobs
 - i. 300 non-union jobs will cover almost all employees
 - ii. 30 union jobs is expected to cover the majority of union employees
 - iii. Fee estimate will be adjusted based on actual number of jobs included
- b. 60-minute meeting with project team to go over list (focusing on union job selection)
 - i. 1 round of revisions

- c. Match all positions to survey sources
 - Mercer expects to use 2 survey sources for non-union jobs: Mercer survey and WTW (may vary depending on comparator markets) in order to be able to capture a robust sample of relevant comparators and industries
 - ii. Mercer expects to use 1 survey source for union jobs: Mercer survey
 - iii. In addition, Mercer will leverage where applicable June 2021 custom survey sponsored by Hydro One, in which Enbridge participated and received summary results
- d. Up to 2 hours of meetings to review and revise matches with Enbridge project team

4. Benchmarking Analysis and Report Delivery

- a. Compile and analyze market data from relevant survey sources including:
 - i. Base Salary
 - ii. Short-Term Incentives
 - iii. Total Cash Compensation
 - iv. Long-Term Incentives
 - v. Total Direct Compensation
- b. Research and compile collective bargaining rates for 30 union positions using Ontario collective agreements
- c. Prepare detailed findings report and excel data workbook with all market findings
- d. Review market data and findings in up to 3 hours of meetings
 - i. Assumes 1 round of revisions
- e. Compile an executive summary report
 - i. Assumes 1 round of revisions
- Description of client responsibilities: Provide Mercer access to necessary data and information as required.
- Estimated period of time over which work will be performed: The work will commence immediately upon acceptance of this PIF and will be completed by 31 December 2021. For accounting purposes only, we expect that this project will not extend beyond 30 June 2022.

Fee Structures

Mercer's estimated compensation for the services will be professional fees in the amount of the services. In addition to such compensation, Mercer also bills for necessary travel and other expenses related to the services requested and applicable taxes.

Page 3

We appreciate your business and look forward to working with you on this project. Please acknowledge your agreement to the project terms by signing below.

MERCER (CANA By:	Cannoch Mung		
lame:	Kenneth Yung	Date:	August 25, 2021
itle:	Partner		

By:	Sisa Marusu		
Name:	Lisa Marusic	Date:	September 16,2021
Title:	(Please Print) Manager Compensation		



SCHEDULE "A-5"

FORM OF STATEMENT OF WORK

THIS STATEMENT OF WORK ("SOW") IS ENTERED INTO BETWEEN ENBRIDGE INC. ("SERVICE RECIPIENT") AND TOWERS WATSON CANADA INC. ("CONSULTANT") AS OF MARCH 1, 2017, AND IS SUBJECT TO THE CONSULTING SERVICES AGREEMENT BETWEEN ENBRIDGE INC. AND THE CONSULTANT DATED JANUARY 22, 2016 (THE "CSA"). ANY CAPITALIZED TERM USED IN THIS SOW BUT NOT DEFINED SHALL HAVE THE MEANING ASCRIBED TO SUCH CAPITALIZED TERM IN THE CSA.

The consultant will provide consulting services ("Services") to the Service Recipient on the terms set out below:

Term

The Term of this SOW is for the period commencing on March 1, 2017 and concluding December 31, 2020.

Renewal

The Service Recipient may, at its sole discretion, and upon notice given to the Consultant no later than thirty (30) days prior to the expiry of the Term of this SOW, extend the Term of this SOW for such further period as the parties agree.

Scope of Services

The Consultant shall provide the Services outlined in the Attachment(s).

Service Fees

The Services outlined in this SOW shall be performed primarily on a "fixed fee and expense" basis with general consulting on a "time and expense" basis as noted in the attachment, along with invoicing and payment terms, as described in the CSA. The fixed fees will be payable in monthly installments.

Key Personnel

The Consultant agrees that the Services shall be performed by Consultant's Health & Benefits Canadian and U.S. teams. Members of the U.S. team are employed by Consultant's affiliate Towers Watson Delaware Inc. Service Recipient must approve any additional personnel.

Page 2

Additional Terms

In accordance with Section 2.2 or 2.3, as applicable, of the Agreement, this SOW shall be deemed to incorporate by reference and shall be subject to all the terms and conditions of the CSA, mutatis mutandis, with the same force and effect as if the terms and conditions of the CSA were fully set out in this SOW, subject to any express amendments, modifications or inclusion of additional terms set forth in this SOW.

We estimate that this engagement will be completed during 2017-2020, and the annual activities for each year will be completed in that calendar year. We will work closely with you on scheduling and use reasonable efforts to adhere to this schedule, but we cannot guarantee that this schedule will be met.

Each Party acknowledges that it has read this SOW, understands it and agrees to be bound by its terms and conditions.

Counterpart

This SOW may be executed in any number of counterparts and all such counterparts shall, for all purposes, constitute one agreement binding on all parties hereto notwithstanding that parties are not signatories to the same counterpart, provided that each party has signed at least one counterpart. This SOW may be executed and delivered by facsimile transmission or electronic transmission in .pdf or similar universally readable format and the parties hereto may rely on all such facsimile or electronically provided signature pages as though the signatures on such facsimile or electronically provided signature pages were original signatures.

IN WITNESS WHEREOF the parties hereto have executed this SOW on the day and year first above written.

TOWERS WATSON CANADA INC.

Signature:

Print Name: Wendy Poirier

Title: Region Leader, Health & Benefits Canada

Date: March 6, 2017

ENBRIDGE INC.

Signature:

Print Name: (

his Boniface.

tp://naict.internal.iowerswatson.com/clients/600428/EnbridgeAcctMgmt/Contracts/Enbridge_ SOW_HB_Ongoing rev.docx

Willis Towers Watson

Attachment 2 Page 1

ONGOING HEALTH AND BENEFITS CONSULTING - Canadian Benefits

Description of Services:

The assignment will encompass the services outlined below:

Annual Strategic Planning Meeting

- Half day annual strategic planning meeting for Canada and U.S. combined
 - Review plan objectives and performance against goals
 - Discuss key market trends, vendor developments and initiatives
 - Agree on project plan for all activities during the upcoming year

Benefit Plan Pricing

Integrated Flex Plan and Retiree Plan – Initial (for 2018)

- Analyze actual health and dental claims experience for 2016 and project claims costs for 2017 under proposed flex plan
- Update overall program costs for 2017 for Enbridge and Spectra Energy separately and combined, incorporating:
 - Spectra Energy and Enbridge enrolment statistics for 2017
 - Current premium rates for 2017 for insured benefits
 - Estimate 2017 claims experience for health and dental benefits
- Project overall program costs for 2018 on a combined basis, taking into consideration proposed premium rates for 2018 for insured benefits and estimated 2018 claims experience for health and dental benefits
- Determine appropriate flex credits and price-tags for proposed flex plan for 2018 plan year
- Review current retiree health plan experience and project for upcoming plan year in order to determine appropriate price-tag for retirees
- Prepare presentation and meet with Enbridge to discuss results

No charge

Integrated Flex Plan and Retiree Plan - Ongoing

- Gather and analyze individual enrolment statistics for the current plan year for employees under the integrated flex plan
- Analyze actual health and dental claims experience for prior plan year and project for claims cost upcoming plan year
- Update overall program costs for current and upcoming plan year to reflect updated enrolment statistics (Enbridge and Spectra Energy employees under integrated flex plan) as well as premium rates for insured benefits, updated claims experience for health and dental benefits and any required changes to credits and price-tags
- Review current retiree health plan experience and project for upcoming plan year in order to determine appropriate price-tag for retirees
- Prepare presentation and meet with Enbridge to discuss results.

Legacy Spectra Energy Flex Plan

- Gather and analyze individual enrolment statistics for the current plan year for employees remaining under the legacy Spectra Energy flex plan
- Analyze actual health and dental claims experience for prior plan year and project for upcoming plan year
- Update overall program costs for the prior plan year based on actual health and dental claims experience to determine if refund to employees is required
- Update overall cost projections for current and upcoming plan year to reflect updated enrolment statistics as well as proposed premium rates for insured benefits, updated claims experience for health and dental benefits and any required changes to credits and price-tag
- Prepare presentation and meet with Enbridge to discuss results

Attachment 2 Page 2

Attachment 2 Page 3

Annual Financials

Legacy Enbridge Plans

- Audit annual financial statements provided by the vendor, for East and West separately, for the refund accounted plans (basic life insurance and LTD), with respect to accuracy and reasonableness of the following:
 - Premium and claims
 - Waiver of premium, disabled life and IBNR reserves
 - Retention and pooling charges and pooling charges
- Check reasonableness of premiums and claims for fully pooled benefits (optional life insurance)
- Audit annual ASO statements provided by vendor for health and dental benefits for accuracy and reasonableness of ASO and pooling charges
- Determine final account balances for refund accounted plans in termination/run-off accounting and outline responsibility of existing disabled claimants (assuming life insurance and LTD moved to another insurer)
- Prepare presentation and meet with Enbridge to review results

Legacy Spectra Plans

- Audit annual financial statements provided by Manulife for basic life insurance (7 plans), LTD (5 plans), health (8 plans), dental (7 plans) and HCSA (4 plans), with respect to accuracy and reasonableness of the following:
 - Premium and claims
 - Waiver of premium, disabled life and IBNR reserves
 - Retention/ASO charges and pooling charges
 - Tax and interest calculations.
- Review in-line transfers between operating companies (Westcoast, Union Gas and St. Clair Pipelines) and benefits, CFR and deposit account balances to confirm Manulife has transferred funds appropriately
- Check reasonableness of premiums and claims for fully pooled benefits (optional life and AD&D)
- Determine actual HCSA "forfeitures" for the plan year
- Determine final account balances for refund accounted and ASO plans in termination/run-off accounting and outline responsibility of existing disabled claimants
- Prepare presentation and meet with Enbridge to review results



New Integrated Plans

- Audit annual financial statements provided by the vendor, for East and West separately, for the refund accounted plans (basic life and LTD), with respect to accuracy and reasonableness of the following:
 - Premium and claims
 - Waiver of premium, disabled life and IBNR reserves
 - Retention and pooling charges and pooling charges
- Check reasonableness of premiums and claims for fully pooled benefits (optional life insurance)
- Audit annual ASO statements provided by vendor for health and dental benefits for accuracy and reasonableness of ASO and pooling charges
- Prepare presentation and meet with Enbridge to review results

Renewal Analysis (Illustrative renewal during guarantee period)

- Review "illustrative renewal analysis prepared by vendor for the life insurance and LTD benefits to determine potential impact on premium rates after expiration of rate guarantees
- Prepare high level presentation and meet with Enbridge

Quebec Taxable Benefit Calculations

Calculate annual taxable benefits for Quebec employees and retirees for health and dental

General Health and Benefits Consulting

- Provide additional consulting to Enbridge with respect to Health & Benefit programs, as needed throughout the year
- Assist Enbridge with policy standardization and compliance efforts, as needed
- Respond to ad hoc questions as required





Time & Expense

Attachment 2 Page 4

Attachment 2 Page 5

Summary of Projects for Canad	a (CAD)			
Project	2017	2018	2019	2020
Flex Benefit Plan Pricing Integrated flex plan - initial Integrated flex plan - ongoing Legacy Spectra Energy flex plan				
Annual Financials Legacy Enbridge plans Legacy Spectra Energy plans New integrated plans 				
Renewal Analysis				
Quebec Taxable Benefit Calculation				
TOTAL				

٠

**.

Will be completed under Spectra Energy scope of work for 2017. May decrease or be eliminated depending on success of union negotiations. May increase if rate guarantees are only three years and full renewal is required. ***

ONGOING HEALTH AND BENEFITS CONSULTING - U.S. Benefits

Description of Services

The assignment will encompass the services outlined below:

Annual Strategic Planning Meeting

- Half day annual strategic planning meeting for Canada and U.S. combined
 - Review plan objectives and performance against goals
 - Discuss key market trends, vendor developments and initiatives
 - Agree on project plan for all activities during the upcoming year

Benefit Plan Strategy and Plan Management – Initial

Abbreviated Process – Initial (for 2018)

- Brief strategic planning update
 - Review senior leadership changes to harmonization strategy
 - Review benchmarking information against key peer group, including annual Oil and Gas BenVal, Financial Benchmark Survey as well as other surveys
- Provide monthly Experience Monitoring Reports to track actual against budget for the current plan year (either March – December 2017 or January – December 2017 if preferred)
- Provide peer technical review of open enrollment communications, including description of benefits provided, employee premium rates and required legal notices

Regular Process – Ongoing

- Benchmarking review meeting
 - Review benchmarking information against key peer group, including annual Oll and Gas BenVal, Financial Benchmark Survey as well as other surveys
 - Discuss key market trends in the oil and gas industry
- Develop and review wellness program strategy
- Provide monthly Experience Monitoring Reports to track actual against budget
- Provide peer technical review of open enrollment communications, including description of benefits provided, employee premium rates and required legal notices

WillisTowers Watson In Milli

Atlachment 2 Page 6



No charge

Benefit Plan Pricing

Integrated Benefit Plans - Initial (for 2018)

- Gather and analyze enrollment statistics for the current plan year
- Analyze actual health and dental claims experience for prior plan year and project for upcoming plan year
- Annual plan pricing and cost projections for the harmonized active program for Enbridge combined with Spectra and legacy Spectra retirees
 - Develop benefit plan projected cost (fully insured equivalent) for each calendar year, using actual claim experience, national trend and underwriting data
 - Provide annual cost information for internal budgets
 - Set 1-2 pricing scenarios and estimate effect on total costs and employee contributions
- Prepare drafts of materials for leadership team approval and attend leadership meetings as requested
- Complete Morneau Shepell rate template for legacy Spectra retirees
- Provide prescription drug creditable coverage testing for the active health insurance plan
- Provide quarterly IBNR estimates for active medical, retiree medical, and dental plans
- Assist with information gathering for plan audit

Integrated Benefit Plans – Ongoing

- Gather and analyze enrollment statistics for the current plan year
- Analyze actual health and dental claims experience for prior plan year and project for upcoming plan year
- Annual plan pricing and cost projections for Enbridge actives and legacy Spectra retirees (note that it is anticipated that legacy Spectra retirees will remain in the self-funded plan until January 1, 2020)
 - Develop benefit plan projected cost (fully insured equivalent) for each calendar year, using actual claim experience, national trend and underwriting data
 - Provide annual cost information for internal budgets
 - Set 3-4 pricing scenarios and estimate effect on total costs and employee contributions
- Prepare drafts of materials for leadership team approval and attend leadership meetings as requested
- Complete Morneau Shepell rate template for legacy Spectra retirees

WillisTowers Watson I.I'I'III



Attachment 2

Page 7

Attachment 2 Page 8

- Provide prescription drug creditable coverage testing for the active health insurance plan.
- Provide quarterly IBNR estimates for active medical, retiree medical, and dental plans
- Assist with information gathering for plan audit

Vendor Management

Legacy Enbridge and Spectra Programs Separately - Initial (for 2018)

- Assist Enbridge with managing and resolving escalated employee issues and systemic problem resolution with vendors
- Facilitate annual vendor performance meetings including work with vendors to create annual vendor presentations that are technically accurate and provide meaningful, customized information, attend annual vendor performance meeting and manage meeting follow ups for:
 - BCBSTX for both Spectra and Enbridge
 - UMR for Spectra post-65 retirees
 - CVS Heath
 - Hartford
 - ActiveHealth
 - Preventure

Integrated Benefit Plans – Ongoing

- Review annual vendor performance
 - Review and evaluate service provider contractual arrangements (e.g., performance guarantees, rebates) and provide recommendations
 - Assist Enbridge in managing and resolving escalated employee issues and systemic problem resolution assistance with vendors
 - Monitor vendor's quality of service and institute quality standards including financial penalties
 - Provide Enbridge with updated vendor contact list
 - Maintain an log of open vendor issues with Blue Cross/Blue Shield of Texas (BCBSTX)
- Facilitate annual vendor performance meetings including work with vendors to create annual vendor presentations that are technically accurate and provide meaningful, customized information, attend annual vendor performance meeting and manage meeting follow ups for:
 - BCBSTX
 - Participate on guarterly/semi-annual calls and meetings to review open issues

- UMR (until post-65 retiree program modified, assumed January 1, 2020)
- Hartford or other life insurance/disability carrier
- Preventure or other wellness plan provider
- Request and analyze vendor renewals (as required)
- Note that all pharmacy management activities will occur through the RxCollaborative

Compliance

- Ongoing compliance consulting
 - Provide consulting relative to health and insurance plans, including compliance, due diligence and support, e.g., contracts, trusts, 5500 Schedule As, daily administrative issues
 - Complete annual Form 5500
 - Assist Enbridge in complying with existing state or federal and state legislation that may impact your health and welfare programs
 - Review existing SPDs for legal/regulatory required changes
- Provide Enbridge with annual compliance calendar and timely updates regarding due dates for any filings
- Provide legislative/legal/industry updates
 - Provide data on current and proposed state and federal legislation and provide interpretation guidance
 - Provide research materials on various topics, as necessary

Medicare Part D Attestation

- Medicare Part D attestation for legacy Spectra Energy retiree populations.
 - Includes Attestation Report and testing for all legacy Spectra plans
- Acting as Account Manager for RDS filing
- Coordinating data submission and guarterly reimbursement requests

General Health and Benefits Consulting

- Provide additional consulting Enbridge with respect to Health and Benefit programs
- Assist Enbridge with policy standardization and compliance efforts
- Ad hoc questions and other consulting activities as requested

Time and Expense

Attachment 2 Page 9 Enbridge Inc.

Statement of Work - Ongoing Health and Benefits Consulting - Canada and U.S.

Attachment 2 Page 10

Summary of Projects for US (US	D)			
Project	2017	2018	2019	2020
Benefit Plan Strategy and Plan Management Initial Ongoing				
Benefit Plan Pricing Initial Ongoing				
Vendor Management Initial Ongoing				
Compliance				
Medicare Part D				
TOTAL				
	724.			

http://natot.internal.towerswatson.com/clients/600428/EnbridgeAcctMgml/Contracts/Enbridge_ SOW_HB_Ongoing rev.docx WillisTowers Watson III'I'III



Enbridge 200, 425 – 1st Street SW Calgary, Alberta T2P 3L8 Canada

November 30, 2020

Willis Towers Watson Inc. 308 4 Avenue SW Suite 2900 Calgary, AB T2P 0H7

Attention: P. Charles Allegro

RE: Renewal of March 1, 2017 Statement of Work

Dear Charlie:

Further to the:

1

- Statement of Work dated March 1, 2017 (the "SOW"); and
- the Consulting Services Agreement dated January 22, 2016 (the "CSA"),

entered into by our two firms, please accept this letter as Enbridge Inc.'s exercise of the renewal option set out in the SOW. In particular, the SOW states:

"The Service Recipient may, at its sole discretion, and upon notice given to the Consultant no later than thirty (30) days prior to the expiry of the Term of this SOW, extend the Term of this SOW for such further period as the parties agree",

Enbridge Inc. wishes to extend the term of the SOW to December 31, 2023 including the following modifications:

Summary of Projects for Canada (CAD)			
Project	2021	2022	2023
 Flex Benefit Plan Pricing Integrated flex plan – ongoing Legacy Spectra Energy flex plan Legacy Enbridge flex plan 			
Annual Financials Enbridge plans 			
Renewal Analysis			
Retiree Renewal Analysis			
Quebec Taxable Benefit Calculation			
TOTAL			

* May decrease or be eliminated depending on success of union negotiations.

Summary of Projects for US (USD)			
Project	2021	2022	2023
Benefit Plan Strategy and Plan Management Ongoing 			
Benefit Plan Pricing Ongoing 			
Vendor Management Ongoing 			
Compliance			
Medicare Part D			
Non-discrimination testing			
TOTAL			

The project descriptions are the same as noted in the SOW except for the Non-discrimination Testing project which is described below.

Non-Discrimination Testing

Enbridge has requested Willis Towers Watson perform nondiscrimination testing under IRC §125, 105, 129 and 79. The specific nondiscrimination testing Willis Towers Watson will perform on behalf of Enbridge is provided below:

SECTION 125 CAFETERIA PLANS

- Eligibility Test
- Contributions or Benefits Test (including utilization)
- Concentration Test

SECTION 105 AMOUNTS RECEIVED UNDER ACCIDENT AND HEALTH PLANS

- Eligibility Test
- Benefits Test

SECTION 129 DEPENDENT CARE ASSISTANCE PROGRAMS

- Eligibility Test
- Contributions or Benefits Test
- 25% Concentration Test
- Average Benefits Test (i.e., 55% utilization test)

SECTION 79 GROUP TERM LIFE INSURANCE PURCHASED FOR EMPLOYEES

- Eligibility Test
- Benefits Test

The above is subject to the discounting agreement we have in place with Willis Towers Watson in the email to Kendra Hand dated July 28, 2020 from Charlie Allegro (attached) except the H&B consulting services will be discounted by 15% instead of 10% until the end of 2021. Further the invoice process will be revised in accordance with the email to Ryan Stelmaschuk dated October 19, 2020 from Charlie Allegro (attached).

Please provide Willis Towers Watson Inc.'s acknowledgement and agreement to this extension by signing a copy of this letter in the place indicated below and forwarding a copy to my attention via email.

Sincerely,

Anod

Ryan Stelmaschuk Manager, Pensions & Benefits

Willis Towers Watson Inc. agrees to the extension and other modifications of the SOW as set forth in this letter.

Per: _____

4

P. Charles Allegro Senior Director, Client Management

cc: Henry Noey – Willis Towers Watson Victoria Kohout – Willis Towers Watson Kathy Elmore – Willis Towers Watson

SCHEDULE C

TO THE CONSULTING AGREEMENT BETWEEN ENBRIDGE GAS INC. AND GUIDEHOUSE CANADA LTD. Dated January 18, 2021

This Schedule is made under the above referenced consulting agreement (the "Agreement") between ENBRIDGE GAS INC. ("Enbridge") and GUIDEHOUSE CANADA LTD. (the "Consultant"). All capitalized terms used in this Schedule have the meaning given to them in the Agreement.

1. SCOPE OF SERVICES

The Consultant will undertake the following Services, as further described in the Deliverables Section below:

Conduct an independent review of EGI's CSS cost allocations

The required tasks and objectives of the review are to:

1. Obtain an understanding of the CAM implemented by Enbridge Inc. to allocate costs to EGI and other Enbridge business units.

Examples of information that is available to assist in obtaining an understanding include:

- a. The Intercorporate Services Agreement between EI and EGI effective January 1, 2019 (ISA)
- b. CAM policy and allocation documents
- c. Documentation outlining services received

2. Review relevant OEB decisions and directives, including those related to OEB-regulated electric utilities.

3. Review and assess the reasonableness and appropriateness of CSS cost allocations received by EGI under CAM in the context of the OEB's three-pronged test established in EBRO 493/494 and other relevant OEB precedents.

- a. When reviewing CAM, consider whether:
- i. the service and level of service is specifically required by EGI
- ii. the costs are allocated based on cost causality and appropriate cost drivers
- iii. the cost to provide the service internally is reasonable relative to the cost to acquire the service externally on a stand-alone basis (benchmarking)
- iv. there are scale economies, and
- v. the CSS fall within the range of fair market value for an organization of Enbridge's size and complexity

4. Review and assess how the ISA and CAM comply with the OEB's past decisions and the ARC

5. Provide a written report and detailed financial analysis (including benchmarking results) supporting conclusions reached

6. The following related work will be carried out under separate engagement, if and as necessary, after the delivery of the final report:

- a. Responses to information requests resulting from the regulatory process
- b. Defend findings before the OEB, as an expert witness

Quality of Work

The quality of all documentation must be suitable for the purposes of regulatory filings, as noted above. Access to the data, records and supporting documentation related to work performed must also be provided to auditors (including external and our internal audit staff or agents) if requested.

2. DELIVERABLES

The Consultant will provide the following deliverables:

A written report that provides descriptions and outcomes of the CAM study. The proponent may need to participate in OEB proceedings as an expert witness – either through written submissions or in person.

3. COMMENCEMENT AND COMPLETION DATES

This Schedule shall be effective as of June 21, 2021 and expire December 23, 2023, or such other date as the parties may mutually agree in writing.

4. KEY PERSONNEL

Craig Sabine, Director Dixon Grant, Managing Consultant David Cohen, Associate Director Matt Croft, Managing Consultant Allan Ng, Managing Consultant Navodi Athapaththu, Consultant

5. FEES AND PAYMENT TERMS

If additional work is required, unrelated to OEB proceedings, or if the Consultant is required to participate in OEB proceedings as an expert witness, either through written submissions or in person, such additional work shall be in accordance with the applicable rate table as in the attached Hourly Rates.

Expenses: N/A

The above fees and expenses cannot be exceeded without the prior written approval of Enbridge.

Fees are payable by Enbridge within sixty (60) days of receipt from the Consultant of an appropriate invoice setting out in reasonable detail the nature of the services provided.

Dated as of June 21, 2021.

GUIDEHOUSE CANADA LTD. ENBRIDGE GAS INC. Chris Tuckwell By: Chris Tuckwell (Jun 15, 2021 10:49 EDT) By: Name: Craig Sabine Name: Chris Tuckwell **Director Accounting UPO** Title: Title: Director By: By: Name: ** Name: Benjamin Grunfeld Title: Title: Partner (Please print name and title of Signing Officer) Witness:

Name:

(Witness required if Contractor is a Sole Proprietor)

Hourly Rate	es for Additional Work (OE	B procee	dings, et	c.)
Rates Applicab	ble for Additional non-OEB	Hearing	Related	Work
		Hour	ly Rates in	CDN \$
		2021	2022	2023
Role Description	Estimated Number of Hours	(\$/hour)	(\$/hour)	(\$/hour)
Partner				
Director				
Associate Director			i — i	
Managing Consultant			i i i	
Senior Consultant				
100 001				
	unted specifically for any increment necessary and that is not related to			in a constant of the states.
Rates above are discou work found to be n interven		o testimony nd material	or respond s basis	in a constant of the states.
Rates above are discou work found to be n interven	necessary and that is not related to nor request completed on a time a	nd material	or respond s basis	ing to
Rates above are discou work found to be n interven	necessary and that is not related to nor request completed on a time a	nd material	or respond s basis Work	ing to CDN \$
Rates above are discou work found to be n interven	necessary and that is not related to nor request completed on a time a	nd material Related Hour	or respond s basis Work y Rates in (ing to CDN \$
Rates above are discou work found to be n interven Rates A Role Description	necessary and that is not related to nor request completed on a time a Applicable to OEB Hearing	restimony nd material Related Hour 2021	or respond s basis Work ly Rates in 2022	ing to CDN \$ 2023
Rates above are discou work found to be n interven Rates Role Description Partner	necessary and that is not related to nor request completed on a time a Applicable to OEB Hearing	restimony nd material Related Hour 2021	or respond s basis Work ly Rates in 2022	ing to CDN \$ 2023
Rates above are discou work found to be n interven Rates A Role Description Partner Director	necessary and that is not related to nor request completed on a time a Applicable to OEB Hearing	restimony nd material Related Hour 2021	or respond s basis Work ly Rates in 2022	ing to CDN \$ 2023
Rates above are discou work found to be n interven Rates A Role Description Partner Director Associate Director	necessary and that is not related to nor request completed on a time a Applicable to OEB Hearing	restimony nd material Related Hour 2021	or respond s basis Work ly Rates in 2022	ing to CDN \$ 2023
Rates above are discou work found to be n interven Rates A Role Description Partner Director Associate Director Managing Consultant	necessary and that is not related to nor request completed on a time a Applicable to OEB Hearing	restimony nd material Related Hour 2021	or respond s basis Work ly Rates in 2022	ing to CDN \$ 2023
Rates above are discou work found to be n interven Rates A Role Description Partner Director Associate Director	necessary and that is not related to nor request completed on a time a Applicable to OEB Hearing	restimony nd material Related Hour 2021	or respond s basis Work ly Rates in 2022	ing to CDN \$ 2023



50 Keil Drive North, Box 2001 Chatham ON N7M 5M1

Danielle Dreveny, Manager Capital FP&A Tel: 519-436-4600 ext. 5002330 Email: Danielle.Dreveny@enbridge.com

April 23, 2021

CONCENTRIC ADVISORS ULC 200 Rivercrest Drive S. E. Calgary Alberta T2C 2X5

Dear Sir / Madam,

RE: Consulting Agreement with Enbridge Gas Inc.

Attached please find for signature our Consulting Agreement. Kindly arrange to have the Agreement and the attached Schedule signed. Please ensure you read and understand all of the terms and conditions of the Agreement, as well as the enclosed Statement on Business Conduct and Lifesaving Rules.

We will also require the following:

 A current clearance certificate or letter of exemption from the Ontario Workplace Safety and Insurance Board ("WSIB"). If your employees are in a jurisdiction other than Ontario, please provide equivalent proof of coverage, and new proof of coverage must be filed with us upon expiry/renewal of such proof of coverage.

Please return the applicable WSIB document noted above, together with a signed copy of the Consulting Agreement and a signed copy of the Schedule, promptly following receipt of this letter. Upon receipt of all the documents in our office, we will execute the Agreement and a PDF copy of the Agreement will be returned to you for your records.

If you have any questions, please contact me at the above-noted telephone number.

Sincerely,

Danielle Dreveny Manager Capital FP&A

Encls.

CONSULTING AGREEMENT

THIS AGREEMENT made effective April 9, 2021.

BETWEEN:

ENBRIDGE GAS INC. ("Enbridge")

- and -

CONCENTRIC ADVISORS ULC (the "Consultant")

WITNESSES THAT in consideration of the mutual covenants and agreements herein contained, the parties hereto covenant and agree as follows:

1. Scope of Services

- (a) During the term hereof (as hereinafter defined), the Consultant shall provide consulting services (the "Services") to Enbridge, on the terms and conditions set forth below.
- (b) The scope of work for specific projects to be undertaken by the Consultant at the request of Enbridge will be described in separate schedules referencing this Agreement, each of which shall become effective, be incorporated by reference and form an integral part of this Agreement upon the execution of each such schedule by Enbridge and the Consultant. The schedule for each project will specify the names of key individuals, scope of Services, deliverables, commencement and completion dates, rate of compensation and payment terms applicable to such project. Each schedule described above shall be prepared using a form similar to the attached Schedule "A".

2. Compensation

In consideration of the Services and deliverables to be provided by the Consultant hereunder, and provided that the Consultant is not in default of its obligations hereunder, Enbridge shall remit to the Consultant all amounts required to be paid in accordance with the applicable schedule.

Consultant shall be responsible for charging, collecting and remitting all applicable federal and provincial sales, use and value-added taxes in respect of the fees paid or payable to Consultant and, in particular, the goods and services tax ("GST") and harmonized sales tax ("HST") imposed under Part IX of the Excise Tax Act (the "ETA"), the Quebec sales tax ("QST") imposed under an Act respecting the Quebec Sales Tax (the "QSTA") and any provincial sales taxes ("PST"); and such taxes, if applicable, shall be shown separately on all invoices. Where Consultant is required to collect any GST/HST, QST or similar tax, Consultant shall provide Enbridge with the documentary evidence as prescribed pursuant to the ETA or QSTA, any successor provision thereto or any similar provision of any other taxing statute as is required to entitle Enbridge to claim an input tax credit, input tax refund, rebate, refund or any other form of relief in respect of such taxes.

Where the Consultant is a non-resident of Canada for purposes of the Income Tax Act (Canada) (the "ITA"), with respect to the invoice or statement of Fees issued pursuant to any Schedule, the Consultant will identify the location where the Services are provided, separate Services performed in Canada from Services performed outside of Canada, identify the number of days Services were performed in Canada (including travel days to/from Canada) and, for Services performed in Canada, identify the physical location, indicating city and province, where such Services were performed. Where the non-resident Consultant has not obtained and provided to Enbridge a non-resident withholding tax waiver at such time as Enbridge makes any payment to the Consultant for Services, Enbridge shall withhold such percentage

of any payment as mandated under the ITA with respect to the Services provided in Canada or on the full invoice or statement amount where the Consultant has not clearly separated the Services performed in Canada from Services performed outside of Canada. Enbridge shall remit the withheld amount to Canada Revenue Agency, or its successor, in the manner and at the time required by the ITA. For further clarification, it is the Consultant's responsibility to obtain the tax waiver, if available. In the event that Enbridge is assessed for any non-resident withholding taxes payable, the Consultant agrees to forthwith reimburse Enbridge for such amount together with applicable interest and penalties, if any.

3. Term

Subject to earlier termination as provided for herein, the term of this Agreement shall commence on the day set forth above and expire on December 31, 2023 (hereinafter the "Term").

4. Termination

- (a) Enbridge may terminate this Agreement or any schedule to this Agreement for convenience upon giving two (2) weeks written notice to the Consultant.
- (b) Either party may terminate this Agreement in case of a breach by the other party of its obligations hereunder, provided that the breach is not cured within five (5) days of written notification by the non-defaulting party to the defaulting party setting out the particulars of the breach.
- (c) Either party may terminate this Agreement upon written notice to the other party, if: (i) the other party is subject to proceedings in bankruptcy, or insolvency, whether voluntary or involuntary, (ii) a receiver is appointed in respect of all or a substantial portion of the other party's assets; or (iii) the other party assigns its property to its creditors or generally becomes unable to pay its debts as they become due.

Upon any termination of this Agreement, the Consultant shall deliver to Enbridge the results of all Services provided as of the date of termination, including completed or uncompleted deliverables for which payment has been received in accordance with the terms of this Agreement.

5. Facilities

Enbridge shall provide to the Consultant use of such office facilities as may be required by the Consultant, acting reasonably, to perform the Services during the Term.

6. Reimbursement for Expenses

In addition to the payments to be made pursuant to Section 2 hereof, Enbridge shall reimburse the Consultant for all reasonable expenses properly incurred by the Consultant in connection with the Services provided to Enbridge hereunder and that have been pre-approved by Enbridge in writing, including, without limitation, reasonable travel and other costs and expenses in connection therewith. Such pre-approved reasonable expenses incurred by the Consultant in rendering Services shall be reimbursed by Enbridge net of GST/HST. GST/HST shall be charged, where applicable, by the Consultant on the expenses incurred, net of the input tax credits/reimbursements for GST/HST claimed by the Consultant. Concurrently with its delivery of invoices to Enbridge as contemplated by Section 2 hereof, the Consultant shall submit to Enbridge invoices and statements setting out in reasonable detail the nature and amount of the expenses or costs incurred by the Consultant for which the Consultant claims reimburse the Consultant for all approved invoiced expenses and costs. The Consultant shall provide to Enbridge copies of all documentation in support of invoiced expenses as Enbridge may request from time to time during the Term hereof.

7. Independent Contractor

Notwithstanding anything to the contrary herein contained, the Consultant shall not, for any purpose, be or be deemed to be an employee of Enbridge during the Term or at any time during which the Services described in Section 1 hereof are provided to Enbridge nor shall anything in this Agreement create or be

construed for any purpose as creating any relationship between Enbridge and the Consultant of employer and employee. Except as expressly provided herein, Enbridge shall not be liable to contribute to any employee benefit or pension plan or pay premiums for any policy or form of insurance whatsoever on behalf of the Consultant nor to pay any amounts or premiums on its behalf in respect of the Canada Pension Plan, Ontario Health Insurance Plan, Workplace Safety and Insurance Board or Employment Insurance, nor to deduct or withhold from source any amount from amounts payable by Enbridge to the Consultant hereunder in respect of any income tax obligation or liability payable by the Consultant to the Canada Revenue Agency. The Consultant agrees to indemnify and hold Enbridge harmless from and against any order, penalty, interest or tax that may be assessed or levied against Enbridge as a result of the failure or delay of the Consultant to file any return or information required to be filed by the Consultant by any law, ordinance or regulation relating to the Services performed by the Consultant herein.

8. Confidential Information and Personal Information

- (a) For the purposes of this Section 8, the following definitions will apply:
 - (i) <u>"Confidential Information"</u>, means all information pertaining to the business and affairs of Enbridge, its affiliates and subsidiaries, whether oral or written, furnished by Enbridge to the Consultant, its employees and representatives, whether furnished or prepared before or after the date of this Agreement, and includes all analysis, compilations, data, studies, reports or other documents prepared by the Consultant based upon or including any of the information furnished by Enbridge, but does not include information which:
 - A. is at the time of disclosure or thereafter becomes generally available to the public other than as a result of disclosure by the Consultant or anyone to whom the Consultant transmits the information;
 - B. is at the time of disclosure or thereafter becomes known or available to the Consultant on a non-confidential basis and not in contravention of applicable law from a source other than Enbridge that is entitled to disclose the information; or
 - C. is already in the possession of the Consultant or is lawfully acquired, provided that such information is not subject to another confidentiality agreement with, or obligations of secrecy to Enbridge.
 - (ii) "Person" includes individuals, partnerships, firms and corporations.
- (b) Enbridge is furnishing the Confidential Information to the Consultant solely for the purpose of assisting the Consultant in the performance of Services which the Consultant provides to Enbridge. The Consultant shall not use the Confidential Information for any purpose other than the performance of Services provided to Enbridge.
- (c) The Consultant acknowledges that the Confidential Information is the property of Enbridge, which is confidential and material to the interests, business and affairs of Enbridge and that disclosure thereof would be detrimental to the interests, business and affairs of Enbridge. Accordingly, the Consultant agrees that it shall maintain the confidentiality of the Confidential Information and that it shall not disclose the Confidential Information to any Person for any reason whatsoever except as expressly provided herein.
- (d) The Consultant may disclose Confidential Information to the extent required by a court of competent jurisdiction or other governmental or regulatory authority or otherwise as required by applicable law, provided that the Consultant first give Enbridge prompt written notice (except where the governmental or regulatory authority has expressly ordered that no notice be given) and co-operate with and assist Enbridge in responding to the request or demand for disclosure.
- (e) The Consultant acknowledges and agrees that Enbridge would be irreparably harmed if any provision of this Agreement is not performed by the Consultant in accordance with its terms. Accordingly, Enbridge shall be entitled to an injunction or injunctions to prevent breaches of any of the provisions of this Agreement and may specifically enforce such provisions by an action

instituted in a court having jurisdiction. These specific remedies are in addition to any other remedy to which Enbridge may be entitled at law or equity.

- (f) If in the course of performing Services hereunder, the Consultant obtains or accesses personal information about an individual, including without limitation, a customer, potential customer or employee or contractor of Enbridge ("Personal Information") the Consultant agrees to treat such Personal Information in compliance with all applicable federal or provincial privacy or protection of personal information laws and to use such Personal Information only for purposes of providing the Services hereunder. Furthermore, the Consultant acknowledges and agrees that it will:
 - not otherwise copy, retain, use, modify, manipulate, disclose or make available any Personal Information, except as required by applicable law;
 - (ii) establish or maintain in place appropriate policies and procedures to protect Personal Information from unauthorized collection, use or disclosure;
 - (iii) implement such policies and procedures thoroughly and effectively;
 - (iv) except as required for purposes of providing the Services hereunder, will not develop or derive, for any purpose whatsoever, any products in machine-readable form or otherwise, that incorporates, modifies, or uses in any manner whatsoever, any Personal Information; and
 - (v) upon completion of its Services for or on behalf of Enbridge, will at Enbridge's direction: A. return; or B. destroy all Personal Information and all copies and records thereof in its possession.

9. Indemnification

The Consultant hereby agrees to and shall:

- (a) be liable to Enbridge and its directors, officers and employees, for all claims, liabilities, damages, costs, losses and expenses whatsoever which Enbridge or any of its directors, officers and employees may suffer, sustain or incur; and
- (b) indemnify and save harmless Enbridge, Enbridge's affiliated and subsidiary companies, and their directors, officers, agents, employees and representatives from and against any and all liabilities, claims, demands, damages, loss, costs and expenses (including without limitation all applicable solicitors' fees, court costs and disbursements, investigation expenses, adjusters' fees and disbursements) to or which any third party may suffer, sustain or incur,

in respect of all matters or anything which may arise out of any act or omission directly related to any breach of this Agreement by the Consultant, its employees or representatives save to the extent that such breach was caused or contributed to by Enbridge, Enbridge's affiliated and subsidiary companies, and their directors, officers, agents, employees and representatives. Consultant's assumed liabilities under this Agreement, including its obligation to indemnify the counterparty, are limited to: (i) the amount Consultant has been paid as compensation for services performed under this Agreement, and/or (ii) Consultant's insurance coverage.

10. Work Product

(a) For the purposes of this Section 10, "Work Product" shall include any of the following, which are developed in the course of or arise from the Services provided by the Consultant to Enbridge hereunder throughout the Term: (i) any deliverables produced under any schedule to this Agreement together with any and all notes, reports, research information, compilations, data specifications, designs, programs, documentation, software (including object code and source materials), development tools, products and other materials or things; (ii) any and all knowledge, know-how, techniques, inventions, processes, trade secrets, methodologies, approaches and other intangible intellectual property rights; and (iii) all designs, patent applications, issued

patents, industrial design registrations, design patents, trade-mark applications, registered trademarks and copyright which may relate thereto.

- (b) For the purposes of this Section 10, "Consultant Materials" comprises any of the following, which were developed by the Consultant, at its own cost and expense in advance of and independent of this Agreement and as proven by the Consultant to be the case in the event of a dispute concerning the same: (i) any and all notes, research, information, data, specifications, designs, programs, documentation, software (including object code and source materials), development tools, products and other materials or things; (ii) any and all knowledge, know-how, techniques, inventions, processes, trade secrets, methodologies, approaches and other intangible intellectual property rights; and (iii) all designs, patent applications, issued patents, industrial design registrations, design patents, trade-mark applications, registered trade-marks and copyright which may relate thereto.
- (c) All right, title and interest in and to the Work Product shall be the property of Enbridge. The Consultant shall ensure that any agent or employee of the Consultant shall have waived in writing all of his or her moral rights over any such Intellectual Property. During and after the Term of this Agreement, the Consultant shall from time to time as and when requested by Enbridge execute all papers and documents and perform other acts as necessary or appropriate to evidence or further document Enbridge's ownership of the Work Product and the intellectual property rights therein.
- (d) The Consultant retains all right, title and interest in and to the Consultant Materials. The Consultant hereby grants to Enbridge a non-exclusive, perpetual, irrevocable, non-terminable, transferable, assignable and royalty-free license to copy, disclose, use, operate, maintain, repair, modify, enhance, make derivative works, license, sub-license and otherwise commercially exploit without limitation or restriction those Consultant Materials used in connection with the delivery of the Services or to the extent contained within any Work Product.
- (e) The Consultant agrees to fully indemnify and hold harmless Enbridge from and against any and all: (i) claims, demands and actions; (ii) liabilities, damages or losses awarded by a court of competent jurisdiction or as agreed to as part of a settlement; and (iii) litigation costs and/or expenses (including reasonable legal fees and disbursements) reasonably incurred by Enbridge in connection with any claim that the Services or Work Product provided hereunder infringe any patent, copyright, trade secret or other right of any third party.

11. Representations and Warranties

- (a) The Consultant represents, warrants and covenants with Enbridge that: (i) it will perform all Services in a good and workmanlike manner using reasonable care (at a level that is at least consistent with industry standards for the provision of similar services) and in accordance with the terms of this Agreement; (ii) it possesses the knowledge, skill and experience necessary for the provision and completion of the Services in accordance with the terms of this Agreement; and (iii) any deliverables provided hereunder shall conform to their relevant specifications as described in the applicable schedule.
- (b) The Consultant agrees that under no circumstances will it interface a non-Enbridge computing device (including without limitation desktops, laptops, handheld device) with the Enbridge intranet or internet without obtaining the prior written approval of Enbridge. To the extent the deliverables produced hereunder involve the provision or development of any software application, interface or electronic data, the Consultant shall use commercially reasonable efforts to prevent the introduction of any virus to the hardware and computer systems upon which the application, interface or electronic data are to be installed. During the Term of this Agreement, the Consultant shall implement and run virus prevention and detection control procedures in accordance with industry standards.
- (c) In addition to the policies described in Section 25, the Consultant shall ensure that it is familiar with and understands all of Enbridge's current policies, procedures and standards that are

pertinent to the activities associated with the Services and which have been provided to the Consultant in advance of the execution of this Agreement.

(d) If, during the performance of these services or within six months following completion of the assignment, such services shall prove to be faulty or defective by reason of a failure to meet such standards, Consultant agrees that upon prompt written notification from Enbridge prior to the expiration of the six month period following the completion of the assignment containing any such fault or defect, such faulty portion of the services shall be redone at no cost to Enbridge up to a maximum amount equivalent to the cost of the services rendered under this assignment. The foregoing shall constitute Consultant's sole liability with respect to the accuracy or completeness of the work and the activities involved in its preparation.

12. Subcontractors

The Consultant shall not enter into any agreement with any other party to assist in the provision of the Services described in Section 1 hereof (hereinafter described as a "Subcontract") nor shall the Consultant allow any other party to perform such Services or any part thereof without first obtaining the consent in writing of Enbridge, which consent may be withheld by Enbridge, acting reasonably. Notwithstanding any approval or consent that may be provided by Enbridge in connection with any Subcontract, the Consultant shall not be relieved of any of its liabilities and responsibilities hereunder. Any party which enters into a Subcontract with the Consultant shall be required by the terms of such Subcontract to comply with and be bound by the obligations and responsibilities of the Consultant described hereunder and without restricting the generality of the foregoing, any Subcontract which has been entered into without the prior written consent of Enbridge shall be null and void and without force and effect.

13. Insurance

Save and except where Enbridge specifies otherwise in writing, the Consultant shall at its own expense maintain and keep in full force and effect during the Term hereof and for a period of two (2) years following the expiry of the Term or other termination of this Agreement:

- (a) Commercial General Liability insurance having a minimum inclusive coverage limit, including personal injury and property damage, of at least Two Million Dollars (\$2,000,000) per occurrence. Enbridge Gas Inc. must be listed as the certificate holder and be added as an additional insured in the insurance policy, which should be extended to cover contractual liability, products/completed operations liability, owners'/ contractors' protective liability and must also contain a cross liability clause;
- (b) Automobile Liability insurance on all vehicles used in connection with this Agreement and such insurance shall have a limit of at least One Million Dollars (\$1,000,000) in respect of bodily injury (including passenger hazard) and property damage inclusive of any one accident;
- (c) Non-Owned Automobile Liability insurance and such insurance shall have a limit of at least One Million Dollars (\$1,000,000) in respect of bodily injury (including passenger hazard) and property damage, inclusive in any one accident; and
- (d) such other insurance as Enbridge may in its discretion determine to be necessary, including, but not limited to, Professional Liability or Errors and Omissions insurance.

The Consultant shall forthwith after entering into this Agreement, and from time to time thereafter at the request of Enbridge, furnish to Enbridge a memorandum of insurance or an insurance certificate setting out the terms and conditions of each policy of insurance (all such policies of insurance being hereinafter described as the "Insurance Policies") maintained by the Consultant in order to satisfy the requirements of this section. At any time and from time to time at the request of Enbridge, the Consultant shall furnish Enbridge with one or more duly completed insurance certificates in the form requested by Enbridge to evidence the details of all the Insurance Policies. The Insurance Policies shall be arranged with insurers acceptable to Enbridge, acting reasonably, and shall contain such terms and conditions as are reasonably acceptable to Enbridge. The Consultant shall not cancel, terminate or materially alter the terms of any of the Insurance Policies without giving thirty (30) days prior notice in writing to Enbridge. The Consultant

shall cause or arrange for any of its insurers under any one or more of the Insurance Policies to oblige itself contractually in writing to Enbridge to provide thirty (30) days prior notice in writing before cancelling, terminating or materially altering the Insurance Policies under which it is an insurer.

14. Compliance with Laws

The Consultant agrees to comply with the Occupational Health and Safety Act (Ontario) and the Workplace Safety and Insurance Act (Ontario) and with all other prevailing federal, provincial and municipal laws and regulations or any other laws or regulations in force in any jurisdiction where the Services are performed (the "Laws") and which are applicable to the Consultant, its subcontractors and the Services provided hereunder, and the Consultant shall familiarize itself and procure all required permits and licenses and pay all charges and fees necessary or incidental to the due and lawful prosecution of this Agreement, and maintain all documentation as may be required by the Laws, and shall indemnify and save harmless Enbridge, its directors, officers, agents and employees thereof against any claim or liability from or based on the violation of any Laws, whether by the Consultant, its officers, employees, subcontractors, representatives or agents. The Consultant shall, from time to time, if requested by Enbridge, furnish Enbridge with evidence of such compliance, and in particular: (i) evidence from the Workplace Safety and Insurance Board, or the equivalent thereof in any jurisdiction where the Services provided hereunder are carried out, that the Consultant and any party with which it has entered into a Subcontract are in compliance with and have paid all assessments and other amounts owing pursuant to the workers' compensation legislation of such jurisdiction; and (ii) evidence of the Consultant's compliance with any training requirements under the Laws including, without limitation, the provision of such statements or certificates pertaining to the Consultant's compliance in the form(s) prescribed by Enbridge from time to time.

Enbridge is committed to compliance with the Accessibility for Ontarians with Disabilities Act, 2005, O.Reg. 429/07 and O.Reg. 191/11, the Enbridge Customer Service Policy for Providing Goods and Services to People with Disabilities and the Enbridge Integrated Accessibility Standards Policy (collectively the "AODA"). The Consultant shall ensure that it is in full compliance with all of its obligations under AODA. Without limiting the generality of the foregoing the Consultant shall ensure that all of its employees, agents, volunteers, or others engaged by the Consultant in the delivery of services under this Agreement receive training in connection with the requirements of the AODA. If requested to do so, the Consultant shall provide Enbridge with copies of its policies, practices, procedures, training materials and training records including the dates on when the training is provided, and the names of the individuals trained, and confirmation the Consultant has reported its compliance to the Ministry of Community and Social Services or such other governmental authority as provided in the AODA.

The Consultant will ensure that any personnel it assigns to work in Canada, where they are not a Canadian citizen or Canadian permanent resident of Canada, will obtain and maintain the lawful ability to engage in commercial activities in Canada through the issuance of the appropriate documentation from Canada Border Services Agency and Citizenship and Immigration Canada. The Consultant's personnel where necessary will obtain lawful work permits to engage in business-related activities as temporary foreign workers and will notify Enbridge if any applications for work permits and work permit renewals are refused. The Consultant will not send personnel to any Enbridge-related work site if they do not possess the necessary lawful permission to work in Canada. The Consultant will take full responsibility to secure the necessary documentation and produce such documentation when entering a Canadian work site of Enbridge.

15. Waiver

Either the Consultant or Enbridge may, in writing, extend the time for performance by the other and waive non-compliance or non-performance by the other of any of the other's obligations, covenants and agreements under this Agreement and any compliance therewith or performance thereof. However, no such extension or waiver shall operate so as to waive, diminish or reduce the scope of or otherwise affect any obligation, covenant or agreement of such other which is not the subject matter of such extension or waiver or, except to the extent of such extension or waiver, of the obligation, covenant and agreement which is the subject matter of such waiver. No act or failure to act of either the Consultant or Enbridge shall be or be deemed to be an extension or waiver of timely or strict performance by the other of the other's obligations, covenants and agreements under this Agreement except to the extent notice thereof is given to the other.

16. Notice

Any notice or other communication to be given under or pursuant to the provisions hereof or in any way concerning this Agreement shall be sufficiently given if reduced to writing and delivered to the person to whom such communication is to be given or sent by facsimile or electronic internet communication, addressed to such person at the address set forth below:

If to Enbridge:

ENBRIDGE GAS INC. 50 Keil Drive North, Box 2001 Chatham ON N7M 5M1 Attention: Danielle Dreveny, Manager Capital FP&A Phone: 519-436-4600 ext. 5002330 Email: Danielle.Dreveny@enbridge.com

With a copy to: Law Department Email: EGILawContracts@enbridge.com

If to the Consultant:

CONCENTRIC ADVISORS ULC 200 Rivercrest Drive S. E. Calgary Alberta T2C 2X5 Attention: Larry Kennedy, Senior Vice President Phone: 587-997-6489 Ext. Email: Ikennedy@ceadvisors.com

or at such other address as may be specified therefor by proper notice hereunder. A notice or communication shall be deemed to have been sent and received on the day it is delivered personally or by courier or by facsimile or by electronic internet communication. If such day is not a business day or if the notice or communication is received after 5:00 PM (at the place of receipt) on any business day, the notice or communication shall be deemed to have been sent and received on the immediately following business day.

17. Interpretation

This Agreement shall be governed by and construed in accordance with the laws of the Province of Ontario and the laws of Canada applicable therein. Headings used herein are for the convenience of reference only and shall not be considered in construing or interpreting this Agreement. The words "herein", "hereunder", "hereof" and other similar words refer to this Agreement as a whole and not to any particular paragraph. Any provision herein prohibited by law shall to the extent prohibited be ineffective without invalidating any other provisions hereof. All references to amounts of money in this Agreement and any schedule shall mean lawful currency of Canada.

18. Assignment

The Consultant may not assign this Agreement in whole or in part without the express prior consent in writing of Enbridge. This Agreement shall be binding upon and enure to the benefit of the successors and assigns of Enbridge.

19. Use of Enbridge Name and Logo

The Consultant shall not use or display Enbridge's name or any symbols, signs, trademarks and other marks denoting and identifying Enbridge in any manner whatsoever without the prior written authorization of Enbridge. Consultant may refer to the following information in materials used to promote its services: (i) a general description of the nature and scope of the services performed, and (ii) the time period of the engagement.

20. Time of Essence

Time shall be of the essence in the performance of the Services.

21. Survival

All warranties and indemnities contained in this Agreement, and the obligations contained in Section 8, shall survive the termination of this Agreement irrespective of the time of or party responsible for such termination, and such warranties, indemnities and obligations shall remain in full force and effect and be binding on the Contractor notwithstanding such termination.

22. Further Assurances

Each of the parties shall, from the time of the written request of the other party, do all such further acts and execute and deliver or cause to be done, executed or delivered all such further acts, deeds, documents, assurances and things as may be required, acting reasonably, in order to fully perform and to more effectively implement and carry out the terms of this Agreement.

23. Entire Agreement

This Agreement, including any schedules attached hereto, constitutes the entire agreement between the parties with respect to the subject matter set out herein and replaces any prior understandings or agreements, whether written or oral, regarding such subject matter. No change or modification of this Agreement is valid unless it is in writing and signed by both parties. No disclaimers, purchase order documents, invoices or other documents of the Consultant shall be binding upon Enbridge.

24. Audit

The Consultant shall, following no less than seven (7) business days advance notice in writing, provide to such auditors (including external auditors and Enbridge's internal audit staff or agents) as Enbridge may designate in writing, supervised access to the data, records and supporting documentation maintained by the Consultant with respect to the Services solely for the purpose of: (i) performing audits and inspections to enable Enbridge to satisfy applicable regulatory requirements or certify compliance with applicable laws; and (ii) to confirm that the Services are being provided in accordance with the terms of this Agreement. Enbridge and its auditors shall use commercially reasonable efforts to conduct such audits in a manner that will result in a minimum of inconvenience and disruption to the Consultant's business operations. In the event that if any such audit reveals any: (a) errors or deficiencies in the completion of the Services or invoicing of the Services; or (b) overpayments to the Consultant by Enbridge, then the Consultant shall forthwith correct such errors or deficiencies, including if applicable refunding any overpayment to Enbridge. The Consultant shall retain all records for three (3) years from the date of expiration or earlier termination of this Agreement, or such longer period as Enbridge may require having regard to the nature of the Services. Enbridge and its auditors may not have access to information deem proprietary, trade secret, and/or confidential by the Consultant.

25. Enbridge Policies

The Consultant acknowledges receipt of a copy of each of Enbridge Inc.'s Statement on Business Conduct for Enbridge Inc. and its Subsidiaries and Lifesaving Rules, each as amended from time to time (the "Policies"). The Consultant agrees to comply with the Policies in connection with its delivery of the Services described in this Agreement, and agrees that, if requested by Enbridge, it will ensure all personnel delivering the Services herein attend training on the Lifesaving Rules.

26. ISNetworld Requirement

If required by Enbridge, the Consultant shall subscribe with ISN Software Corporation as a registrant of ISNetworld ("ISN") or any successor service mandated by Enbridge from time to time, and maintain a performance grading within ISN that is acceptable to Enbridge (the "ISNetworld Requirement") and shall: (a) provide all records and information as required by ISN or Enbridge, including, but not limited to, training and qualification data of the Consultant personnel, including subcontractors and employees, relating to the Services; and (b) maintain compliance with the ISNetworld Requirement during the currency of this Agreement.

[remainder of page intentionally left blank]

27. Counterparts and Execution

This Agreement may be executed by the parties in separate counterparts, each of which when so executed and delivered will be deemed to be an original, and all such counterparts will together constitute one and the same instrument. Delivery of a signature by electronic transmission or by facsimile transmission, including by email delivery of a "portable document format" ("pdf") document, shall create a valid and binding obligation. This Agreement may be executed using electronic signatures.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date first written above.

CONCENTRIC ADVISORS'ULC By: Name: Kennedy ie President Title: 60 110

ENBRIDGE GAS INC.

Colin Healey Colin Healey (May 7, 20 21 16:04 MDT) By:

Name: Colin Healey Title: Director FP&A GDS

By: ______ Name: Title: (Please print name and title of Signing Officer) By: ____ Name: ** Title: *

Witness:

Name:

(Witness required if Contractor is a Sole Proprietor)

SCHEDULE A

TO THE CONSULTING AGREEMENT BETWEEN ENBRIDGE GAS INC. AND CONCENTRIC ADVISORS ULC Dated April 9, 2021

This Schedule is made under the above referenced consulting agreement (the "Agreement") between ENBRIDGE GAS INC. ("Enbridge") and CONCENTRIC ADVISORS ULC (the "Consultant").

1. SCOPE OF SERVICES

The Consultant will undertake the following Services:

- 1. Determine methodologies for depreciation and the estimation of net salvage, including:
- a. Performing research to identify applicable methodologies

b. Assessing the methodologies identified with consideration to a base case and alternative scenarios including energy transition

- c. Recommending appropriate methodologies
- 2. Perform a service life study which will include the following tasks:
- a. A full review of plant accounting data and plant balances as of EGI's 2020 fiscal year-end

b. Inclusion of the forecast 2022-2023 capital program related to capital additions and retirements into the databases used for the review of average service life and depreciation rate calculations

- c. A physical field review of facilities (if necessary)
- d. Interviews with EGI management and internal subject matter experts
- e. Development of a detailed peer comparison analysis

3. Determine the adequacy of the current accumulated depreciation accounts to reflect the consumption of the consumed service value of the EGI plant in service

4. Determine the appropriate net salvage percentages and assess the adequacy of the current balance of net salvage recoveries

5. Determine appropriate discount rates to be used in analyses and perform sensitivity analysis as required

6. Deliver a full and comprehensive draft report by November 30th, 2021; management meetings to discuss the depreciation policies and results of the depreciation study

7. Review the actual 2021 plant accounting activity immediately following the close of the 2021 financial ledgers to determine if any changes are required to the draft depreciation study report

8. Deliver a final report, in format suitable to be presented as evidence before the OEB by February 11, 2022

2. DELIVERABLES

The Consultant will provide the following deliverables:

A written report that provides descriptions and outcomes of the analyses of depreciation and net salvage estimation methods under various scenarios, service lives, net salvage values, and summaries and detailed tabulations of annual and accrued depreciation. The consultant may need to participate in the OEB proceeding as an expert witness – either through written submissions or in person.

3. TERM AND COMMENCEMENT AND COMPLETION DATES

This Schedule shall be effective as of April 9, 2021 and expire December 31, 2023, or such other date as the parties may mutually agree in writing.

4. KEY PERSONNEL

The Consultant will provide the following personnel to deliver the services set out above under Scope of Services:

Larry Kennedy, Senior Vice President Amanda Nori, Project Manager Colin Burns, Consultant Javier Sola, Consultant

5. FEES AND PAYMENT TERMS

Fees: Consultant to conduct the study for a lump sum price of Consultant Stall Consultant shall conduct any post filing work at their standard rates which are attached to this Contract. These rates will increase annually at a rate to be determined, but not exceeding 2% per year. Consultant will communicate any rate increases to Enbridge as soon as they are approved.

Expenses: N/A

The above fees and expenses cannot be exceeded without prior written approval from Enbridge.

Fees are payable by Enbridge within sixty (60) days of receipt from the Consultant of an appropriate invoice setting out in reasonable detail the nature of the services provided.

[Remainder of page intentionally left blank; signature page to follow]

Dated as of April 9, 2021.

CONCENTRIC ADVISORS ULC

ENBRIDGE GAS INC.

By: Colin Healey Colin Healey (May 7, 2021 16:04 MDT)

Name: Colin Healey Title: Director FP&A GDS

By: ______ Name: Title: (Please print name and title of Signing Officer)

Larry Kednedy Senior Vice Prendent -

> Name: ** Title: *

Witness:

Name:

By:

Name:

Title:

(Witness required if Contractor is a Sole Proprietor)

____ By: Nan Title

Rates f	or O.E.B.	filing and	proceedings
---------	-----------	------------	-------------

	Г	Hourly Rates in CDN \$		
	l l l l l l l l l l l l l l l l l l l	2021	2022 2023	
Role Description	Estimated Number of Hours			
Senior Vice President	52		_	
Project Manager	114		unknown	
Senior Consultant	161		Unknown	
Consultant				
Analyst	68			



500 Consumers Rd North York ON M2J 1P8 Lesley Austin, Advisor Regulatory Tel: 416-495-6505 Email: lesley.austin@enbridge.com

June 28, 2021

CONCENTRIC ENERGY ADVISORS, INC. 293 Boston Post Road West, Ste 500 Malborough Massachusetts 01752

Dear Sir / Madam,

RE: Consulting Agreement with Enbridge Gas Inc.

Attached please find for signature our Consulting Agreement. Kindly arrange to have the Agreement and the attached Schedule signed. Please ensure you read and understand all of the terms and conditions of the Agreement, as well as the enclosed Statement on Business Conduct and Lifesaving Rules.

We will also require the following:

 A current clearance certificate or letter of exemption from the Ontario Workplace Safety and Insurance Board ("WSIB"). If your employees are in a jurisdiction other than Ontario, please provide equivalent proof of coverage, and new proof of coverage must be filed with us upon expiry/renewal of such proof of coverage.

Please return the applicable WSIB document noted above, together with a signed copy of the Consulting Agreement and a signed copy of the Schedule, promptly following receipt of this letter. Upon receipt of all the documents in our office, we will execute the Agreement and a PDF copy of the Agreement will be returned to you for your records.

If you have any questions, please contact me at the above-noted telephone number.

Sincerely,

Lesley Austin Advisor Regulatory

Encls.

CONSULTING AGREEMENT

THIS AGREEMENT made effective June 14, 2021.

BETWEEN:

ENBRIDGE GAS INC.

("Enbridge")

- and -

CONCENTRIC ENERGY ADVISORS, INC.

(the "Consultant")

WITNESSES THAT in consideration of the mutual covenants and agreements herein contained, the parties hereto covenant and agree as follows:

- 1. Scope of Services
 - (a) During the term hereof (as hereinafter defined), the Consultant shall provide consulting services (the "Services") to Enbridge, on the terms and conditions set forth below.
 - (b) The scope of work for specific projects to be undertaken by the Consultant at the request of Enbridge will be described in separate schedules and/or service/purchase orders (each a "schedule") referencing this Agreement, each of which shall become effective, be incorporated by reference and form an integral part of this Agreement upon the execution or acknowledgement of each such schedule by Enbridge and the Consultant. The schedule for each project may specify the names of key individuals, scope of Services, deliverables, commencement and completion dates, rate of compensation and payment terms applicable to such project. Each schedule described above shall be prepared using a form similar to the attached Schedule "A" or other forms as provided by Enbridge from time to time.

2. Compensation

In consideration of the Services and deliverables to be provided by the Consultant hereunder, and provided that the Consultant is not in default of its obligations hereunder, Enbridge shall remit to the Consultant all amounts required to be paid in accordance with the applicable schedule.

Consultant shall be responsible for charging, collecting and remitting all applicable federal and provincial sales, use and value-added taxes in respect of the fees paid or payable to Consultant and, in particular, the goods and services tax ("GST") and harmonized sales tax ("HST") imposed under Part IX of the Excise Tax Act (the "ETA"), the Quebec sales tax ("QST") imposed under an Act respecting the Quebec Sales Tax (the "QSTA") and any provincial sales taxes ("PST"); and such taxes, if applicable, shall be shown separately on all invoices. Where Consultant is required to collect any GST/HST, QST or similar tax, Consultant shall provide Enbridge with the documentary evidence as prescribed pursuant to the ETA or QSTA, any successor provision thereto or any similar provision of any other taxing statute as is required to entitle Enbridge to claim an input tax credit, input tax refund, rebate, refund or any other form of relief in respect of such taxes.

Where the Consultant is a non-resident of Canada for purposes of the Income Tax Act (Canada) (the "ITA"), with respect to the invoice or statement of Fees issued pursuant to any schedule, the Consultant will identify the location where the Services are provided, separate Services performed in Canada from Services performed outside of Canada, identify the number of days Services were performed in Canada (including travel days to/from Canada) and, for Services performed in Canada, identify the physical location, indicating city and province, where such Services were performed. Where the non-resident

Consultant has not obtained and provided to Enbridge a non-resident withholding tax waiver at such time as Enbridge makes any payment to the Consultant for Services, Enbridge shall withhold such percentage of any payment as mandated under the ITA with respect to the Services provided in Canada or on the full invoice or statement amount where the Consultant has not clearly separated the Services performed in Canada from Services performed outside of Canada. Enbridge shall remit the withheld amount to Canada Revenue Agency, or its successor, in the manner and at the time required by the ITA. For further clarification, it is the Consultant's responsibility to obtain the tax waiver, if available. In the event that Enbridge is assessed for any non-resident withholding taxes payable, the Consultant agrees to forthwith reimburse Enbridge for such amount together with applicable interest and penalties, if any.

3. Term

Subject to earlier termination as provided for herein, the term of this Agreement shall commence on the day set forth above and expire on December 31, 2023 (hereinafter the "Term").

4. Termination

- (a) Enbridge may terminate this Agreement or any schedule to this Agreement for convenience upon giving two (2) weeks written notice to the Consultant.
- (b) Either party may terminate this Agreement in case of a breach by the other party of its obligations hereunder, provided that the breach is not cured within five (5) days of written notification by the non-defaulting party to the defaulting party setting out the particulars of the breach.
- (c) Either party may terminate this Agreement upon written notice to the other party, if: (i) the other party is subject to proceedings in bankruptcy, or insolvency, whether voluntary or involuntary, (ii) a receiver is appointed in respect of all or a substantial portion of the other party's assets; or (iii) the other party assigns its property to its creditors or generally becomes unable to pay its debts as they become due.

Upon any termination of this Agreement, the Consultant shall deliver to Enbridge the results of all Services provided as of the date of termination, including completed or uncompleted deliverables for which payment has been received in accordance with the terms of this Agreement.

5. Facilities

Enbridge shall provide to the Consultant use of such office facilities as may be required by the Consultant, acting reasonably, to perform the Services during the Term.

6. Reimbursement for Expenses

In addition to the payments to be made pursuant to Section 2 hereof, Enbridge shall reimburse the Consultant for all reasonable expenses properly incurred by the Consultant in connection with the Services provided to Enbridge hereunder and that have been pre-approved by Enbridge in writing, including, without limitation, reasonable travel and other costs and expenses in connection therewith. Such pre-approved reasonable expenses incurred by the Consultant in rendering Services shall be reimbursed by Enbridge net of GST/HST. GST/HST shall be charged, where applicable, by the Consultant on the expenses incurred, net of the input tax credits/reimbursements for GST/HST claimed by the Consultant. Concurrently with its delivery of invoices to Enbridge as contemplated by Section 2 hereof, the Consultant shall submit to Enbridge invoices and statements setting out in reasonable detail the nature and amount of the expenses or costs incurred by the Consultant for which the Consultant claims reimbursee the Consultant for all approved invoiced expenses and costs. The Consultant shall provide to Enbridge copies of all documentation in support of invoiced expenses as Enbridge may request from time to time during the Term hereof.

7. Independent Contractor

Notwithstanding anything to the contrary herein contained, the Consultant shall not, for any purpose, be or be deemed to be an employee of Enbridge during the Term or at any time during which the Services described in Section 1 hereof are provided to Enbridge nor shall anything in this Agreement create or be construed for any purpose as creating any relationship between Enbridge and the Consultant of employer and employee. Except as expressly provided herein, Enbridge shall not be liable to contribute to any employee benefit or pension plan or pay premiums for any policy or form of insurance whatsoever on behalf of the Consultant nor to pay any amounts or premiums on its behalf in respect of the Canada Pension Plan, Ontario Health Insurance Plan, Workplace Safety and Insurance Board or Employment Insurance, nor to deduct or withhold from source any amount from amounts payable by Enbridge to the Consultant hereunder in respect of any income tax obligation or liability payable by the Consultant to the Canada Revenue Agency. The Consultant agrees to indemnify and hold Enbridge harmless from and against any order, penalty, interest or tax that may be assessed or levied against Enbridge as a result of the failure or delay of the Consultant to file any return or information required to be filed by the Consultant by any law, ordinance or regulation relating to the Services performed by the Consultant herein.

8. Confidential Information and Personal Information

- (a) For the purposes of this Section 8, the following definitions will apply:
 - (i) <u>"Confidential Information"</u>, means all information pertaining to the business and affairs of Enbridge, its affiliates and subsidiaries, whether oral or written, furnished by Enbridge to the Consultant, its employees and representatives, whether furnished or prepared before or after the date of this Agreement, and includes all analysis, compilations, data, studies, reports or other documents prepared by the Consultant based upon or including any of the information furnished by Enbridge, but does not include information which:
 - A. is at the time of disclosure or thereafter becomes generally available to the public other than as a result of disclosure by the Consultant or anyone to whom the Consultant transmits the information;
 - B. is at the time of disclosure or thereafter becomes known or available to the Consultant on a non-confidential basis and not in contravention of applicable law from a source other than Enbridge that is entitled to disclose the information; or
 - C. is already in the possession of the Consultant or is lawfully acquired, provided that such information is not subject to another confidentiality agreement with, or obligations of secrecy to Enbridge.
 - (ii) "Person" includes individuals, partnerships, firms and corporations.
- (b) Enbridge is furnishing the Confidential Information to the Consultant solely for the purpose of assisting the Consultant in the performance of Services which the Consultant provides to Enbridge. The Consultant shall not use the Confidential Information for any purpose other than the performance of Services provided to Enbridge.
- (c) The Consultant acknowledges that the Confidential Information is the property of Enbridge, which is confidential and material to the interests, business and affairs of Enbridge and that disclosure thereof would be detrimental to the interests, business and affairs of Enbridge. Accordingly, the Consultant agrees that it shall maintain the confidentiality of the Confidential Information and that it shall not disclose the Confidential Information to any Person for any reason whatsoever except as expressly provided herein.
- (d) The Consultant may disclose Confidential Information to the extent required by a court of competent jurisdiction or other governmental or regulatory authority or otherwise as required by applicable law, provided that the Consultant first give Enbridge prompt written notice (except where the governmental or regulatory authority has expressly ordered that no notice be given) and co-operate with and assist Enbridge in responding to the request or demand for disclosure.

- (e) The Consultant acknowledges and agrees that Enbridge would be irreparably harmed if any provision of this Agreement is not performed by the Consultant in accordance with its terms. Accordingly, Enbridge shall be entitled to an injunction or injunctions to prevent breaches of any of the provisions of this Agreement and may specifically enforce such provisions by an action instituted in a court having jurisdiction. These specific remedies are in addition to any other remedy to which Enbridge may be entitled at law or equity.
- (f) If in the course of performing Services hereunder, the Consultant obtains or accesses personal information about an individual, including without limitation, a customer, potential customer or employee or contractor of Enbridge ("Personal Information") the Consultant agrees to treat such Personal Information in compliance with all applicable federal or provincial privacy or protection of personal information laws and to use such Personal Information only for purposes of providing the Services hereunder. Furthermore, the Consultant acknowledges and agrees that it will:
 - (i) not otherwise copy, retain, use, modify, manipulate, disclose or make available any Personal Information, except as required by applicable law;
 - (ii) establish or maintain in place appropriate policies and procedures to protect Personal Information from unauthorized collection, use or disclosure;
 - (iii) implement such policies and procedures thoroughly and effectively;
 - (iv) except as required for purposes of providing the Services hereunder, will not develop or derive, for any purpose whatsoever, any products in machine-readable form or otherwise, that incorporates, modifies, or uses in any manner whatsoever, any Personal Information; and
 - (v) upon completion of its Services for or on behalf of Enbridge, will at Enbridge's direction: A. return; or B. destroy all Personal Information and all copies and records thereof in its possession.

9. Indemnification

The Consultant hereby agrees to and shall:

- (a) be liable to Enbridge and its directors, officers and employees, for all claims, liabilities, damages, costs, losses and expenses whatsoever which Enbridge or any of its directors, officers and employees may suffer, sustain or incur; and
- (b) indemnify and save harmless Enbridge, Enbridge's affiliated and subsidiary companies, and their directors, officers, agents, employees and representatives from and against any and all liabilities, claims, demands, damages, loss, costs and expenses (including without limitation all applicable solicitors' fees, court costs and disbursements, investigation expenses, adjusters' fees and disbursements) to or which any third party may suffer, sustain or incur,

in respect of all matters or anything which may arise out of any act or omission directly related to any breach of this Agreement by the Consultant, its employees or representatives save to the extent that such breach was caused or contributed to by Enbridge, Enbridge's affiliated and subsidiary companies, and their directors, officers, agents, employees and representatives. Consultant's assumed liabilities under this Agreement, including its obligation to indemnify the counterparty, are limited to: (i) the amount Consultant has been paid as compensation for services performed under this Agreement, and/or (ii) Consultant's insurance coverage.

10. Work Product

(a) For the purposes of this Section 10, "Work Product" shall include any of the following, which are developed in the course of or arise from the Services provided by the Consultant to Enbridge hereunder throughout the Term: (i) any deliverables produced under any schedule to this Agreement together with any and all notes, reports, research information, compilations, data

specifications, designs, programs, documentation, software (including object code and source materials), development tools, products and other materials or things; (ii) any and all knowledge, know-how, techniques, inventions, processes, trade secrets, methodologies, approaches and other intangible intellectual property rights; and (iii) all designs, patent applications, issued patents, industrial design registrations, design patents, trade-mark applications, registered trade-marks and copyright which may relate thereto.

- (b) For the purposes of this Section 10, "Consultant Materials" comprises any of the following, which were developed by the Consultant, at its own cost and expense in advance of and independent of this Agreement and as proven by the Consultant to be the case in the event of a dispute concerning the same: (i) any and all notes, research, information, data, specifications, designs, programs, documentation, software (including object code and source materials), development tools, products and other materials or things; (ii) any and all knowledge, know-how, techniques, inventions, processes, trade secrets, methodologies, approaches and other intangible intellectual property rights; and (iii) all designs, patent applications, registered trade-marks and copyright which may relate thereto.
- (c) All right, title and interest in and to the Work Product shall be the property of Enbridge. The Consultant shall ensure that any agent or employee of the Consultant shall have waived in writing all of his or her moral rights over any such Intellectual Property. During and after the Term of this Agreement, the Consultant shall from time to time as and when requested by Enbridge execute all papers and documents and perform other acts as necessary or appropriate to evidence or further document Enbridge's ownership of the Work Product and the intellectual property rights therein.
- (d) The Consultant retains all right, title and interest in and to the Consultant Materials. The Consultant hereby grants to Enbridge a non-exclusive, perpetual, irrevocable, non-terminable, transferable, assignable and royalty-free license to copy, disclose, use, operate, maintain, repair, modify, enhance, make derivative works, license, sub-license and otherwise commercially exploit without limitation or restriction those Consultant Materials used in connection with the delivery of the Services or to the extent contained within any Work Product.
- (e) The Consultant agrees to fully indemnify and hold harmless Enbridge from and against any and all: (i) claims, demands and actions; (ii) liabilities, damages or losses awarded by a court of competent jurisdiction or as agreed to as part of a settlement; and (iii) litigation costs and/or expenses (including reasonable legal fees and disbursements) reasonably incurred by Enbridge in connection with any claim that the Services or Work Product provided hereunder infringe any patent, copyright, trade secret or other right of any third party.

11. Representations and Warranties

- (a) The Consultant represents, warrants and covenants with Enbridge that: (i) it will perform all Services in a good and workmanlike manner using reasonable care (at a level that is at least consistent with industry standards for the provision of similar services) and in accordance with the terms of this Agreement; (ii) it possesses the knowledge, skill and experience necessary for the provision and completion of the Services in accordance with the terms of this Agreement; and (iii) any deliverables provided hereunder shall conform to their relevant specifications as described in the applicable schedule.
- (b) The Consultant agrees that under no circumstances will it interface a non-Enbridge computing device (including without limitation desktops, laptops, handheld device) with the Enbridge intranet or internet without obtaining the prior written approval of Enbridge. To the extent the deliverables produced hereunder involve the provision or development of any software application, interface or electronic data, the Consultant shall use commercially reasonable efforts to prevent the introduction of any virus to the hardware and computer systems upon which the application, interface or electronic data are to be installed. During the Term of this Agreement, the Consultant shall implement and run virus prevention and detection control procedures in accordance with industry standards.

- (c) In addition to the policies described in Section 25, the Consultant shall ensure that it is familiar with and understands all of Enbridge's current policies, procedures and standards that are pertinent to the activities associated with the Services and which have been provided to the Consultant in advance of the execution of this Agreement.
- (d) If, during the performance of these services or within six months following completion of the assignment, such services shall prove to be faulty or defective by reason of a failure to meet such standards, Consultant agrees that upon prompt written notification from Enbridge prior to the expiration of the six month period following the completion of the assignment containing any such fault or defect, such faulty portion of the services shall be redone at no cost to Enbridge up to a maximum amount equivalent to the cost of the services rendered under this assignment. The foregoing shall constitute Consultant's sole liability with respect to the accuracy or completeness of the work and the activities involved in its preparation.

12. Subcontractors

The Consultant shall not enter into any agreement with any other party to assist in the provision of the Services described in Section 1 hereof (hereinafter described as a "Subcontract") nor shall the Consultant allow any other party to perform such Services or any part thereof without first obtaining the consent in writing of Enbridge, which consent may be withheld by Enbridge, acting reasonably. Notwithstanding any approval or consent that may be provided by Enbridge in connection with any Subcontract, the Consultant shall not be relieved of any of its liabilities and responsibilities hereunder. Any party which enters into a Subcontract with the Consultant shall be required by the terms of such Subcontract to comply with and be bound by the obligations and responsibilities of the Consultant described hereunder and without restricting the generality of the foregoing, any Subcontract which has been entered into without the prior written consent of Enbridge shall be null and void and without force and effect.

13. Insurance

Save and except where Enbridge specifies otherwise in writing, the Consultant shall at its own expense maintain and keep in full force and effect during the Term hereof and for a period of two (2) years following the expiry of the Term or other termination of this Agreement:

- (a) Commercial General Liability insurance having a minimum inclusive coverage limit, including personal injury and property damage, of at least Two Million Dollars (\$2,000,000) per occurrence. Enbridge Gas Inc. must be listed as the certificate holder and be added as an additional insured in the insurance policy, which should be extended to cover contractual liability, products/completed operations liability, owners'/ contractors' protective liability and must also contain a cross liability clause;
- (b) Automobile Liability insurance on all vehicles used in connection with this Agreement and such insurance shall have a limit of at least One Million Dollars (\$1,000,000) in respect of bodily injury (including passenger hazard) and property damage inclusive of any one accident;
- (c) Non-Owned Automobile Liability insurance and such insurance shall have a limit of at least One Million Dollars (\$1,000,000) in respect of bodily injury (including passenger hazard) and property damage, inclusive in any one accident; and
- (d) such other insurance as Enbridge may in its discretion determine to be necessary, including, but not limited to, Professional Liability or Errors and Omissions insurance.

The Consultant shall forthwith after entering into this Agreement, and from time to time thereafter at the request of Enbridge, furnish to Enbridge a memorandum of insurance or an insurance certificate setting out the terms and conditions of each policy of insurance (all such policies of insurance being hereinafter described as the "Insurance Policies") maintained by the Consultant in order to satisfy the requirements of this section. At any time and from time to time at the request of Enbridge, the Consultant shall furnish Enbridge with one or more duly completed insurance certificates in the form requested by Enbridge to evidence the details of all the Insurance Policies. The Insurance Policies shall be arranged with insurers acceptable to Enbridge, acting reasonably, and shall contain such terms and conditions as are reasonably

acceptable to Enbridge. The Consultant shall not cancel, terminate or materially alter the terms of any of the Insurance Policies without giving thirty (30) days prior notice in writing to Enbridge. The Consultant shall cause or arrange for any of its insurers under any one or more of the Insurance Policies to oblige itself contractually in writing to Enbridge to provide thirty (30) days prior notice in writing before cancelling, terminating or materially altering the Insurance Policies under which it is an insurer.

14. Compliance with Laws

The Consultant agrees to comply with the Occupational Health and Safety Act (Ontario) and the Workplace Safety and Insurance Act (Ontario) and with all other prevailing federal, provincial and municipal laws and regulations or any other laws or regulations in force in any jurisdiction where the Services are performed (the "Laws") and which are applicable to the Consultant, its subcontractors and the Services provided hereunder, and the Consultant shall familiarize itself and procure all required permits and licenses and pay all charges and fees necessary or incidental to the due and lawful prosecution of this Agreement, and maintain all documentation as may be required by the Laws, and shall indemnify and save harmless Enbridge, its directors, officers, agents and employees thereof against any claim or liability from or based on the violation of any Laws, whether by the Consultant, its officers, employees, subcontractors, representatives or agents. The Consultant shall, from time to time, if requested by Enbridge, furnish Enbridge with evidence of such compliance, and in particular: (i) evidence from the Workplace Safety and Insurance Board, or the equivalent thereof in any jurisdiction where the Services provided hereunder are carried out, that the Consultant and any party with which it has entered into a Subcontract are in compliance with and have paid all assessments and other amounts owing pursuant to the workers' compensation legislation of such jurisdiction; and (ii) evidence of the Consultant's compliance with any training requirements under the Laws including, without limitation, the provision of such statements or certificates pertaining to the Consultant's compliance in the form(s) prescribed by Enbridge from time to time.

Enbridge is committed to compliance with the Accessibility for Ontarians with Disabilities Act, 2005, O.Reg. 429/07 and O.Reg. 191/11, the Enbridge Customer Service Policy for Providing Goods and Services to People with Disabilities and the Enbridge Integrated Accessibility Standards Policy (collectively the "AODA"). The Consultant shall ensure that it is in full compliance with all of its obligations under AODA. Without limiting the generality of the foregoing the Consultant shall ensure that all of its employees, agents, volunteers, or others engaged by the Consultant in the delivery of services under this Agreement receive training in connection with the requirements of the AODA. If requested to do so, the Consultant shall provide Enbridge with copies of its policies, practices, procedures, training materials and training records including the dates on when the training is provided, and the names of the individuals trained, and confirmation the Consultant has reported its compliance to the Ministry of Community and Social Services or such other governmental authority as provided in the AODA.

The Consultant will ensure that any personnel it assigns to work in Canada, where they are not a Canadian citizen or Canadian permanent resident of Canada, will obtain and maintain the lawful ability to engage in commercial activities in Canada through the issuance of the appropriate documentation from Canada Border Services Agency and Citizenship and Immigration Canada. The Consultant's personnel where necessary will obtain lawful work permits to engage in business-related activities as temporary foreign workers and will notify Enbridge if any applications for work permits and work permit renewals are refused. The Consultant will not send personnel to any Enbridge-related work site if they do not possess the necessary lawful permission to work in Canada. The Consultant will take full responsibility to secure the necessary documentation and produce such documentation when entering a Canadian work site of Enbridge.

15. Waiver

Either the Consultant or Enbridge may, in writing, extend the time for performance by the other and waive non-compliance or non-performance by the other of any of the other's obligations, covenants and agreements under this Agreement and any compliance therewith or performance thereof. However, no such extension or waiver shall operate so as to waive, diminish or reduce the scope of or otherwise affect any obligation, covenant or agreement of such other which is not the subject matter of such extension or waiver or, except to the extent of such extension or waiver, of the obligation, covenant and agreement which is the subject matter of such waiver. No act or failure to act of either the Consultant or Enbridge shall be or be deemed to be an extension or waiver of timely or strict performance by the other of the other's obligations, covenants and agreements under this Agreement except to the extent notice thereof is given to the other.

16. Notice

Any notice or other communication to be given under or pursuant to the provisions hereof or in any way concerning this Agreement shall be sufficiently given if reduced to writing and delivered to the person to whom such communication is to be given or sent by electronic internet communication, addressed to such person at the address set forth below:

If to Enbridge:

ENBRIDGE GAS INC. 500 Consumers Rd North York ON M2J 1P8 Attention: Lesley Austin, Advisor Regulatory Phone: 416-495-6505 Email: lesley.austin@enbridge.com

With a copy to: Law Department Email: egilawcontracts@enbridge.com

If to the Consultant:

CONCENTRIC ENERGY ADVISORS, INC. 293 Boston Post Road West, Ste 500 Malborough Massachusetts 01752 Attention: Jill Barrile, Project Assistant Phone: 508-263-6218 Ext. Email: jbarrile@ceadvisors.com

or at such other address as may be specified therefor by proper notice hereunder. A notice or communication shall be deemed to have been sent and received on the day it is delivered personally or by courier or by electronic internet communication. If such day is not a business day or if the notice or communication is received after 5:00 PM (at the place of receipt) on any business day, the notice or communication shall be deemed to have been sent and received on the immediately following business day.

17. Interpretation

This Agreement shall be governed by and construed in accordance with the laws of the Province of Ontario and the laws of Canada applicable therein. Headings used herein are for the convenience of reference only and shall not be considered in construing or interpreting this Agreement. The words "herein", "hereunder", "hereof" and other similar words refer to this Agreement as a whole and not to any particular paragraph. Any provision herein prohibited by law shall to the extent prohibited be ineffective without invalidating any other provisions hereof. All references to amounts of money in this Agreement and any schedule shall mean lawful currency of Canada.

18. Assignment

The Consultant may not assign this Agreement in whole or in part without the express prior consent in writing of Enbridge. This Agreement shall be binding upon and enure to the benefit of the successors and assigns of Enbridge.

19. Use of Enbridge Name and Logo

The Consultant shall not use or display Enbridge's name or any symbols, signs, trademarks and other marks denoting and identifying Enbridge in any manner whatsoever without the prior written authorization of Enbridge. Consultant may refer to the following information in materials used to promote its services: (i) a general description of the nature and scope of the services performed, and (ii) the time period of the engagement.

20. Time of Essence

Time shall be of the essence in the performance of the Services.

21. Survival

All warranties and indemnities contained in this Agreement, and the obligations contained in Section 8, shall survive the termination of this Agreement irrespective of the time of or party responsible for such termination, and such warranties, indemnities and obligations shall remain in full force and effect and be binding on the Contractor notwithstanding such termination.

22. Further Assurances

Each of the parties shall, from the time of the written request of the other party, do all such further acts and execute and deliver or cause to be done, executed or delivered all such further acts, deeds, documents, assurances and things as may be required, acting reasonably, in order to fully perform and to more effectively implement and carry out the terms of this Agreement.

23. Entire Agreement

This Agreement, including any schedules attached hereto, constitutes the entire agreement between the parties with respect to the subject matter set out herein and replaces any prior understandings or agreements, whether written or oral, regarding such subject matter. No change or modification of this Agreement is valid unless it is in writing and signed by both parties. No disclaimers, purchase order documents, invoices or other documents of the Consultant shall be binding upon Enbridge.

24. Audit

The Consultant shall, following no less than seven (7) business days advance notice in writing, provide to such auditors (including external auditors and Enbridge's internal audit staff or agents) as Enbridge may designate in writing, supervised access to the data, records and supporting documentation maintained by the Consultant with respect to the Services solely for the purpose of: (i) performing audits and inspections to enable Enbridge to satisfy applicable regulatory requirements or certify compliance with applicable laws; and (ii) to confirm that the Services are being provided in accordance with the terms of this Agreement. Enbridge and its auditors shall use commercially reasonable efforts to conduct such audits in a manner that will result in a minimum of inconvenience and disruption to the Consultant's business operations. In the event that if any such audit reveals any: (a) errors or deficiencies in the completion of the Services or invoicing of the Services; or (b) overpayments to the Consultant by Enbridge, then the Consultant shall forthwith correct such errors or deficiencies, including if applicable refunding any overpayment to Enbridge. The Consultant shall retain all records for three (3) years from the date of expiration or earlier termination of this Agreement, or such longer period as Enbridge may require having regard to the nature of the Services. Enbridge and its auditors may not have access to information deemed proprietary, trade secret, and/or confidential by the Consultant.

25. Enbridge Policies

The Consultant acknowledges receipt of a copy of each of Enbridge Inc.'s Statement on Business Conduct for Enbridge Inc. and its Subsidiaries and Lifesaving Rules, each as amended from time to time (the "Policies"). The Consultant agrees to comply with the Policies in connection with its delivery of the Services described in this Agreement, and agrees that, if requested by Enbridge, it will ensure all personnel delivering the Services herein attend training on the Lifesaving Rules.

26. ISNetworld Requirement

If required by Enbridge, the Consultant shall subscribe with ISN Software Corporation as a registrant of ISNetworld ("ISN") or any successor service mandated by Enbridge from time to time, and maintain a performance grading within ISN that is acceptable to Enbridge (the "ISNetworld Requirement") and shall: (a) provide all records and information as required by ISN or Enbridge, including, but not limited to, training and qualification data of the Consultant personnel, including subcontractors and employees, relating to the Services; and (b) maintain compliance with the ISNetworld Requirement during the currency of this Agreement.

[remainder of page intentionally left blank]

27. Counterparts and Execution

This Agreement may be executed by the parties in separate counterparts, each of which when so executed and delivered will be deemed to be an original, and all such counterparts will together constitute one and the same instrument. Delivery of a signature by electronic transmission, including by email delivery of a "portable document format" ("pdf") document, shall create a valid and binding obligation. This Agreement may be executed using electronic signatures.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date first written above.

CONCENTRIC ENERGY ADVISORS, INC.	ENBRIDGE GAS INC.
By: Name: James M. Coyne Title: Senior Vice President	By: Joel Denomy (Jul 6, 2021 13:50 EDT) Name: Joel Denomy Title: Technical Manager Regulatory Applications
By::	Ву:
Name:	Name: **
Title:	Title: *
(Please print name and title of Signing Officer)	
Witness:	_
Name:	
(Witness required if Contractor is a Sole Proprietor)	

SCHEDULE A

TO THE CONSULTING AGREEMENT BETWEEN ENBRIDGE GAS INC. AND CONCENTRIC ENERGY ADVISORS, INC. Dated June 14, 2021

This Schedule is made under the above referenced consulting agreement (the "Agreement") between ENBRIDGE GAS INC. ("Enbridge") and CONCENTRIC ENERGY ADVISORS, INC. (the "Consultant").

1. SCOPE OF SERVICES

The Consultant will undertake the following Services:

Consultant will conduct an independent capital structure review to access the reasonableness of Enbridge's current capital structure.

As further defined in the attached letter detailing scope of work.

2. DELIVERABLES

The Consultant will provide the following deliverables:

• An assessment of Enbridge's business risk and financial risk compared to the last assessment that was reviewed by the OEB;

- An assessment of Enbridge's prospective business risk and financial risk;
- · An examination of information on utility actual and approved capital structures;

• A comparison of other North America utility capital structures to Enbridge's current and proposed capital structure;

- · Provision of a recommendation on the appropriate common equity level for Enbridge; and
- · A written report detailing all of the above.

3. TERM AND COMMENCEMENT AND COMPLETION DATES

This Schedule shall be effective as of June 14, 2021 and expire December 31, 2023, or such other date as the parties may mutually agree in writing.

4. KEY PERSONNEL

The Consultant will provide the following personnel to deliver the services set out above under Scope of Services:

Jim Coyne, SVP Robert C. Yardley, Jr., SVP Dan Dane, SVP Jacob Hurwitz, Project Manager

5. FEES AND PAYMENT TERMS

Fees: 2021 Hourly Rates in USD:



Expenses: N/A

The above fees and expenses cannot be exceeded without prior written approval from Enbridge.

Fees are payable by Enbridge within sixty (60) days of receipt from the Consultant of an appropriate invoice setting out in reasonable detail the nature of the services provided.

[Remainder of page intentionally left blank; signature page to follow]

Dated as of June 30, 2021.

CONCENTRIC ENERGY ADVISORS, INC. ENBRIDGE GAS INC. -

By: Name: Title:	James M. Coyne Senior Vice President	By: <u></u> Name:	el Denomy el Denomy (Jul 6, 2021 13:50 EDT) Joel Denomy Technical Manager Regulatory Applications
By:		By:	
Name:		Name:	**
Title:		Title:	*
(Please p	rint name and title of Signing Officer)		
Witness	S:		
Name:			

(Witness required if Contractor is a Sole Proprietor)



Joel Demony Technical Manager Regulatory Applications Tel: 416-495-5499 EGIRegulatoryProceedings@enbridge.com Enbridge Gas Inc. 500 Consumers Road North York, Ontario M2J 1P8 Canada

Via Email

May 28, 2021

James M. Coyne Senior Vice President Concentric Energy Advisors jcoyne@ceadvisors.com

Dear Mr. Coyne,

Re: Capital Structure - Scope of Work

Enbridge Gas Inc. (Enbridge Gas) is a Canadian natural gas utility regulated by the Ontario Energy Board (OEB). Enbridge Gas provides safe, reliable and cost-effective natural gas distribution, transmission, storage and related services to approximately 3.8 million customers throughout the province of Ontario. Enbridge Gas also provides natural gas storage and transmission services to other utilities and customers located outside of Ontario. Enbridge Gas is North America's largest natural gas utility by volume, and third largest by customer count. Enbridge Gas was formed on January 1, 2019 with the amalgamation of Enbridge Gas Distribution and Union Gas.

Enbridge Gas is currently in the third year of a five-year deferred rebasing period following the aforementioned amalgamation. The deferred rebasing period term runs from 2019 to 2023. Rates during the deferred rebasing period are set using an incentive rate setting mechanism (IRM) whereby rates are adjusted annually using a price cap model.

Enbridge Gas is currently preparing to file a rebasing application (the 2024 rebasing application) with the OEB for rates commencing January 1, 2024. This application will include a cost of service (or rebasing) component in addition to a proposal for an IRM¹ to set rates through to 2028.

Enbridge Gas' rate base is financed by a combination of common equity and long-term and short-term debt, the ratios for which are approved by the OEB. The current OEB approved capital structure for Enbridge Gas is comprised of 36% common equity and 64% long-term and short-term debt.

The cost included in rates associated with these financing instruments is determined in different ways. An OEB approved formula is used to determine the return on equity (ROE) applied to common equity. The yield on long-term debt when issued plus the

¹ The OEB provides two options that a utility can propose as an IRM: a price cap model or a custom incentive regulation model.

May 27, 2021 Page 3

forecast cost of any new issuances is used to determine the cost of long-term debt. The cost of short-term debt is determined by a forecast of the cost of short-term debt. As part of the 2024 rebasing application Enbridge Gas would like to investigate the suitability of its current capital structure, specifically if 36% common equity is appropriate. For this investigation it should be assumed that the OEB approved ROE formula will apply.

This investigation is intended to address three main concerns: 1) Enbridge Gas' capital structure relative to other regulated utilities, 2) Enbridge Gas' ability to finance capital expenditures in 2024 and during the IRM term; and 3) The appropriateness of Enbridge Gas' capital structure in terms of i) business risk relative to the last time capital structure was assessed and approved by the OEB and ii) prospective business risks.

To support Enbridge Gas' investigation and a possible request of the OEB to approve a different capital structure in the 2024 rebasing application, Concentric Energy Advisors (Concentric) has agreed to conduct an independent capital structure review to assess the reasonableness of Enbridge Gas' current capital structure. Concentric's deliverables are as follows:

- An assessment of Enbridge Gas' business risk and financial risk compared to the last assessment that was reviewed by the OEB;
- An assessment of Enbridge Gas' prospective business risk and financial risk;
- An examination of information on utility actual and approved capital structures;
- A comparison of other North America utility capital structures to Enbridge Gas' current and proposed capital structure;
- Provision of a recommendation on the appropriate common equity level for Enbridge Gas; and
- A written report detailing all of the above

The written report detailing Concentric's findings and recommendations resulting from the independent assessment will be subject to a stakeholder engagement process and may be filed with the OEB as part of the 2024 rebasing application. It is likely that the OEB will hold an oral hearing for the 2024 rebasing application. Concentric may be required to participate in the stakeholder engagement process and the OEB proceeding process (including any and all processes set out by the OEB related to the 2024 rebasing application). In addition, Enbridge Gas may seek, from time to time, input from Concentric on other regulatory matters that are related to capital structure and cost of capital.

Concentric's participation in the stakeholder engagement and proceeding process may include but not be limited to:

- Presentation of the results of the independent assessment to stakeholders;
- Preparation of the written report which may be filed with the OEB;
- Responding to interrogatories and undertakings; and
- Appearing as a witness on behalf of Enbridge Gas in the 2024 rebasing application, as required

May 27, 2021 Page 3

Concentric should recognize that during the course of performing the aforementioned activities for Enbridge Gas it could receive, deliver, prepare, review, analyze, reproduce, summarize or otherwise work with confidential and propriety information. Concentric agrees to treat all such information as confidential and privileged.

Enbridge Gas is requesting that Concentric provide a draft assessment report to Enbridge Gas by August 2021. Timing of a final report will be dependent on timing of the 2024 rebasing application filing.

In terms of remuneration for this work Enbridge Gas requests that Concentric provide a cost estimate based on the deliverables outlined above. It is expected that the cost estimate includes a fixed price for preparation of the report.

Any questions or correspondence regarding the scope of the independent investigation and/or the deliverables should be submitted to:

Joel Denomy, Technical Manager, Regulatory Applications 500 Consumers Road North York, Ontario, Canada M2J 1P8 joel.denomy@enbridge.com



Asset Management Maturity Review

Final Report (Revised)

FES0826201216CGY | 1.1 September 8, 2020

Enbridge Inc.



Jacobs

Asset Management Maturity Review

Project No:	CE777500
Document Title:	Final Report
Document No.:	FES0826201216CGY 1
Revision:	1.1
Document Status:	Final (revised)
Date:	September 8, 2020
Client Name:	Enbridge Inc.
Project Manager:	Andy Whittaker, PHD
Author:	Catherine Simpson, RPP, MCIP

Jacobs Consultancy Canada Inc.

245 Consumers Road, Suite 400 Toronto, Ontario M2J 1R3 Canada T +1.416.499.9000

www.jacobs.com

© Copyright 2020 Jacobs Consultancy Canada Inc. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This document has been prepared on behalf of, and for the exclusive use of Jacobs' client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this document by any third-party.

Revision	Date	Description	Author	Checked	Reviewed	Approved
0	08-31-2020	Report for staff review	C. Simpson	A. Whittaker	C. Simpson	A. Whittaker
1	09-03-2020	Final report	C: Simpson			
1.1	09-08-2020	Final report (revised)	C. Simpson			

Document history and status

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 3 of 166

Final Report

Jacobs

Contents

1.	Introd	uction	
	1.1	Background	1
	1.2	Target Operating Model	1
	1.3	Foundational Elements of Asset Management	1
2.	The Ma	aturity Assessment Process	3
	2.1	SAM+ Tool	
	2.2	Maturity Scale	3
	2.3	2020 Review Process	
	2.4	Workshop Schedule and Attendees	
3.	Maturi	ty Assessment Results	9
	3.1	Gas Distribution and Storage Assessment Details	
	3.2	Liquid Pipelines Assessment Details	
	3.3	Gas Transmission Details	
	3.4	Summary	
4.	Key Ob	oservations and Recommendations	45
	4.1	General Observations	45
	4.2	Recommendations	45
Appen	dixes		

A	Workshop Questions
В	Records of Workshop and Meeting Notes

Table

2-1	Workshop Schedule and Attendees	5
-----	---------------------------------	---

Figures

2-1	GFMAM Subject Areas	ii
2-2	ISO 5501 Maturity Assessment Scale	
2-3	GFMAM Subjects and Elements with 18 Enbridge Priorities	
3-1	GDS Maturity in 2018 and 2020	
3-2	Liquid Pipelines Maturity in 2018 and 2020	23
3-3	Gas Transmission Maturity in 2018 and 2020	
3-4	Maturity Scores by Business Unit for 2018 and 2020	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 4 of 166

Jacobs

Acronyms and Abbreviations

AIPM	Asset Investment Planning and Management
AM	asset management
AM Objective	Asset Management Objective
AM Policy	Asset Management Policy
AM Strategy	Asset Management Strategy
AMP	Asset Management Plan
BU	Business Unit
CAPEX	capital expenditure
EAM	Enterprise Asset Management
ECM	Equipment Class Manager / Management
EGD	Enbridge Gas Distribution
Enbridge	Enbridge Inc.
FP&A	Financial Planning and Analysis
GDS	Gas Distribution and Storage
GFMAM	Global Forum on Maintenance and Asset Management
GTM	Gas Transmission
IAM	Institute for Asset Management
ICS	Integrity Control Service
ILI	in-line inspection
IMS	Integrated Management System
ISO	International Standards Organization
km	kilometre(s)
LoS	Level(s) of Service
LP	Liquid Pipelines
LP MRP	Liquid Pipelines Maintenance and Reliability Program
MEC	Materials Evaluation Centre
МоС	Management of Change
O&M	Operations and Maintenance
OD	Operations & Data
OPEX	operating expenditure
PI	Pipeline Integrity
RM	Reliability Management
SAMP	Strategic Asset Management Plan
SCADA	Supervisory Control and Data Acquisition

Jacobs

Final Report

SME	Subject Matter Expert
SOP	Standard Operating Procedure
SP	Strategy and Planning
STO	Storage and Transmission Operations
том	Target Operating Model
TOTEX	Total Expenditure
UG	Union Gas

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 6 of 166

Final Report



1. Introduction

Enbridge Inc. (Enbridge) retained Jacobs Consultancy Canada Inc. (Jacobs) to facilitate a series of Asset Management (AM) Target Operating Model (TOM) Reviews with the liquid pipelines (LP), gas transmission (GTM), and gas distribution and storage (GDS) Business Units (BUs). This report identifies the outcomes of these reviews, which were based upon an assessment of existing practices against globally-recognized good practice as set out in the 39 Subjects of the Global Forum on Maintenance & Asset Management (GFMAM) AM Landscape. The assessment also compares the results to the priority improvements in 18 of the 39 Subjects over Enbridge's 3-year Roadmap period.

1.1 Background

Enbridge is an energy delivery company operating across North America. With Canadian headquarters in Calgary, Alberta, Enbridge is a publicly traded company with a workforce of approximately 13,000. There are three core business areas: LP, natural gas pipelines, and utilities and power.

The LP business area operates the world's longest and most complex crude oil and liquids transportation system with approximately 27,564 kilometres (km) of active crude pipeline across North America.

The natural gas pipelines (GTM) business area connects North America's natural gas supply basins to major demand centres, in addition to liquefied natural gas and Mexico export markets. GTM and midstream pipelines cover approximately 38,375 km.

The utilities and power (GDS) business area operates North America's largest natural gas utility by volume, with 78,214 km of gas distribution mainlines, 66,787 km of gas distribution service lines, and 5,471 km of gas transmission lines. In addition, the renewable energy portfolio includes wind, solar, and geothermal projects in North America and Europe.

1.2 Target Operating Model

In early 2018, Enbridge executive leadership approved a business case to drive improvement in Enterprise Asset Management (EAM) practices and capabilities. A TOM was developed which defines a vision for EAM to confidently state "Our assets are safe, reliable, and profitable. We know it and we can prove it."

The approved business case required a step change in certain aspects of EAM over a 3-year program with continual improvement activities beyond that. Improvement plans (Roadmaps) were developed at the Enterprise and BU levels for this 3-year period based on an assessment of existing practices against global good practice, as set out in the 39 Subject Elements of the GFMAM AM Landscape. Enbridge leaders prioritized improvements in 18 of the 39 Subject Elements.

Enbridge is now in the second year of the EAM Program implementation. Executive leaders have asked for a check-in on progress to enable the LP, GTM, and GDS BUs to subsequently identify any opportunities to refocus plans and resources where applicable. This report outlines the results from the 2020 Asset Management TOM Progression Reviews.

1.3 Foundational Elements of Asset Management

Over the past few decades, the management of infrastructure assets has advanced significantly. By the early 2000s, several guidance documents had been published in Australia, New Zealand, and the United Kingdom, describing key principles for better managing infrastructure assets and providing methods for gaining the most value from those assets.

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 7 of 166

Final Report

Jacobs

In 2014, the International Organization for Standardization (ISO) released the first international standard for AM, ISO 55000. As with other ISO standards, ISO 55000 is a "management system." A management system is "the way in which an organization manages the inter-related parts of its business in order to achieve its objectives"¹. ISO 55000 is composed of three documents:

- 1) ISO 55000 provides an overview of the standards, AM principles, and terminology;
- 2) ISO 55001 stipulates the AM System requirements; and
- 3) ISO 55002 offers guidelines for the application of the requirements included in ISO 55001.

While organizations can eventually achieve ISO 55000 certification, most organizations are demonstrating alignment to the standard and using it to incorporate the best-in-class principles and practices to improve service and optimize investments.

In ISO 55000, AM is defined as the "coordinated activity of an organization to realize value from assets" and "involves the balancing of costs, opportunities and risks against the desired performance of assets, to achieve the organizational objectives"². As such, coordinated activities, realizing value from assets, and using risk management to balance the objective of delivering established levels of service while minimizing life cycle costs can be considered the cornerstone principles of AM.

Within a private Enterprise context, the ability to produce and sell a commodity at a profit relies upon the performance of infrastructure assets and on the application of "good practice" decision-making to utilize resources efficiently and effectively. Consequently, understanding how to define AM, how well is it being practiced, and what is "good practice" is important.

¹ International Organization for Standardization (ISO). 2019. Management system standards. Accessed July 2019. <u>https://www.iso.org/management-system-standards.html</u>.

² ISO 55000:2014 Asset management -- Overview, principles and terminology

Jacobs

2. The Maturity Assessment Process

Assets fundamentally exist to provide value to customers and other stakeholders, as well as the environment, and as such, AM is very much focused on understanding the connection between the assets and the service they provide, with ultimately all investment linked to either maintaining or enhancing service. In addition, people "do" AM and, therefore, the quality of AM is reliant on people, their knowledge, competence, motivation, and teamwork.

To be truly effective, AM needs to be multi-disciplinary, involving many parts of the organization including, but not limited to, leadership and management, finance, planning, engineering, and Operations and Maintenance (O&M).

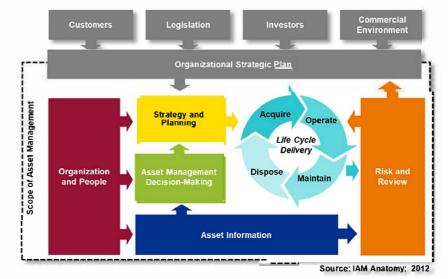
Many organizations carry out maturity assessments to obtain a better understanding of their capabilities and competencies with regard to AM. There are various approaches to AM assessments. For this project, the Institute for Asset Management's (IAM's) SAM+ tool will be used.

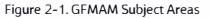
2.1 SAM+ Tool

Although initially designed for PAS 55 and ISO 55000 assessments, the SAM+ tool has been updated to contain additional functionality for assessment of the 39 GFMAM Subject Elements, organized within the six Subject Areas of the AM Landscape (Figure 2-1).

These Subject Areas are aligned to the content of the following seven key requirements of ISO 55001:

- Clause 4 Context of the organization;
- 2) Clause 5 Leadership;
- 3) Clause 6 Planning;
- 4) Clause 7 Support;
- 5) Clause 8 Operation;
- 6) Clause 9 Performance evaluation; and
- 7) Clause 10 Improvement.





The SAM+ tool therefore aims to meet the intent of ISO 55001, however is not intended to be a formal assessment

against the standard. IAM Maturity Assessment focuses on AM practices, not assets. It provides a baseline for an action plan to address key gaps, as well as identifying strengths.

2.2 Maturity Scale

Maturity is ranked on a five-point Maturity Assessment Scale (Levels 0 to 3 and beyond) as shown in Figure 2-2, where Level 3 is deemed as competent. This scale enables benchmarking and demonstrating progress, diagnosing and prioritizing the development of new capabilities, and communicating competency or excellence to stakeholders. It also serves to establish processes and habits of continual improvement with an objective basis of evidence across the many dimensions of AM.

Jacobs

Innocent	Aware	Developing	Competent	Optimising	Excellent
Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Bey	ond
The organisation has not recognised the need for this requirement and/or there is no evidence of commitment to put it in place	The organisation has identified the need for this requirement, and there is evidence of intent to progress it.	The organisation has identified the means of systematically and consistently achieving the requirements, and can demonstrate that these are being progressed with credible and resourced plans in place.	The organisation can demonstrate that it systematically and consistently achieves relevant requirements set out in ISO 55001.	The organisation can demonstrate that it is systematically and consistently optimising its asset management practice, in line with the organisation's objectives and operating context.	The organisation can demonstrate that it employs the leading practices, and achieves maximum value from the management of its assets, in line with the organisation's objectives and operating context.

Figure 2-2. ISO 5501 Maturity Assessment Scale

2.3 2020 Review Process

Jacobs, an IAM-endorsed assessor, was engaged to conduct the 2020 TOM Progression Reviews as follows:

- 1) Discovery Phase Two documents were provided during discovery, the 2018 maturity assessment across all three BUs and the EGD maturity assessment 2017.
- 2) Maturity Assessment Conducting an IAM Maturity Assessment separately for the GDS (Toronto), LP (Calgary), and GTM (Houston) BUs through a series of workshops. The objective of each assessment was to capture a single maturity level score by consensus of workshop participants for each of the 39 Subject Elements. At the workshop, the IAM SAM+ Tool was used to record and evaluate the input from the participants. For the 18 GFMAM elements identified in the business case (Figure 2-3), the assessment included a progress review against the original baseline. These elements were prioritized for in-depth discussion and review. For the remaining GFMAM elements, the assessment was discovery based and less intensive, as the intent was to create an initial baseline for those elements. Follow-up sessions will be held to explore additional detail, engaging additional staff where warranted.

itiateev & Planning	Asset Management Policy Asset Management Strategy & Objectives	
	Demand Analysis	
	Strategic Planning	
	Asset Management Plavoing	AM Assessments – progression towards
sset Man agement Decision	Making Capital Investment Decision-Malong	
	Deviations & Maintenance Decision-Making	target maturity levels within 39 (18
	Forgate Marya Remanden	prioritized) GFMAM elements
		promized) Griviawi elements
	Resourcing Strategy	
fetyde Delivery	chinical Standards & Legislation	
	Asset Creation & Acquisition	
	System: Engineering	
	Configuration Management	
	Maintenance Delivery	
	Reliability Engineering	
	Asses OPerations	Interdependencies
	Resource Management	Interdependencies
	Shutdown & Outage Management	
	Fault and Incident Resilonse	
	Asset Degommissioning & Disposal	
asset information	Assest information Strategy	AIPM/C65
	Asset Information Standard s	Implementation
	is set Information Systems	
	Data & Information Management	
Wanningtion & Boonlo	pata & information Management	
UNANA P BAARA	Procurement & Supply Chain Management	Unify
	Organizational Structure Organizational Culture	
Market and an and an and an		
lisk & Review	Com Assessment and Management	
	Contingency Prenning & Resilience Analysis	
	Sustainable Development	Finance Transformation
	Management of Change	
	Assets Performance & Health Manifering	
	Asset Management System Monitoring	
	Management Review, Audit & Assurance	
	Acset Costing & Valuation	
	Btakeholder Engagement-	

Figure 2-3. GFMAM Subjects and Elements with 18 Enbridge Priorities

3) Report – A preliminary report was prepared for each BU summarizing the workshop results. This final report was prepared to incorporate all BU results from this 2020 Review in comparison to the 2018 Review.

2.4 Workshop Schedule and Attendees

The assessment was conducted through remote delivery rather than in-person meetings due to COVID-19 protocols. A series of six preliminary workshops were held with two workshops per BU in order to divide the assessment into manageable timeslots for remote delivery. The first workshop with each BU was focused on 20 Subjects that were mostly related to Strategy and Planning (SP) while the second workshop focused on 19 Subjects that were mostly related to Operations and Data (OD). Follow-up sessions occurred to complete question sets and confirm details. The workshop schedule and attendees for each BU are presented in Table 2-1. Results from the workshop are described in Section 3.

GDS				
Strategy and Planning		July 27		
Catherine McCowan, Manager Risk, SP Danielle Tumey, Specialist II AM	Michael Vettese, Specialist II AM Stations Danielle Dreveny, Supervisor	Steve Dinopoulos, Specialist Project Plan Design Kevin Bando, Manager	Observer: Rebecca Mayhew, EAM Governance	
Integration	Capital FP&A	Operations		
Erik Naczynski, Manager Asset Classes Distribution	Mike Hildebrand, Mgr Asset Classes Storage & Transmission	Angela Scott, Manager Integrity Management		
Operations and Data		July 28		
Catherine McCowan, Manager Risk, SP	Pamela Callow, Supervisor Process Attachment &	Todd Piercey, Manager Pipeline Engineering	Observer: Rebecca Mayhew, EAM Governance	
Andrew Welburn, Manager Asset Data & Information	Construction Jim Harradine, Mgr O&M	Ahmed Nossair, Manager Stations & Utilizations	Observer: Caryn Campbell, Manager, EAM Project	
Taylor Jones, Specialist II AM Distribution Pipe	Engineering Hugh MacMillan, Manager Fin/Law/Aff/Data/Support	Engineering Johanna Sanchez Gomez, Manager Construction	Management	
Operations and Data Follo	w-up	August 17	·	
Catherine McCowan, Manager Risk, SP Erik Naczynski, Manager Asset	Angela Scott, Manager Integrity Management Mike Hildebrand, Manager	Andrew Welburn, Manager Asset Data & Information	Observer: Rebecca Mayhew, EAM Governance Observer: Caryn Campbell,	
Classes Distribution	Asset Classes Storage & Transmission		Manager, EAM Project Management	
Competence Management		August 10		
Catherine McCowan, Manager Risk, SP	Bridget Sneddon, Manager of Technical Training		Observer: Rebecca Mayhew, EAM Governance	

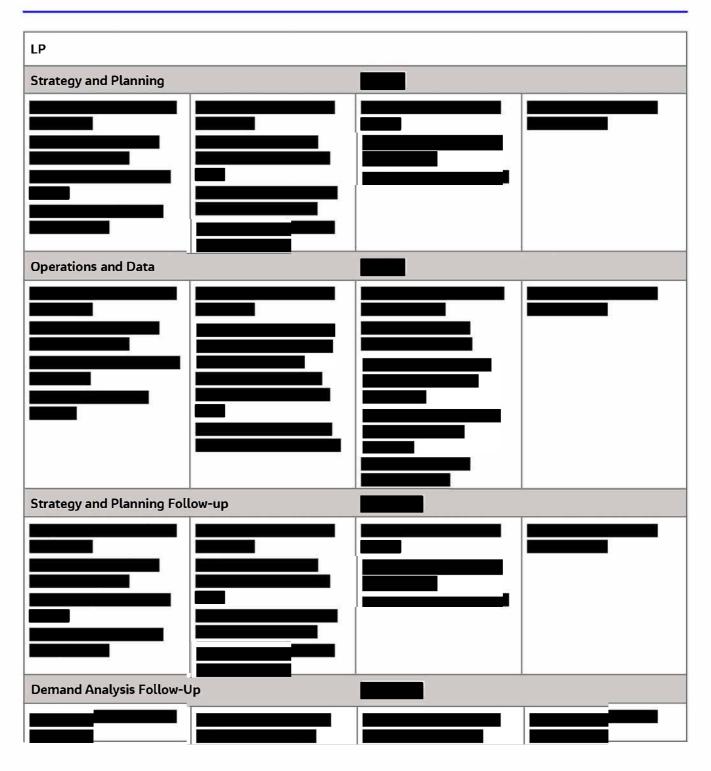
Table 2-1. Workshop Schedule and Attendees

Note:

FP&A = Financial Planning and Analysis

REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 11 of 166

Final Report



Jacobs

REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 12 of 166

Final Report

Jacobs

Procurement and Supply Chain Follow-Up				
Systems Engineering Follow-Up				
GTM				
Strategy and Planning				
Strategy and Planning Follow-up				

REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 13 of 166

Final Report			Jacobs
Operations and Data			
Competence Management			
Demand Analysis			
Subjects 7, 9, 18, 19			
Procurement and Supply C	Chain Management		

3. Maturity Assessment Results

Results from the 39 Subjects assessed for each BU are described as follows. Detailed workshop questions are included in Appendix A and workshop notes are included in Appendix B.

3.1 Gas Distribution and Storage Assessment Details

A total of 17 GDS staff were engaged during this process in addition to two observers from EAM. The GDS SP Workshop was held on July 27 and two OD Workshops were held on July 28 and August 17. A follow-up meeting to gather further information regarding the SP area of Competence Management was held August 10.

The 2020 results for GDS are summarized in Figure 3-1 alongside the 2018 results for the 18 Subjects previously assessed prior to integration. The 2018 results are for Enbridge Gas Distribution (EGD) and Union Gas (UG) respectively.

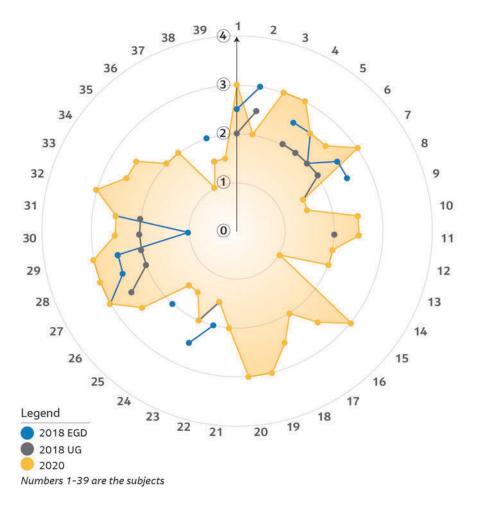


Figure 3-1. GDS Maturity in 2018 and 2020

The current maturity level has been presented for each of the 39 Subjects assessed along with a description of progress to date, rationale, and evidence.

Subject 1: Asset Management Policy (AM Policy) – The principles and mandated requirements derived from and consistent with the organizational strategic plan, providing a framework for the development and implementation of the Asset Management Strategy (AM Strategy) and the setting of the Asset Management Objectives (AM Objectives).

An AM Policy is in place and endorsed by top management. It is updated annually to reflect organizational priorities and published for ease of access by staff across the organization as well as the public. The AM Policy is linked to the Strategic Asset Management Plan (SAMP).

While awareness of the AM Policy exists across the organization, there are opportunities for further communication and training.

Subject 2: Asset Management Strategy and Objectives – The strategic plan for the management of assets of an organization that will be used to achieve the organizational/corporate objectives.

There is a SAMP in place, along with a Roadmap for the TOM which is a separate document. Top level objectives and performance measures are in place, however are not linked to the asset base. The extent of performance measures varies across asset classes. For example,

performance measures are strong for non-gas assets and distribution assets, however other areas (such as, tying in compression reliability with criticality of specific assets) could be improved considering the criticality of the assets.

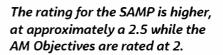
There is an opportunity to promote further integration across asset classes by aligning performance measures. In addition, some required financial information is available but further work is necessary as part of the integration process in order to gain consensus on demonstrating the effectiveness of the organization as a whole. Measurability of some objectives is a challenge. There is an opportunity for stronger documentation, such as adding metrics to the TOM prior to finalizing and corporate roll-out.

Subject 3: Demand Analysis – The processes an organization uses to both assess and influence the demand for, and Level of Service (LoS) from, an organization's assets.

There are annual processes for both planning and network analysis that re-evaluate the need for products. This includes consideration of expansion and growth projects.

Subject 4: Strategic Planning – The processes an organization uses to conduct strategic AM planning.

Strategic planning is being conducted in alignment with business needs and overall financial forecasts. Inputs from demand forecasts are being linked to AM. Asset plans exist for each asset class which includes a set of asset strategies (Section 5 of each plan), including documents and approaches outlining the balance being maintained between risk and safety, capital and O&M, and so forth.

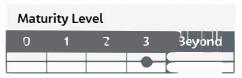


7

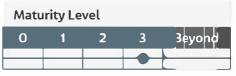
Beyond

Maturity Level

0



Working beyond a level 3 maturity; this is an area of strength and part of the core business.



And in some instances beyond this rating.

).

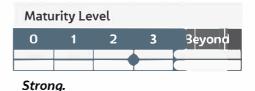


Jacobs

Jacobs

Furthermore, there are various levels of risk-based analysis being conducted on parts of the asset base. Strategic planning processes are in place for demand forecasts and to address the existing asset base. Growth is documented in addition to the need for expansion based on specific regulations (such as, the Canada Energy Regulator).

Subject 5: Asset Management Planning – The activities to develop the Asset Management Plans (AMPs) that specify the detailed activities and resources, responsibilities, and timescales and risks for the achievement of the AM Objectives.

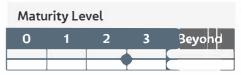


An AMP exists and the latest edition will be published in August 2020.

AMPs are a regulatory requirement. Asset managers review the AMP with executing groups to verify their ability to implement it. There is a review with stakeholders after the initial version of the AMP and feedback is incorporated.

The resources required to achieve the AMP/end state are not understood or well documented. For example, processes for understanding additional O&M requirements associated with new projects could be applied with additional rigour. Furthermore, there are opportunities for improvement in linking planned capital expenditure (CAPEX) with actual engineering resources required for delivery of the CAPEX.

Subject 6: Capital Investment Decision-Making – The processes and decisions to evaluate and analyze scenarios for decisions related to capital investments of an organization. These processes and decisions may relate to new assets for the organization (such as, greenfield projects) and replacements of assets at end-of-life (CAPEX sustaining programs).



Moving towards a 3; some fluctuations by asset class.

Overall fairly strong. There are systematic capital investment decision-making processes and methods in place, supported by documentation. Business case processes exist in the form of flow charts. Risk assessments are conducted as part of the process. There is alignment across groups. Although C55 is being used, there is more rigour placed on capital and the O&M component of the decision is often missing.

There are good processes and practices in place; however, it is not yet a well-oiled machine and some fine-tuning is needed.

Subject 7: Operations & Maintenance Decision-Making – The management activities and processes involved in determining the O&M requirements in support of the AM Objectives and goals.

O&M decision-making is based on a suite of requirements and methods including business requirements, manufacturer's recommendations, reliability-centered maintenance, and a significant amount of Canadian code and legislative requirements. Standards are updated every 5 years.

Documents and practices are reviewed, and this is triggered when a standard is changed. Both legacy companies rate high so, even though work is still underway to bring them together, performance has been maintained and the result will further enhance business and risk management. From an integration perspective, there is movement towards having one set of documents to show frequency of O&M for assets, inspection frequency, and



Maturity depends on the area, with some being more advanced.

FES0826201216CGY

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 17 of 166

Final Report

established procedures for how to complete maintenance. Harmonization is in progress, with maintenance schedules working and effective. A company-wide approach to preventative and predictive maintenance is being taken – both defined by history of failure and manufacturer's recommendations. Most risk is associated with damage and third-party intervention.

Subject 8: Life Cycle Value Realization – The activities conducted by an organization to balance the costs and benefits of different renewal, maintenance, overhaul, and disposal interventions.

The ability to manage life cycle costs has been explored, and there is some understanding of what activities need to be done. Activities are conducted in key areas and those with risk drivers. Fleet is also being done well. Storage & Transmission is more reactive. There is

uncertainty regarding areas that are not tied directly to capital project spending.

There are opportunities for improvement, including working towards the systematic and consistent achievement of O&M as part of an asset's life cycle.

Subject 9: Resourcing Strategy – Determining and documenting the activities and processes to be conducted by an organization to procure and utilize people, plant, tools, and materials to deliver the AM Objectives and AMP(s).

Resourcing is strong when looking out 1 year, however it is weaker longer-term. The approach is more reactive than proactive, with limited consistency across the organization. From an execution perspective, staff work to ensure a balance of available resources across regions. A clear view of upcoming resourcing needs is not often available; however, this is more effective for larger projects. Typically, staff are made aware of projects as they come in for approval. It is more difficult to look at smaller jobs and tie that to specific requirements within AMPs. Resources exist to execute work in the AMPs, and there are robust tools in place to manage these, however there is a heavy reliance upon third-party contractors. Also, current hiring practices are focusing on future leadership potential making it difficult to hire future SMEs.

Subject 10: Shutdowns & Outage Strategy – The activities taken by an organization to develop a strategy for shutdown and outages.

There is extensive planning around the annual shutdown strategy

however there are no documented processes and it is reliant on the people. The strategy does not extend beyond the current year. There is 100 percent redundancy in summer, where construction necessitates some shutdowns. There have been some very complex outages over last few years and they have been addressed well. For storage and transmission, the process is well-defined and led by the operations group – prepared at the beginning of construction season for current year starting with the maintenance schedule and construction outages sit on top of that. Weekly meetings are held regarding planned outages. There are no major outages for distribution.

There is an opportunity to further document processes and extend the planning window.





Jacobs

Moving towards a 2, with more strength in non-gas carrying assets.

12



Jacobs

Subject 11: Technical Standards & Legislation – The processes used by an organization to verify its AM activities are compliant with the relevant technical standards and legislation.

Processes are in place to verify AM activities are compliant with technical standards and legislation for commodity carrying assets. There is a regulatory Management of Change (MoC) group that updates standards. These updates are sent through Maximo for determination of possible effects on AM. Currently, there are two sets of standards; processes and procedures – one for each legacy company. A 3- to 4- year process is underway to update documentation and complete integration. In the interim, change

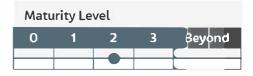


Evidence is pointing towards a 3, and there is a higher-level of maturity on the gas carrying side as well as for engineering. Maturity as one integrated organization is lower than individual legacy organizations.

processes are in place along with a clear approach to use until transition is complete. For buildings as an example, there are standardized documents to allow for consistent and repeatable design and execution of real estate. There has been a mismatch in technical standards between head office, engineering office, versus major/core projects. There is not yet a harmonized set of design standards, however some mismatch has been cleaned-up recently by a dedicated project team.

There is an opportunity to further address gaps and provide further clarity regarding integration when considering technical standards and legislation.

Subject 12: Asset Creation & Acquisition – An organization's processes for the acquisition, installation, and commissioning of assets.



Front-end asset design processes by the projects organization follow a

project life cycle gating process which is robust. However, asset handover has been less rigorously managed. Typically, a good job is done with commissioning activities, training plans, and maintenance strategies for new projects. However, a robust suite of documented processes and standards for commissioning and back-end handover is not readily available.

With the above in mind, GDS recently implemented an initiative to develop a standard and associated process for asset turnover between the projects organization and operations. One area where asset creation is managed particularly well is service installations where thousands of instances are dealt with every year and the process is well laid out and understood.

Subject 13: Systems Engineering – An interdisciplinary, collaborative approach to derive, evolve, and verify a life cycle balanced system solution which satisfies customer expectations and meets public acceptability.

There are well-established practices in place including resources, system analysis tools, and functionality that are applied on a consistent basis. From a distribution analysis perspective, there is a centralized team of network modelers within Engineering that are using Synergy and have developed cascading models with multiple pressure classes.



Solid, leading into a 3 once existing practices are tied together. Network analysis is closer to a 3.

Assumptions are documented in the model, however the rationale for those assumptions may not be documented. Network analysis is well documented and tracked in Maximo; it is transaction based. For large projects, a Leave to Construct Application provides justification, alternatives, and analysis to the Ontario Energy

FES0826201216CGY

Final Report

Board. A number of different planning groups (such as, network analysis, transmission engineering, and optimization, storage planning) meet monthly and look at the entire system to make decisions collaboratively regarding the most balanced solutions. The right people are getting together, however there are not any process maps documented.

There is an opportunity to document processes for the planning groups and tie existing practices together.

Subject 14: Configuration Management – A management process for establishing and maintaining consistency of a product's physical and functional attributes with its design and operational information throughout its life.

Changing expectations over time, as well as expectations that exceed capabilities, are resulting in performance issues (for example, with older storage, compression and LNG facilities such as the Dawn Dehydration Plant). Reliability-centered maintenance analysis has been

attempted in the past, however expectations have not been formalized, and configuration management relies on people. However, for thousands of distribution stations there are documented processes, as well as records for MOP-in and MOP-out, capacity, and performance.

There is an opportunity to improve documentation, which would enable changes to be flagged (such as, degrading performance) and when it is not functionally possible to achieve expectations.

Subject 15: Maintenance Delivery – The management of maintenance activities including both preventive and corrective maintenance management methodologies.

There is a blend of proactive, predictive, and reactive maintenance

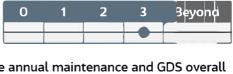
being conducted. Work plans are in place (in SAP and Maximo) to manage annual maintenance and GDS overall achieves 100 percent compliance with the maintenance schedule. A score card is available regarding system equipment reliability. Plans are reviewed as OEMs (original equipment manufacturer) change, which demonstrates that system equipment reliability is being achieved for the business. Overall work is delivered safely, on-time, and on-budget, with adjustments made as required. For legacy UG, there was a robust nonconformance process with heavy mitigations plans in place if the full maintenance workload was not delivered.

Subject 16: Reliability Engineering – The processes for ensuring that an item shall operate to a defined standard for a defined period of time in a defined environment.

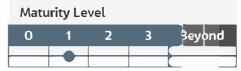
There are some robust reliability practices, however not all of the asset

base is covered. This has been focused primarily on distribution. Legacy EGD had more robust procedures around equipment failures (such as, regulator valves). Now there are triggers on failures for Materials Evaluation Centre (MEC) with full-blown analysis resulting in a report to determine if it is a systemic issue. However, this can only be scaled for certain sized assets. For compressors, the root cause analysis is managed and follows a similar process. Maintenance practices have changed based on failure analysis in some instances in the past.

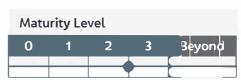
There is an opportunity to take a step back and re-evaluate the level of detail and rigour for some assets.



Maturity Level



There is strength for most assets (many km of mains and services, as well as stations which are closer to a 2.5).





Subject 17: Asset Operation – The processes used by an organization to operate its assets to achieve the business objectives.

This is a successfully operating system, with effective asset operation in place. It is currently going through integration and is adapting as

required, recognizing that there is currently a heavy reliance on subject matter expertise. Documented procedures are in place and being updated alongside a more robust training program that is under development. For Storage and Transmission Operations (STO), there are processes for operators, mechanics, plant operators, gas controllers, and technicians that direct how equipment is operated. There is an Operations Manager Committee, and resource challenges are often raised particularly during the summer months as competing priorities arise.

The system is starting to experience the impacts of the recent Voluntary Workforce Options on asset operations, as a lot of field experience was lost. There has been an increasing strain on operations and reliance on knowledge.

Subject 18: Strategy to manage the use of funds, people, plant, tools, and materials in delivering AM activities.

There is a good track record of execution and delivering on the capital

plan regardless of whether internal or outsourced resources are utilized. Resources are well-managed, and additional support is brought in from across the organization or externally as required. This is demonstrated even in emergency situations. There are few projects that are deferred due to resourcing, typically delays are due to permitting.

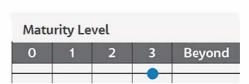
There is an opportunity to improve predictions for future resource needs, and to address skillset boundaries for support functions (such as, engineering and drafting resources).

Shutdown & Outage Management – An organization's Subject 19: processes for identification, planning, scheduling, execution, and control of work related to shutdowns or outages.

There are existing operational and execution processes within Gas Control, STO, Distribution Operations and System Improvement to manage planned and unplanned outages. Shutdown and outage management is most prevalent in the STO division, however examples for Distribution Operations would include planned in-line inspections (ILIs) and unplanned outages (such as, the Red Lake fires which resulted in the loss of 1,500 customers in 2020). Robust plans are in place and built into annual maintenance plans (such as, turbines taken offline during off season, and ILI). This is coordinated with operations and tentative dates and allowances for each plant are reviewed in meetings. The Work Planning Group prepares a package of permitting while the Execution Group conducts the work.

For compression stations, shutdown and outage management is part of the maintenance program and built into procedures. Staff feel they are being as effective as possible with the equipment available. There are procedures in place for safe shutdowns of pipelines, how to properly blow down a pipeline, blowdown times, and so forth with extensive supporting documentation.

Resource Management – Implementing the Resourcing





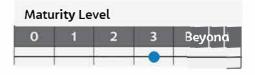
Moving towards a 2.5.

Jacobs



The gap relates to the time horizon for the planning of outages and the execution efficiencies that could come from planning outages in the 2- to 3-year timeline. There is also a strong reliance on individuals and their knowledge, and an opportunity to further document the full range of processes in place.

Subject 20: Fault & Incident Response – Responding to failures and incidents in a systematic manner, including incident detection, and identification, fault analysis, use of standard responses, temporary, and permanent repairs as well as the taking over and handing back of sites.



There is a strong safety culture and a solid corporate memory regarding major incidents. The STO division primarily leads fault incident and response at the STO facilities. This is achieved through individual expertise as a function within the organization as opposed to a department.

There is a very robust and integrated emergency response plan (filed with the Canada Energy Regulator) through the Incident Command Structure, with more than 300 people trained. It involves procedures regarding how to establish local groups and escalate up as required. There are also emergency response metrics in place, and these are reported to the Ontario Energy Board.

There is also a detailed process for incident investigation and response in Distribution Operations. Failures are analyzed through the MEC to understand systematic issues, with feedback provided to determine if a program is needed to be more proactive. Where appropriate these are communicated upwards through the GDS Integrated Management System Top Management Review. This has proven to be an excellent method for reporting and capturing learning even when failures do not become incidents.

The main gaps are in the fault analysis and documentation of the more routine faults. Although failed components are routinely sent to the MEC for analysis and there are regular stakeholder meetings, the capture of information on routine work orders for regulator replacement, main repair, and station rebuilds is not consistent and accurate. Further, there are opportunities to ensure that risk, integrity, and data are always considered in the incident investigation.

Subject 21: Asset Decommissioning & Disposal – The processes used by an organization to decommission and dispose of assets due to ageing or changes in performance and capacity requirements.



There is a standard process in place for pipe decommissioning and

disposal with a defined funding program. Decommissioning planning for rotating assets is less effective and can result in a costly inventory of spares left behind in stores. Decommissioning planning often begins at the end of asset life and there have been challenges with agreeing the responsibility for funding disposal costs.

While future abandonment costs are assigned for pipe assets there is an opportunity to further consider end-oflife strategies when building new assets and take a more proactive approach to decommissioning.

Subject 22: Asset Information Strategy – The strategic approach to the definition, collection, management, reporting, and overall governance of asset information necessary to support the implementation of an organization's AM Strategy and AM Objectives.

Extensive efforts have been conducted over the last few years as the AM Program has been initiated. The recent focus has been at the Enterprise-level; however, this is shifting back to BUs with a push that occurred initially before integration.

An appropriate governance framework is being put in place at the Enterprise-level. There are solid components of an Asset Information Strategy, however the focus is narrow with an outlook to 2023, and some components (such as, a detailed Roadmap) are missing. Various documents record elements of the system (such as, a high-level Roadmap with timelines), however, there is not a single document consolidating the approach.

Each legacy company has its own work management system. Eventually, this will be replaced by the new Maximo work management system, and a Roadmap is being prepared to migrate assets into the new system.

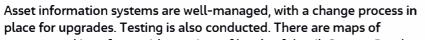
There are challenges with information that is not always readily available, and in beginning to roll-out a system in advance of the processes and procedures in place at the Enterprise-level. There is an opportunity to develop a Roadmap with a wider breadth, and look at a longer-term approach, as part of updating the Asset Information Strategy. Communication across the organization is also needed.

Subject 23: Asset Information Standards – The specification of a consistent structure and format for collecting and storing asset information and for reporting on the quality and accuracy of asset information.

There is a clear picture of where the organization is going with respect to asset information standards, and work is underway to integrate legacy businesses. Many standards are defined in existing systems, however, in the past they were not consistently adhered to. The approach to keeping records is well-defined, with corporate guidelines, policies, and procedures in place. Standards are being implemented for GDS. From a data perspective, attributes are defined, and systems are in place, however this is not necessarily enforced.

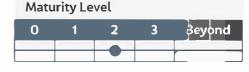
There is variation in how records are stored (such as, SharePoint and personal storage) that will be addressed through standardization over approximately the next year. Furthermore, there is an opportunity to improve data quality as part of the process for amalgamating information collection from the legacy businesses.

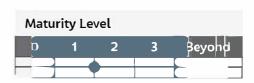
Subject 24: Asset Information Systems – The asset information systems an organization has in place to support the AM activities and decision-making processes in accordance with the Asset Information Strategy.



systems and interfaces with a variety of levels of detail. System Roadmaps are in place, with a focused 1- to 2year horizon and a less focused 2- to 3-year horizon. These Roadmaps are integrated into processes, utilities, Unify, and AM. However, the landscape is changing rapidly (month to month) and this evolution is making a longer-term Roadmap more difficult to establish.

An implementation plan is also in place, although it is a fluid and it does not cover all systems. In general, staff know where data are and the system of record for particular data, however getting access to the data can be





With a solid 2 in some situations.

Jacobs

Moving towards a 2 by updating to a corporate approach with a wider range of information types and systems.

Jacobs

difficult where experts have moved on to different roles. The Asset and Work System is being well planned, implemented, resourced, and tested.

There is an acknowledged need for consistency and work is being conducted to address related gaps. This is challenging as data and integration reviews across legacy systems is complex. There are opportunities to prepare a longer-term Roadmap for asset information systems, and to improve the consistency of information within systems. Furthermore, there are other systems that are posing challenges that will need to be addressed.

Subject 25: Data & Information – The data and information held within an organization's asset information systems and the processes for the management and governance of that data and information.

It is very clear what data has been created and where it is stored, and the systems in place are doing their jobs well. Within individual ecosystems, information needs are identified and consistent. However,

there are inconsistencies across legacy companies and, as a result, it is currently difficult to meet the needs of the business. A Fit for Purpose Study was conducted before integration and it showed that most attribute data were in reasonably good shape for operating and maintaining pipelines. Some problems were identified with integrity management (such as, pipe location data were good quality and easily accessible, however, material grade data were not easily accessible and needed to be taken from as-built drawings). Most data issues are related to historical data, so the organization is in better shape for moving forward. Data stewards have been identified, the level of awareness about data integrity and stewardship has increased significantly over last couple of years, and the structure and process exist for moving forward.

There is an opportunity through integration to improve overall consistency and address past challenges while moving into the future. There is an acknowledged need for a standard level of rigour to be applied.

Subject 26: Procurement and supply chain management – The processes used by an organization to ensure that all outsourced AM activities are aligned with the AM Objectives of the organization and to monitor the outcomes of these activities against these objectives.

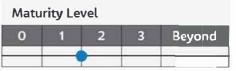
There is a strong focus on procurement and supply chain management, with structured processes in place. This is centralized through the Enterprise. The standard to which service providers are being held has increased, and controls have continued to improve over time. Contracts cannot be secured independently; the process ensures the right people and right prices are obtained. Service level agreements and metrics are being tracked. Consequences are being enforced for contractors unable to meet expectations.

Procurement and Supply Chain Management has come a long way, however there are still opportunities for improvement. For example, in some cases the data that is captured by third-parties have limited controls on the quality.

Subject 27: Asset Management Leadership – The leadership of an organization required to promote a whole life AM approach to deliver the organizational and AM Objectives of the organization.

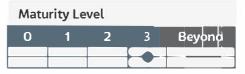
AM leadership is engaged from the top down. Senior levels of the organization are demonstrating strong leadership and commitment

(for example, asset investment planning process, risk, and decision-making). There is a commitment to a whole



Approaching 2, for failure data the pipeline assets are in good shape but station assets further behind.





Strong and pushing beyond.

FES0826201216CGY

Final Report

life approach for assets. Resources are in place, including an entire AM function for the organization. The recent webcast, monthly steering committee, and specific AM roles (such as, a Vice President of Engineering and Asset Management, the President of GDS is supporting organizational AM as well as acting as the head of EAM work) demonstrate this commitment.

The next step is to execute on the whole life approach for assets. Additional awareness is need for average employees regarding AM, and in particular communicating their connection and building support.

Subject 28: Organizational Structure – The structure of an organization in terms of its ability to deliver the organizational and AM Objectives.

The AM Organizational Structure is solid, and the core AM process is generally well understood. The AMP is part of regulatory requirements and this helps to drive the organizational set up.

The integration of the legacy businesses is still ongoing and there are a couple of areas that require more clarity, (such as, risk assessments) but they are of lesser impact.

Subject 29: Organizational Culture – The culture of an organization in terms of its ability to deliver the organizational and AM Objectives.

There is a good culture and support, starting from the Director level

and flowing into operations as demonstrated by the asset investment planning process and capital portfolio. Overall, everyone is able to drive organizational and AM Objectives. Results indicate consistency.

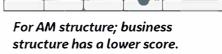
The regional groups have less visibility of each other's activities than in the past; therefore, this is an area that may improve collaboration.

Subject 30: Competence Management – The processes used by an organization to systematically develop and maintain an adequate supply of competent and motivated people to fulfil its AM Objectives including arrangements for managing competence in the boardroom and the workplace.

Well-developed, very robust training programs are in place for critical roles within GDS (that is, technical training to field and office technical

systems), with a clearly laid out learning journey. This program was established 3 years ago in-house and has made significant progress. There are 17 technical competency learning maps in place that illustrate the journey from end to end (beginner to specialized through technical and health and safety and system courses). There is a learning chapter/module for each competency, along with assessments (levels 1 to 4 and n/a), evaluations, and module tests.

On-the-job training and mentorship are also in place. Placemats are used to illustrate the journey, and to show annual progress against competencies (such as, needs formal training, needs informal training, does not need competency, masters, and so forth). A video has recently been created for new leaders coming into a supervisor role for annual assessment of performance. The program is reviewed annually to verify the competencies are still appropriate and aligned with the business, with an annual Directors meeting to provide statistics and enable discussion regarding future focus areas.



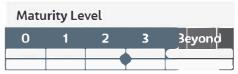
2

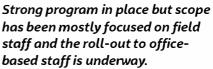
3

Beyond

Maturity Level

0







A report is also prepared each year for Directors to demonstrate progress and recognize the transition of staff. A separate program for Integrity Engineers is being prepared based on the same program model with consistent and aligned processes. Training programs for other roles (such as, professional realm of employees, and in particular risk and capital project managers) are out of scope.

A high turnover rate has posed challenges in the past, as investments are made in training and staff and they move to other regions. There are opportunities to fully integrate the program with GDS over the next year and a half. Furthermore, professional employees (lawyers, financial/budgeting experts) have not yet been included, however the model for Competence Management lends itself to being adapted for these roles. Additionally, there is an opportunity for more broad communication regarding the EAM framework and how it relates to GDS Competence Management.

Subject 31: Risk Assessment and Management – The policies and processes for identifying, quantifying, and mitigating risk and exploiting opportunities.

The Risk Management process includes a centralized 7x7 risk matrix to

assist in identifying, quantifying and mitigating risk. There are processes in place for risk assessments that are working, with a consistent approach being applied to drive asset replacements. Both legacy organizations have had risk processes in place for years.

Opportunities are identified through the investment management process (C55) which includes the Value Framework and is also based on the 7x7 matrices but brings in additionally the stream of financial benefits and costs that are more relevant on opportunity type investments.

A shared mindset is beginning to emerge but there can be inconsistencies in the way that risk is applied across GDS. There is a tendency to be somewhat reactive rather than proactive in understanding risk, as long-term perspectives and planning for emerging risks are still a challenge.

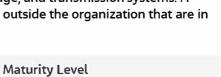
Subject 32: Contingency Planning & Resilience Analysis – The processes and systems put in place by an organization to ensure it is able to continue to either operate its assets to deliver the required LoS in the event of an adverse impact or maintain the safety and integrity of the assets (whether or not they operate).

Doing well in this area, with solid documentation, structured and

forward-looking processes, adequate staffing, and tests occurring regularly. Time and effort are spent on mock emergencies, looking at the range of possibilities with the distribution, storage, and transmission systems. A process and associated accountabilities are set up. There are also resources outside the organization that are in place to provide mutual support in an emergency.

Subject 33: Sustainable Development – The interdisciplinary, collaborative processes used by an organization to ensure an enduring, balanced approach to economic activity, environmental responsibility, and social progress to verify activities are sustainable in perpetuity.

Customer surveys are conducted, and the results are used to drive spending allocations. Some sustainable development processes are incorporated into the SAMP and AMPs, however more work is needed. Sustainability



3

2

Maturity Level

continuity planning.

2

Quite mature with emergency

response planning and business

3

0

0



Jacobs

Beyond

Bevond

goals have been translated into C55 decision criteria and projects are prioritized to deliver on environmental goals, such as working to reduce greenhouse gas emissions, leakage rates, and recovering more gas from planned releases.

Subject 34: Management of Change – An organization's processes for the identification, assessment, implementation and communication of changes to people, processes, and assets.

MoC processes exist and are documented; however, they are not necessarily in place for all levels and all areas. These processes are supported by the organization. Existing processes are more effective for assets than for people.

There are opportunities for further clarity regarding documentation to support people changes (for example, as a result of turnover), and for more broad communication to the average employee.

Subject 35: Assets Performance & Health Monitoring – The processes and measures used by an organization to assess the performance and health of its assets using performance indicators.

A recent third-party assurance exercise indicates that GDS is industry leading in this area for integrity. For distribution assets, there is clear definition about what needs to be collected, condition monitoring is conducted, and asset performance and health information is being

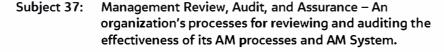
collected, historical performance data is used to forecast, and there is a review process in place. Facilities are moving towards this level. For transmission pipelines, inspection data is available to determine the life of assets. For stations assets, condition and performance information is gathered but there is not a good understanding of how to utilize this data to inform decisions. For storage and transmission facilities, inspection routines are good, however there is uncertainty about the best measures of condition and performance and how to use that information to forecast.

There are opportunities for further improvement with station assets, as well as storage and transmission facilities.

Subject 36: Asset Management System Monitoring – The processes and measures used by an organization to assess the performance and health of its AM System.

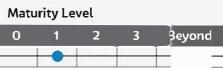
There is reporting up to top management on the AM System, and a series of measures are being well-monitored. This is part of an

integrated management system, with regular meetings as part of the program. There are concerns about whether the current monitoring measures are the most appropriate and effective and this is an area for improvement. Although the program is functioning in an integrated manner, the documentation for program and processes is not complete.

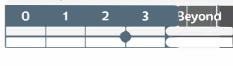


An internal audit team exists; however, the team has been instructed not to proceed with a review of AM as part of internal audit because AM it is not a regulatory requirement. Instead, an external reviewer will be engaged.





Moving towards a 1.5



3

3evond

Maturity Level

Maturity Level

0

facilities

1

7

Closer to a 3 for transmission pipelines; a 2 for stations and

Jacobs

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 27 of 166

Final Report

Subject 38: Asset Costing and Valuation – An organization's processes for defining and capturing 'as-built', maintenance and renewal unit costs and the methods used by an organization for the valuation and depreciation of its assets.

There is variation in the process for Asset Costing and Valuation

depending on the asset class. Where effort is defined and captured through work orders in SAP, there has been good costing and other information recorded since the system was put in place in 2016 (for example, related to compression assets, station assets, and commercial meter sets). With respect to construction costs, legacy Union had information tracked on the cost per metre of installed pipe.

There are some gaps in information and processes when time or materials are not booked through work orders, for smaller assets such as residential meter sets, and for non-gas carrying assets (for example, electronics on a station). There are also opportunities to gather and utilize information collected through work orders to inform future decision-making.

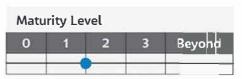
Subject 39: Stakeholder Engagement – The methods an organization uses to engage with stakeholders.

Internal stakeholder engagement is done well. Currently, there is not

much formalized external AM stakeholder engagement, however

customers surveys have been conducted in the past. There is likely value in doing more stakeholder engagement with certain external stakeholders, for example the Ontario Energy Board.

There is an opportunity to conduct additional external stakeholder engagement (for example, sharing proposed plans as a follow-up to initial customer engagement) and it is likely that this will be done in the future.



Jacobs

Moving towards a 2.





3.2 Liquid Pipelines Assessment Details





FES0826201216CGY



















REDACTED Filed: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 39 of 166

Final Report

Jacobs

3.3 Gas Transmission Details





















REDACTED Updated: 2023-07-18, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 49 of 166

Preliminary Report

Jacobs

3.4 Summary

A comparison of the maturity scores for each BU for 2018 and 2020 is shown in Figure 3-4 for the 18 priority Subjects.

											Progress			
Subject Area		Subject				G	DS				LP		GTM	
Subject Area		Subject		20	18			20	20					
			0	1	2	3	0	1	2	3				
	1	Asset Management Policy			٩	R				٦				
Strategy &	2	Asset Management Strategy & Objectives							<					
Planning	4	Strategic Planning			4	6				>				
	5	Asset Management Planning				þ				5				
Asset	6	Capital Investment Decision-Making			-					2				
Management Decision-	7	Operations & Maintenance Decision-Making			•									
Making	8	Life Cycle Value Realization				•								
Lifecycle Delivery	11	Technical Standards & Legislation				F				>				
	22	Asset Information Strategy		(
Asset Information	23	Asset Information Standards				þ			•					
	25	Data & Information			K			•						
	27	Asset Management Leadership								•				
Organization	28	Organizational Structure			4	K				•				
& People	29	Organizational Culture			•	5				•				
	30	Competence Management		~	•					5				
	31	Risk Assessment and Management			-	P			5	>				
Risk & Review	35	Assets Performance & Health Monitoring			8				•					
	38	Asset Costing and Valuation			4				5					
												.egend		

Figure 3-4. Maturity Scores by Business Unit for 2018 and 2020



4. Key Observations and Recommendations

4.1 General Observations

Enbridge is a mature and successful business and all of the BUs have demonstrated a good degree of maturity in processes and practices for several of the 39 subjects. A score of 3 has been assigned when the BU has already achieved the threshold requirements, or where the BU is close to achieving these requirements in recognition of ongoing improvement activities.

The final scores are considered to be a reasonable overall representation of BU maturity. The two initial workshops covered many subjects and captured maturity scores and rationale. The follow-up sessions focused on subjects where it was important to consult additional staff to get an understanding of current practices. The final review made a few small adjustments (plus/minus half-point) and provided additional rationale as evidence for the scores.

The differences between 2018 maturity scores and 2020 maturity scores are due to two main factors:

Progress made by the BU

4.2 Recommendations

There are some broad recommendations relating to the lower scores on the 18 priority Subjects. For the other subjects with higher maturity scores Enbridge has ongoing initiatives in place, and it is important to continue the momentum and continue to progress.

Subject 2 Asset Management Strategy and Objectives

Enbridge could derive significant value from implementing SAMPs. More sophisticated businesses tend to get more value from SAMPs as elements of existing good practice can be further aligned and strengthened during the SAMP development process. There appear to be different approaches across the three BUs and a fragmentation of what would be considered to be the contents of a SAMP document into separate parts. While it is not a requirement of ISO 55000 to have a single document, it is very helpful in the early stages of SAMP development. Defining a clear, common structure for all BUs by, for example, expanding the IMS Asset Management Program document requirements to become a SAMP, is a possible way forward. This would achieve two purposes of both developing a SAMP and implementing IMS documentation should Enbridge decide to include AM as a mandatory program in IMS.

Subject 4 Strategic Planning

Subject 5 Asset Management Planning

Preliminary Report



Subject 7 Operations & Maintenance Decision-Making

All BUs already have well-developed practices and processes. This subject is a crucial capability for all BUs and Enbridge should consider setting a higher maturity target that drives continued focus on integration of existing practices in the short term and moves the BUs towards optimization in the medium to long-term.

Subject 8 Life Cycle Value Realization

Enbridge would benefit from more coordination and drive for this subject. It might be useful to establish an Enterprise wide project, with representation from each BU, to establish a common framework, conduct BU pilots in coordination, and share learnings.

Subjects 22, 23, 25 Asset Information Strategy, Asset Information Standards, Data, and Information

There are several Enterprise and BU projects and initiatives in place already to progress these subjects. Enbridge should continue to drive these activities in coordination with other ongoing Enterprise-wide systems and data initiatives.

Subjects 27, 28, 29 Asset Management Leadership, Organizational Structure, Organizational Culture



Subject 35 Assets Performance and Health Monitoring

Similar to Subjects 2 and 8 it seems likely that Enbridge would benefit from more coordination and drive for this Subject. It might be useful to establish an Enterprise wide project, with representation from each BU, to establish a common framework and conduct BU pilots in coordination and share learnings.

Additional Recommendations

Subject 33 Sustainable Development: Enbridge has a corporate sustainability team that have recently established sustainability goals and strategy. The development of the SAMP would be an excellent opportunity to clarify sustainability goals and objectives and incorporate these into AM decision-making frameworks (such as, C55).

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 52 of 166

Appendix A Workshop Questions

Asset Management Anatomy Question Set								
No.	Subsection	Question	Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3		
	Asset Management Policy	The principles and mandated requirements derived from and consistent with the organizational strategic plan, providing a framework for the development and implementation of the asset management strategy and the setting of the asset management objectives.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 1.1 The AM Policy has been authorized by the top man 1.2 AM Policy is appropriate to the purpose, scale and 1.3 AM Policy provides a set of principles, intentions, o 1.4 AM Policy provides a framework for development a 1.5 AM Policy is consistent with Organisational Plan, or policies within the organization 1.6 The policy sets out the organization's commitment improvement 1.7 The policy is effectively communicated to employe 1.8 The AM Policy is regularly reviewed and updated to 		
	Asset Management 2 Strategy & Objectives	The strategic plan for the management of assets of an organisation that will be used to achieve the organizational / corporate objectives.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 2.1 AM objectives have been established at relevant le 2.2 AM objectives consider stakeholder and other rele 2.3 The AM objectives are Specific. Measurable, Achiev 2.4 The AM objectives are documented and included w 2.5 The SAMP sets out the organization's strategic app 2.6 The AM objectives and SAMP are aligned with the e 2.7 The SAMP is consistent with the risk tolerability cri 2.8 The SAMP outlines the role of the asset management capability. 2.10 The SAMP and AM objectives take into account ex 2.11 The SAMP & AM objectives are reviewed and up 		
	3 Demand Analysis	The processes an organization uses to both assess and influence the demand for, and level of service from, an organization's assets.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 3.1 The organization identifies internal and external far 3.2 The organisation forecasts how these factors can in requirements this will place on the assets. 3.3 Quantitative analysis tools and techniques are used requirements of the organization. 3.4 Demand analysis is used to develop alternative plan 3.5 The results of demand analysis are taken into accordeveloping the SAMP and the asset management plans 3.6 Demand analyses are reviewed and updated to refuse 		
	4 Strategic Planning	The processes an organization uses to undertake strategic asset management planning.	 The organisation has not recognised this subject and/or there is no evidence of commitment to develop it. 	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 4.1 The strategic planning process to achieve asset ma including financial, human resources and other support 4.2 The strategic planning process is aligned with and s 4.3 The strategic planning process incorporates the res 4.4 The strategic planning process provides a structure systems and asset types. 4.5 The strategic planning process and the asset managed own direction with bottom-up asset needs. 		

nanagement

- nd nature of the organization
- s, organization's mandated requirements and commitments.
- nt and implementation of the Strategic Asset Management Plan.
- , organizational objectives, stakeholder requirements, constraints and other relevant

ent to satisfy applicable (e.g. legal, regulatory, etc) requirements and to continual

- yees and stakeholders as appropriate
- to support continual improvement.
- levels and functions of the organisation
- elevant requirements
- ievable, Realistic and Time bound.
- d within the Strategic Asset Management Plan (SAMP).
- approach to the management of its assets and the achievement of AM objectives.
- he organisation's objectives, the AM Policy and relevant requirements
- criteria and the organisation's decision making criteria.
- or determining asset criticality
- ement system in achieving the AM objectives and plans for developing asset
- t existing and future needs in relation to assets and AM capabilities. nicated to relevant internal and external parties. I updated.

I factors that may pose risks or opportunities to achieving its AM objectives n influence the demand for its products and services in the future and the

sed for forecasting demand and required levels of service as appropriate to the

- planning scenarios and to address uncertainties in data and models.
- count in setting organizational objectives and asset management objectives; and in ans.
- reflect changes.
- management objectives integrates with other organizational planning activities, port functions.
- nd supports the organization's overall business planning
- results of supply and demand forecasting
- ured approach and framework for developing Asset Management Plans for asset

nagement planning processes are undertaken in an iterative way combining top-

Γ	Asset	Management Anatom	v Question Set				
		Asset Management Planning	The activities to develop the Asset Management plans that specify the detailed activities and resources, responsibilities and timescales and risks for the achievement of the asset management objectives.		 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 5.1 Documented Asset Management (AM) plans exist f achievement of the asset management objectives. 5.2 The AM Plans take account of the risks and opportu 5.3 The AM plans take account of requirements from or the plans. 5.4 The AM plans take account of the results of deman 5.5 the AM plans take account of the results of deman 5.6 AM Planning activity is integrated with other plann 5.7 The AM plans detail the processes and methods for 5.8 AM plans include activities and their timescales, the the expected outputs/outcomes from the delivery of the 5.9 Activities within the AM plan are prioritised based of SAMP. 5.10 The AM plans are reviewed and updated regularly of risks and opportunities.
	6	Capital Investment Decision-Making	The processes and decisions to evaluate and analyse scenarios for decisions related to capital investments of an organization. These processes and decisions may relate to new assets for the organization (e.g. Greenfield projects) and/or replacements of assets at end of life (CAPEX sustaining programs).	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 6.1 Capital investment decision-making follows the org stakeholders 6.2 The processes and methods for capital investment asset management policy, asset management objective 6.3 Credible alternatives are considered, including non systems level. 6.4 Options are evaluated considering the agreed decision the impact of decisions over all life cycle stages and the 6.5 Records are maintained of the decision. 6.6 Risk is included in the evaluation, including considering the processes and methods are consistently applie refurbishment (where this extends asset life). Records a criticality of the assets, and are commensurate to the rife. The methods and processes are reviewed for their required.
	7	Operations & Maintenance Decision-Making	The management activities and processes involved in determining the Operations and Maintenance requirements in support of the Asset Management objectives and goals.	 The organisation has not recognised this subject and/or there is no evidence of commitment to develop it. 	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 7.1 Operations & Maintenance (O&M) strategies are domaking. 7.2 The methods and processes for determining O&M smanagement policy, asset management objectives and 7.3 The processes and methods are consistently applie assets, required service levels, planned capital interventare available to demonstrate conformance. 7.4 Risk is included in the evaluation of O&M strategies 7.5 Asset performance, condition, costs and maintenari identify the need for any changes. 7.6 Review processes ensure that, where appropriate, through the capital investment decision making process
	8	Life Cycle Value Realisation	The activities undertaken by an organization to balance the costs and benefits of different renewal, maintenance, overhaul and disposal interventions.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 8.1 Criteria for 'life cycle value' are determined and do agreed with its stakeholders. 8.2 The methods and processes for life cycle value real management policy, asset management objectives, Strainvestment decision-making and operations and mainters. 8.3 The processes and methods for life cycle value real the best combination of asset acquisition/creation, utilicycle of assets (i.e. life cycle strategies). Records are available. 8.4 Risk is included in determining the life cycle strategies. The organisation continually improves its approach

st for asset systems and critical assets in alignment with the SAMP for the

ortunities, including how these can change with time. m outside the AM system and consider the financial and non-financial implications of

nand analysis

ement opportunities

anning activities such as IT, human resources and financial planning

for managing the assets over their life cycles.

the resources to be utilized, the roles and responsibilities, risks/opportunities and f the plans.

ed on the organisation's agreed method and decision criteria documented in the

arly, in accordance with specified review periods, to account for the dynamic nature

organization's criteria for asset management decision-making agreed with its

ent decision-making are documented, where necessary, and are aligned with the tives and SAMP.

non-capital interventions, at an individual asset, groupings of assets and asset

ecision criteria, constraints and mandatory compliance requirements, and consider the organisation's long term need for the asset.

sideration of how risk changes with time.

plied across all capital investments, including new build, replacement and ds are available to demonstrate compliance. Processes consider the nature and re risk and opportunity.

eir effectiveness in achieving asset management objectives and are updated as

determined using the organization's criteria for asset management decision-

M strategies are documented, where necessary, and are aligned with the asset and SAMP.

plied across all assets and operations and consider asset criticality, remaining life of ventions and the balance between preventive and corrective maintenance. Records

gies, including consideration of how risk changes with time. nance history is analysed regularly to verify the effectiveness of O&M strategies and

te, capital interventions will be initiated at the appropriate time and considered cess.

documented using the organization's criteria for asset management decision-making

ealisation are documented, where necessary, and are aligned with the asset Strategic Asset Management Plan, and methods and criteria used for capital intenance decision-making.

ealisation are consistently applied across all assets and operations in determining utilization, maintenance, improvement, renewal and disposal activities over the life available to demonstrate conformance.

tegies, including consideration of how risk changes with time.

ach to quantifying, modelling, forecasting, measuring and improving life cycle value.

Asse	t Management Anatom	y Question Set				
	Resourcing Strategy	Determining and documenting the activities and processes to be undertaken by an organization in order to procure and use people, plant, tools and materials to deliver the Asset Management objectives and Asset Management Plan(s).	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 9.1 The organization determines the required asset m implement, maintain and improve its Asset Manageme 9.2 The resourcing strategy is be consistent with all re 9.3 The organization determines the people, plant, eq objectives and for implementing the activities specified and enable those plans. 9.4 The organization develops its resourcing strategy to outsourcing or procuring the resources as appropriate 9.5 The resourcing strategy is aligned with the Strategy strategy, customer demand for its products/services, a chain. 9.6 The resourcing strategy is communicated to all relused in developing resourcing plans. 9.8 The resourcing strategy is reviewed periodically in
1	Shutdowns & Outage Strategy	The activities taken by an organisation to develop a strategy for shutdown and outages.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 10.1 Criteria for developing the shutdown and outage making agreed with its stakeholders. 10.2 The shutdown and outage strategy is aligned with Asset Management Plan. 10.3 The shutdown and outage strategy considers the and outages on external stakeholders, including custor 10.4 The shutdown and outage strategy considers the shorter shutdown and outages. 10.5 The shutdown and outage strategy is consistently 10.6 The organization ensures that the AM Plan(s) taken
1	& Legislation	The processes used by an organisation to ensure its asset management activities are compliant with the relevant technical standards and legislation.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 11.1 The organisation determines the full extent of finobligations. 11.2 The organisation has all relevant documented information to support the Asset Management System. 11.3 The organisation has a process to ensure that any applicable legal and regulatory requirements are availated in the organisation has a process to create and regulated to any reguirements are availated to the organisation has a process to control the doct preservation, version control and retention and/or distention. 11.6 The organisation has a process to identify and correquired by the Asset Management System. 11.7 Technical documents are aligned to and support to the organisation is able to demonstrate how any communicated. 11.9 The organisation has a process in place to ensure compliance with any legal and regulatory requirement

- management roles and the type and level of human resources required to establish, ment System.
- relevant mandatory and organizational policies and strategies.
- equipment, tools and materials required for meeting the asset management fied in the Asset Management Plan(s), including those activities required to support
- gy to source the required resources, including through recruitment, partnering, ate.
- tegic Asset Management Plan and takes into account the organization's long term s, availability of skills in the market and the level of competition amongst the supply
- s, including risks associated with the long term sustainability of the strategy. relevant functions within the organization, including HR, Procurement, etc. and is
- in light of market conditions and updated to ensure it remains effective.
- ge strategy are in line with the organization's criteria for asset management decision-
- with the asset management policy, asset management objectives and the Strategic
- he requirements of all internal stakeholders and the impact of planned shutdowns tomers.
- he trade-off between fewer and longer shutdown and outages against frequent and
- ntly applied in the development and implementation of Asset Management Plan(s). take into account relevant requirements coming from outside the AM system.
- financial, non-financial and technical information required to enable it to meet its
- information required by applicable standards and legal and regulatory requirements
- any documents required by the Asset Management System and any standards and ailable and suitable for use when required and are adequately protected. egularly review and update the documented information.
- documented information, including the distribution and access, storage and disposal.
- control documented information from sources outside the organisation that is
- ort the Asset Management System.
- ny changes to technical and legislative documentation are appropriately
- ure that there is consistency and traceability between organisational data in ents.

Asset	Management Anatom	y Question Set				
	Asset Creation &	An organisation's processes for the acquisition, installation and commissioning of assets.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 12.1 The organisation determines and documents the 12.2 The organisation's processes and methods related assets. 12.3 The organisation's processes and methods related non-technical risks associated with the acquisition and 12.4 The documented processes ensure that the acquisition and 12.5 The acquisition process complies with legal and st Management Policy. 12.6 The organisation considers appropriate life cycle of 12.7 The acquisition process utilises project management plan(s) and consideration of relevant time
13	Systems Engineering	An interdisciplinary, collaborative approach to derive, evolve and verify a life-cycle balanced system solution which satisfies customer expectations and meets public acceptability.	 The organisation has not recognised this subject and/or there is no evidence of commitment to develop it. 	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 13.1 The organisation determines and documents the 13.2 The organisation considers the interaction and in 13.3 The organisation has processes to ensure that ow 13.4 The organisation has processes and methods that the period of operation or use of the asset(s). 13.5 The Asset Management System is of an appropria 13.6 The organisation has a process in place to ensure 13.7 Ensure risk is considered and managed at a system
	Configuration Management	A management process for establishing and maintaining consistency of a product's physical and functional attributes with its design and operational information throughout its life.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 14.1 The organisation determines and documents the 14.2 The organisation determines its information requires management system. 14.3 The organisation has process(es) for assessing the 14.4 The organisation has process(es) for internal and their lives. 14.5 The organisation has processes for evaluating and 14.6 The organisation has processes for identifying no appropriate action to deal with them. 14.7 The organisation determines the requirements of asset systems ensuring the physical and functional attrlife. 14.8 The organisation has clear processes defined for the information onto appropriate information systems. 14.9 The organisation is compliant with relevant configuration.

he processes and methods related to the acquisition and creation of assets. Ated to the acquisition and creation of assets are integral to the life cycles of the

ated to the acquisition and creation of assets identify and manage the technical and nd creation of assets for the organisation..

quisition and creation of assets is consistent with organisational standards and with

statutory requirements, including all relevant organisational policies and the Asset

le costing in the acquisition and creation of assets. ement controls to ensure the timely and cost efficient delivery of the asset ime horizons.

he processes and methods to manage its assets throughout their lives I interdependency of assets operating as a system (or systems). overall system solutions are optimised for cost, risk and performance. hat consider asset risks that will change over time and any residual liabilities beyond

briate scale according to the nature and complexity of the organisation. Ire that the relevant systems engineering standards are followed. Item level consistent with asset and other risk management processes.

he processes and methods to manage its assets throughout their lives equirements to support its assets throughout their lives and also to support its asset

the impacts of planned changes and for managing risks that arise. nd external dissemination of information that is relevant to its assets throughout

and reporting asset and asset system performance non-conformities or incidents related to its assets and asset systems and for taking

s of how to identify and document asset information to enable the configuration of ttributes are consistent with the design and operational requirements throughout its

or the collection and quality control of information and the addition of the

nfiguration management standards.

As	set	Management Anatom	y Question Set				
		Maintenance Delivery	The management of maintenance activities including both preventive and corrective maintenance management methodologies.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 15.1 The organisation determines and documents the 15.2 The organisation determines the extent, resourci assets. 15.3 The organisation plans, implements and controls 15.4 The organisation determines its information requiranagement. 15.5 The organisation reviews the performance of its a performance. 15.6 The organisation has processes for identifying no appropriate corrective or preventive action to deal wit 15.7 The organisation has identified maintenance action 15.8 The organisation reviews the effectiveness of its and the organisation reviews the effectiveness of its and the organisation adapts maintenance as operating
	101	Reliability	The processes for ensuring that an item shall operate to a defined standard for a defined period of time in a defined environment.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.		 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 16.1 The organisation determines and documents the 16.2 The organisation determines its information requiranagement system. 16.3 The organisation has process(es) for assessing the 16.4 The organisation has processes for evaluating and 16.5 The organisation reviews the performance of its a 16.6 The organisation has processes for identifying no appropriate corrective or preventive action to deal wit 16.7 The organisation uses a root cause analysis proce actions that consider cost, risks and performance. 16.8 The organisation tracks mitigation actions resulting reliability plan to reflect root cause findings. 16.9 The organisation carries out systematic periodic
	17	Asset Operation	The processes used by an organisation to operate its assets to achieve the business objectives.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.		 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 17.1 The organisation is systematically managing the inlifecycle of the assets. 17.2 The organisation is using operational processes to 17.3 The organisation has in place processes to ensure 17.4 The organisation clearly documents the processe integration of outsourcing activities into the Asset Mar 17.5 The organisation has controls in place to ensure of specified. 17.6 The organisation clearly documents in appropriat 17.7 The organisation retains documented information with requirements. 17.8 The organisation has implemented mechanisms the lifecycle of the assets. 17.9 The organisation has a change management processes in the organisation collects and assesses feedback operating regimes as required.

- he processes and methods to manage its assets throughout their lives rcing, responsibilities and target achievement of actions required to manage its
- ols the processes needed to implement the asset management plans equirements to support its assets throughout their lives and also to support its asset
- ts assets and asset systems and takes appropriate action to manage asset
- non-conformities or incidents related to its assets and asset systems and for taking with them.
- ctions as part of process(es) and methods to manage its assets.
- ts maintenance strategy to ensure optimal delivery.
- ting contexts, objectives and constraints change over time

he processes and methods to manage its assets throughout their lives quirements to support its assets throughout their lives and also to support its asset

- the impacts of planned changes and for managing risks that arise.
- and reporting asset and asset system performance
- ts assets and asset systems and takes appropriate action.
- non-conformities or incidents related to its assets and asset systems and for taking with them.
- ocess that is aligned with the reliability plan goals, and has developed preventative
- Iting from root cause analysis, and carries out periodic reviews and revisions of the

g a reliability plan which includes definitions of reliability goals and requirements. dic reviews and revisions of reliability plans using appropriate tools and techniques.

e interaction between operations and other asset management activities over the

s to address identified risks and opportunities and corrective and preventive actions ure that all operating requirements are aligned with the Asset Management System. sses, activities, responsibilities and risks related to outsourcing, and ensures the Management System.

- e operational activities are carried out in accordance with the requirements
- iate standards and specifications the operating requirements for all assets. tion as assurance that operational activities have been undertaken in accordance
- s to ensure appropriate interactions between operations and other functions over
- rocess that controls, reviews and mitigates the consequences of planned changes. ack and results from all operating activities and implements improvement to

Asse	Management Anatom	ny Question Set				
18	Resource Management	Implementing the Resourcing Strategy to manage the use of funds, people, plant, tools and materials in delivering asset management activities.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 18.1 The organisation provides adequate resources for resourcing strategy 18.2 The organisation implements and controls the remain Management Plan(s) and Asset Management System. 18.3 The organization delivers activities through an all 18.4 The organisation allocates people resources to wo for resources. 18.5 The organisation considers and justifies work primplant resources. 18.6 The organisation's inventory and stock is deliverated. 18.7 The organisation maintains and calibrates all equip of activities and objectives. 18.8 The organisation applies consistent processes to requirements.
19	Shutdown & Outage Management	An organisation's processes for identification, planning, scheduling, execution and control of work related to shutdowns or outages	 The organisation has not recognised this subject and/or there is no evidence of commitment to develop it. 	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 19.1 Shutdown constraints have been considered who Plan. 19.2 Planning of delivery activities associated with shut 19.3 Processes are in place for managing and controll minimised and measures are in place to ensure unplar 19.4 Mechanisms are in place to maximise opportunit 19.5 Effective communication is in place across lifecy downtime. 19.6 Lessons learnt from shutdowns and outages are
20	Fault & Incident Response	Responding to failures and incidents in a systematic manner, including incident detection and identification, fault analysis, use of standard responses, temporary and permanent repairs as well as the taking over and handing back of sites.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 20.1 The organisation has documented and systematin nonconformities with Asset Management processes. 20.2 Response plans include provision for adequate reconstruction of the organisation has identified the scope, method conformities in order to determine the root cause(s) 20.5 Evidence is retained of analysis of failures, incide 20.6 Procedures for investigation of incidents and rep 20.7 Processes are in place for planning and controllinincluding taking ownership of and handing back assets the issue. 20.8 Actions include, where applicable, elimination of prevent future occurrences. 20.9 Records are kept of faults, incidents and non-cord
21	Asset Decommissioning & Disposal	The processes used by an organisation to decommission and dispose of assets due to ageing or changes in performance and capacity requirements.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 21.1 Decommissioning and disposal is considered as p management. 21.2 Decommissioning and disposal activities are effe human resource planning) 21.3 Decommissioning and disposal processes are def 21.4 The organisation ensures records are made avail

for the management of the Asset Management System, in accordance with the

- requirements of the resource strategy; which address the needs of the Asset n.
- aligned and integrated resource management process. work in a systematic way which ensures and justifies the effectiveness and efficiency
- priorities, risks and flexibility to changes in work plans, while allocating people and
- ered according to specific requirements within agreed timescales. quipment and tools at appropriate frequencies that are consistent with the delivery

to ensure that outsourced resources meet internal and external specifications and

when developing the Strategic Asset Management Plan and the Asset Management

- shutdowns and outages is consistent with shutdown strategy
- olling shutdown activities to ensure the impact on service and stakeholders is lanned shutdowns are minimised and risk managed.
- nities arising from unplanned or extended shutdowns.
- cycle activities to ensure that shutdown plans are aligned in order to minimise

re used to improve shutdown management

atic processes and/or plans in place for managing unplanned events - including

- resources
- nisation

hod and timing for analysis and evaluation activities for failures, incidents and non-

- dents and non-conformities
- eporting align with mandatory and other requirements.
- lling the implementation of (permanent and/or temporary) treatment actions,
- ets, where relevant treatment actions are proportionate to the nature and scale of

of the cause of nonconformity and any changes to the Asset Management System to

onformities, actions taken and outcome of actions taken.

s part of lifecycle cost and benefit analysis at all relevant stages of lifecycle

fectively planned, including the integration with other planning activities (such as

- lefined, documented and consistently applied.
- ailable to demonstrate the processes are being followed.
- information is updated and that all interfaces to assets that remain in service are

greed period beyond disposal of asset, in line with requirements and as defined in

A	sset	Management Anatom	y Question Set				
	22	Asset Information Strategy	The strategic approach to the definition, collection, management, reporting and overall governance of asset information necessary to support the implementation of an organisation's asset management strategy and objectives.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 22.1 The organisation determines what asset manage System and organizational objectives. 22.2 The organization has a documented Asset Inform 22.3 • Development of the strategy considers: o the significance of identified risks on information required to support key decisions require o the exchange of information with stakeholders, inclue o how and when information is to be collected, analys o impact of quality, availability and management of inf 22.5 The strategy defines the quality required of asset 22.5 The strategy is designed to ensure there is approrelevant to asset management to the extent required to objectives. 22.6 The strategy contains objectives relating to propridentification of gaps between the currently available 22.7 The strategy identifies the processes that are required of asset 22.8 The strategy contains information system busine information needs. 22.9 The strategy includes processes to ensure asset i including migration of data and users from existing sys 22.10 The requirements are determined for aligning to organization.
	23	Asset Information Standards	linformation and for reporting on the quality	 The organisation has not recognised this subject and/or there is no evidence of commitment to develop it. 	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 23.1 The organization has developed standards and gravet the asset information needs defined in the Asset 23.2 The information structure has a hierarchy for ass 23.3 There are definitions for the attributes required is 23.4 The information structure enables collection of do conformities and describes how these should be recorreliability, support long and short term planning activitiant 23.5 The organization has defined the quality and acc 23.6 The organization has defined how the quality and
	24	Asset Information Systems	The asset information systems an organization has in place to support the asset management activities and decision- making processes in accordance with the Asset Information Strategy.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 24.1 The organization has identified the necessary ass and analyse the asset information to manage its assets 24.2 The organization has an Asset Information Syster governance arrangements. 24.3 The organization has implemented, in accordance Asset Information Strategy. 24.4 There is consideration of the optimum mix of sof and the regulatory environment it operates in. This indi- information systems; evaluation of how systems can b existing business processes and IT solutions. 24.5 The organization has clearly defined system own 24.6 The asset information system contains a robust r

gement information is required to support its assets, management of assets, the AM

rmation Strategy that is consistent and aligned with the SAMP.

- requirements.
- uired within asset management processes, procedures and activities.
- cluding service providers.
- lysed and evaluated.
- information on its' organizational decision-making.
- set information.
- propriate traceability and consistency between financial and non-financial information ed to meet its legal, regulatory and stakeholder requirements and organisational
- oposed improvements in asset information that are SMART including the le information (including its quality and accuracy) and that which is required. required to manage asset information and assure its quality, along with their
- bilities, and any programmes to improve these processes.
- ness requirements necessary to support the organization's business processes and
- et information retains alignment to needs as the organization's requirements evolve systems to new systems.
- g terminology (financial and non-financial) relevant to asset management across the
- I guidelines to ensure a consistent approach to the recording of asset information to set Information Strategy.
- assets, and enables the recording of their physical location.
- d for asset information, including acceptable values and quality criteria.
- f data on asset utilisation, condition and performance, incidents and non-
- corded in order to support strategic Asset Management planning, improve service and ivities and help determine overall asset lives and intervals between intervention
- ccuracy that is required for all asset information.
- and accuracy of all asset information is to be assessed.

asset information systems and architecture required in order to collect, store, process ets over their life cycle and deliver the Asset Information Strategy. tems implementation plan and migration plans (when required), which include

nce with the organisation's IT strategy, the systems required in order to deliver the

software applications, taking account of the size and complexity of the organization includes an analysis of the costs and benefits of implementing new or updated asset n be used to automate business processes; an assessment of compatibility between

wnership responsibilities. st reporting system.

A	set	Management Anatom	y Question Set	•	1		
	25	Data & Information	The data and information held within an organization's asset information systems and the processes for the management and governance of that data and information.	• The organisation has not	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 25.1 There are governance processes to provide assur defined in the Asset Information Strategy and asset inf 25.2 There are data collection and maintenance plans 25.3 There are processes to ensure provision of asset i 25.4 Suitable controls are incorporated into the busine inform the decision. 25.5 Processes and governance for managing asset ma 25.6 There are processes and systems in place for the information to ensure that required information is ava 25.7 Information is adequately protected, including fro 25.8 There are processes in place for the control of ch 25.9 Information is adequately protected, including fro 25.10 There are processes and systems in place for the control of ch 25.11 There are processes and systems in place for the control of ch 25.12 Documented information originating from outsid activities is identified and controlled.
	26	Procurement and supply chain management	The processes used by an organisation to ensure that all outsourced asset management activities are aligned with the asset management objectives of the organisation and to monitor the outcomes of these activities against these objectives	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 26.1 The organization identifies Asset Management achouse. 26.2 The organization provides the resources required activities specified in the Asset Management Plans, inc 26.3 Where the organization develops processes and swith the Strategic Asset Management Plan and Asset N processes. 26.4 The organization establishes risk and opportunity controlled consistent with achieving Asset Managemer 26.5 Responsibilities and authorities for the management 26.6 The organizational resourcing strategy includes the and service levels. 26.7 The organization specifies and clearly documents for outsourced activities. 26.8 The organization ensures that outsourced activiti with Asset Management System requirements. 26.9 The organization ensures that the performance appropriate performance indicators consistent with Asset Asset Management System relationships with suppliers. 26.10 The organization ensures that the performance appropriate performance indicators consistent with Asset Asset Management System relationship viability and longevity. 26.12 The organization establishes processes for minir

- surance that information is consistent with the quality and accuracy requirements information standards.
- ns to address any information gaps identified in the Asset Information Strategy. et information resulting from asset interventions.
- iness decision making process to ensure data of the required data quality is used to
- management information are specified, implemented and maintained.
- he storage and preservation, distribution, access, retrieval and use of data and available and suitable for use, where and when it is needed.
- from loss of confidentiality, improper use or loss of integrity.
- changes to data and information
- from loss of confidentiality, improper use or loss of integrity.
- f changes to data and information
- the retention and disposition of data and information.
- tside the organization and determined to be necessary for asset management

activities that are appropriate for outsourcing and those which should remain in-

- red for meeting the Asset Management Objectives and for implementing the including outsourced activities.
- nd sets objectives for outsourced Asset Management activities these are fully aligned et Management Objectives, the Asset Management System and other internal
- nity management processes that ensure outsourced processes and activities are nent Objectives and which are integrated with the Asset Management System. ement of outsourced activities are clearly defined and documented.
- s the selection of appropriate service providers and the development of clear criteria
- nts the requirements, scope, and the means for information and knowledge sharing
- vities meet requirements of competency, awareness and documentation consistent
- contracts with appropriate incentive schemes, and actively builds sustainable, long-
- ce of outsourced activity is adequately monitored through the establishment of Asset Management System requirements.
- nstances and ownership structures of service providers and suppliers to ensure

nimizing risk when transitioning from one supplier to another.

P	sset	Management Anatom	y Question Set				
	27	Asset Management Leadership	The leadership of an organisation required to promote a whole life asset management approach to deliver the organisational and asset management objectives of the organisation	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 27.1 Top management demonstrate leadership and cor Asset Management Plan and Asset Management Object 27.2 Top management ensures the Asset Management Management System achieves intended outcomes. 27.3 Top management ensures resources for the Asset contribute to effective Asset Management. 27.4 Leaders support and influence staff to deliver the 27.5 Leaders communicate the importance of asset ma manner. 27.6 Top Management actively promotes cross-functio 27.7 Leaders demonstrate, by their behaviour, commit Management Policy, Objectives and Strategic Asset Management 27.9 Leaders promote continual improvement. 27.10 Leaders are responsible for ensuring that Asset M 27.11 Top management and leaders endorse all key As 27.13 Top Management and leaders identify the interfation
	28	Organisational Structure	The structure of an organisation in terms of its ability to deliver the organizational and asset management objectives.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 28.1 The organization clearly understands its purpose a scale, customers and stakeholders) and whether assets 28.2 The organization considers both external and interpolitical, legal, regulatory, financial, technological, econobjectives etc.) 28.3 The organization designs and implements an apprauthorities and responsibilities. 28.4 Roles and responsibilities. 28.5 Top management assigns responsibility and author Management System and ensuring that the Asset Management System and ensuring that the Asset Management 28.7 Decision-making processes are clearly defined acrito be a leader in taking key performance and reliability 28.8 The organizational structure is resourced consistent the organization and delivery of Asset Management Objectives and training are aligned 28.10 Individuals challenge the way of working to contize. 28.11 Top management.

- commitment to Asset Management by ensuring Asset Management Policy, Strategic ectives are established and are aligned to the organisational objectives. ent System requirements are integrated into business processes and that the Asset
- set Management System are available and actively directs and supports people to
- he Asset Management Strategy and objectives of the organization. management and Asset Management System requirements in a clear and concise
- tional working and supports leadership in Asset Management.
- nitment to values and principles of Asset Management set out in the Asset Management Plan.
- ration of asset risk into the organisational risk management system.
- t Management decisions are taken by the relevant role.
- ence of the direction being taken and benefits that will be achieved.
- Asset Management System documentation.
- erfaces between Asset Management activities and other organizational activities.
- se and gives consideration to multiple factors (e.g. sector, product, service, location, ets and Asset Management are central to its purpose or enablers.
- iternal factors when designing an appropriate structure (e.g. social, cultural, onomic, environmental, internal governance, capability, policies, strategies,
- propriate organizational structure that clearly and unambiguously identifies roles,
- stood by everybody, communicated, maintained and updated as required.
- hority for ensuring the adequacy, ongoing suitability and effectiveness of the Asset anagement System supports delivery of the Strategic Asset Management Plan.
- thority for the establishment and update of the Strategic Asset Management Plan, ent Plans
- across the cross-functional organizational structure and management is best placed ity decisions.
- stent with its roles, responsibilities and workload to enable effective performance of Objectives, statutory and stakeholder requirements.
- ned and consistent with the organizational structure.
- ntinuously improve the Asset Management System.
- d authority for reporting the performance of the Asset Management System back

4	lsset	Management Anatom	ny Question Set				
	29	Organizational	The culture of an organization in terms of its ability to deliver the organizational and asset management objectives	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 29.1 The organization identifies internal and external is Management System. 29.2 Every individual in the organisation perceives Asses 29.3 There is consistent self-discipline at all levels in the 29.4 Top management proactively shapes organisation Asset Management Policy, and achievement of Asset New 29.5 The organization ensures roles and responsibilities Management thinking. 29.6 The organization has an embedded culture of risk trained and made aware of the activities they are responsive systematically captured and where appropriate progree 29.7 The organization considers and plans for the long 29.8 Top management promotes collaborative and paorganisation faces. 29.9 A clear chain of command and communication provisues. 29.10 The organization identifies and determines the adesired culture. 29.11 The organisation actively identifies barriers and organization establishes effective processes for culture 29.12 The organization is a 'learning organization' with
	30	Lompetence Management	The processes used by an organisation to systematically develop and maintain an adequate supply of competent and motivated people to fulfil its asset management objectives including arrangements for managing competence in the boardroom and the workplace.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 30.1 The organisation establishes a Competence Manaroles and responsibilities identified within the organisation. 30.2 The Competence Management System incorporation activities and assessing competence of resources both an activities and assessing competence of resources both an agement System. 30.4 The Competence Management System is utilised Management System. 30.5 The organization ensures persons are competent activities and organization identifies appropriate activities an agement system. 30.6 The organization retains appropriate documenter resources. 30.8 The organization periodically reviews current and an advent and the delivery of the Strategic Asset Management Plance.

al issues relevant to its purpose and considers these in designing its Asset

- Asset Management as a good investment with positive long term benefits. In the organisation as an observable habit.
- tional culture to ensure observed behaviours align with organizational values, the et Management Objectives.
- ities are assigned and conducive to collaborative and cross-functional Asset
- risk management and all persons working under the organization's control are esponsible for, the associated risks and required controls, and opportunities are gressed.
- ong term and values processes as well as outputs.
- participative consultation to understand and address the cultural challenges that the

processes exist in the organization and everybody understands how to escalate

ne aspects of culture that need to change and the pathway between current and

nd constraints for culture change and proactively plans to remove or mitigate. The ure change and identifies the mechanisms of change that are most effective. *v*ith consistency in understanding, behaviour and good practice.

- anagement System which aligns all required asset management competences to the isation's Asset Management System.
- prates processes for identifying competency requirements for asset management oth internal and external.
- quire competent persons and evaluates the effectiveness of such actions.
- ed to support the recruitment, development and training of all staff within the Asset

ent on the basis of education, training and/or experience.

- es to address any gaps in competence.
- ted information as evidence of competence, for both internal and outsourced

and future competency requirements.

ence requirements to support the development of the Asset Management System t Plan.

Ass	et l	Management Anatom	y Question Set				
	311	KISK ASSESSMENT and	The policies and processes for identifying, quantifying and mitigating risk and exploiting opportunities.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 31.1 Top management ensures that the management approach. 31.2 The organization's approach to risk and opportur requirements and is consistent with stakeholder requi at. The organization assesses the risks and opportunachievement of its asset management objectives 31.4 The organization determines the risks and opportunachievement or reduce undesired effects on the asset management system to achieve its required outcomess b) prevent or reduce undesired effects on the asset material. The organization assesses how these risks and opportant or reduce undesired effects on the asset material. The organization assesses how these risks and op at. The organization creates and carries out action p management processes. 31.7 The organization evaluates the effectiveness of it at. The organization has documented risk management appropriate treatments for rise d) Monitor these treatments and their effectiveness; 31.9 The organization documents its risks in a way the reporting, review, , updating and archiving and closure at. 11 The organization manages risks and opportunity achievement of objectives before the change is implered at. 12 The organization includes the treatment and material.
	32	Contingency Planning & Resilience Analysis		• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 32.1 Top management ensures that the management approach including contingency planning 32.2 The organization has considered and evaluated at to deliver the required continuity of business function 32.3 The organization has established processes to preventive action addressed through contingency plan 32.4 The organization's operational planning and contrisks that have been identified that this is appropriate. 32.5 Contingency plans and/or procedures include infa) establishing levels of command and person in charge b) responsibility matrix and escalation criteria c) the provision of resources, and the maintenance of incidents or emergency situations; d) identifying required support organisations, with the including contact details; e) contacts and arrangements for internal and externation of essential information whilst responding h) the process for returning to normal operations. 32.6 The organization tests its contingency plans on a lessons learned. 32.7 The organization seeks continual improvement or provement or plans and provement or plans on a lessons learned.

ent of asset management risks is aligned the organization's risk management tunity assessment and management ensures compliance with legal, statutory quirements and expectations. cunities associated with outsourcing any activities that can have an impact on the bortunities to be addressed to: management system m opportunities can change over time. n plans to address the risks and opportunities and integrates the actions into its asset f its actions to address risks and opportunities. ement processes for assets and asset management activities to:

hievement of asset management objectives; risks and opportunities;

ut risk and opportunity assessment are competent to perform the activity. y that supports the identification, recording, evaluation, ranking/ prioritizing,

ure of business risk records.

nity arising from the management of change, and assesses risks which can impact on lemented.

monitoring of risks and opportunities in its processes for operational planning and

e effectiveness of its processes for managing risks and opportunities.

ent of asset management risks is aligned with the organization's risk management

d asset and other risks (internal and external) that impact on the capability of assets ons under adverse conditions.

proactively identify potential failures in asset performance and evaluate the need for lans.

ontrol processes include documented contingency management processes for the te.

information on:

arge for each event type

of any equipment, facilities or services that could be required during disruptions,

heir specified responsibilities, needed for each type of event (or phase of an event),

nal communication;

aintained or restored in the event of disruption;

ing to, and managing, incidents and emergencies;

a regular basis, as far as is reasonably practicable, and implements the appropriate

t of its contingency planning

Asset Management Anatomy Question Set							
		Sustainable Development	The interdisciplinary, collaborative processes used by an organisation to ensure an enduring, balanced approach to economic activity, environmental responsibility and social progress to ensure all activities are sustainable in perpetuity.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 33.1 The organisation determines the external issues to impacts, 33.2 The organisation determines the requirements and financial impacts of its asset management activities. 33.3 The organization demonstrates that it takes accous social and financial impacts in the development of its A
	34	Management of Change	An organization's processes for the identification, assessment, implementation and communication of changes to people, processes and assets.	 The organisation has not recognised this subject and/or there is no evidence of commitment to develop it. 	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 34.1 The organisation has documented policies & proc and the supporting resources 34.2 The organization carries out risk and opportunity management objectives prior to the implementation of 34.3 The management of risks associated with changin documented risk management processes . 34.4 The organization controls planned changes and re mitigates adverse effects as required. 34.5 Records are available to demonstrate that changes
	35		The processes and measures used by an organization to assess the performance and health of its assets using performance indicators.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 35.1 The organization determines its requirements to a) What is to be monitored and measured b) Methods of monitoring, measurement, analysis and c) Establishing criteria to understand when there is dev conformance d) The frequency of monitoring, measurement, analysis 35.2 The organization reports on asset performance, ir 35.3 The organization develops a hierarchy of asset per needs and decisions that are being managed 35.4 The organization develops a range of leading and 35.5 The organization regularly reviews asset performance and reports are being managed 35.4 The organization develops a range of leading and asset performance and reports are being managed 35.5 The organization regularly reviews asset performation and reports and reports are being managed and asset performation regularly reviews asset performation and reports and reports the achievement of asset mana asset and asset mana asset performation maintains records of asset performation and reports and reports the achievement of asset mana asset performation maintains records of asset performation maintains records of asset performation and reports and asset performation maintains records of asset performation asset performation maintains records of asset performation and reports the achievement of asset performation asset performation maintains records of asset performation asset performation maintains records of asset performation asset performation asset performation and reports and asset performation maintains records of asset performation asset pe

s that are relevant to its purpose, including its environmental, social and financial

and expectations of stakeholders with respect to the environmental, social and

count of the external issues and stakeholder requirements related to environmental, s AM policy, AM objectives, SAMP and AM plans.

ocesses for dealing with changes to physical assets, asset management processes

- ity assessment on any planned change that can affect the delivery of asset n of the changes.
- ging assets or asset management activities is consistent with the organisation's

I reviews the unintended consequences of the changes as required. The organization

nge management processes and plans are followed.

to monitor and measure the performance and health of its assets, including:

nd evaluation to ensure results are valid deviation from the required level of performance, and if appropriate identify as a non-

sis and evaluation

, including asset health, in accordance with stakeholder requirements performance and asset health reporting through the organization appropriate to the

nd lagging performance measures for its assets

porting that allows for the prediction of future asset performance & health mance and asset health monitoring, measurement, analysis and evaluation to

nagement objectives and to identify opportunities for improvement.

formance and asset health monitoring, analysis and evaluation

A	sset	set Management Anatomy Question Set						
		Asset Management System Monitoring	The processes and measures used by an organization to assess the performance and health of its Asset Management System.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 36.1 The organization determines its requirements to rincluding: a) What is to be monitored and measured for financial follows the elements of the AM system) b) methods of monitoring, measurement, analysis and c) Establishing criteria to understand when there is deviconformance d) The frequency of monitoring, measurement, analysis 36.2 The organization reports on the effectiveness of it 36.3 The organization has in place a hierarchy of asset needs and decisions that are being managed 36.4 The organization has in place a range of leading an 36.5 The organization regularly reviews its asset management system and implements these where the 36.7 The organization maintains records of asset management system and implements these where the 36.7 The organization maintains records of asset management system and implements these where the set management system and implements these set management set management system and implements these set management set mana	
		Management Review, Audit and Assurance	An organization's processes for reviewing and auditing the effectiveness of its asset management processes and asset management system.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 37.1 The organisation has documented audit policies a 37.2 The organization carries out internal audits in accomeets: a) its own requirements b) the requirements of ISO55001. 37.3 The organization determines the frequency and companization's processes and the results of previous audits area a) Using competent auditors, independent of those have b) Conducting audits in accordance with agreed definities (Retaining records of the audit results 37.6 The organization reports the audit findings to the 37.7 The organization's top management reviews the aby: a) Conducting the review in accordance with a planned b) Considering the status of actions from previous management and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and analysis of non-conformities and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous managements and compares and the status of actions from previous	

to monitor and measure the effectiveness of the asset management system,

ial and non-financial performance (including the extent to which the organisation

nd evaluation to ensure results are valid deviation from the required level of performance, and if appropriate identify as a non-

ysis and evaluation

of its asset management system, in accordance with stakeholder requirements. set management performance reporting through the organization appropriate to the

and lagging performance measures for its asset management processes naging risks and opportunities in the asset management system and reports on their

nagement system monitoring, measurement, analysis and evaluation of the asset hey are found to be beneficial and cost effective. nagement system monitoring, analysis and evaluation.

s and processes.

ccordance with its programme, to confirm that the asset management system

content of internal audit of its asset management system

nually develops the audit programme to reflect the relative importance of the audits

are objective and impartial by:

having direct responsibility for the activity being examined.

nitions for scope and audit criteria

he appropriate level of management

ne asset management system, to ensure its suitability, adequacy and effectiveness,

ed schedule

anagement reviews

e asset management system

corrective actions, results derived from monitoring and measurement, and audit

les

hanges needed to the asset management system of the top management review.

A	sset	set Management Anatomy Question Set						
		Asset Costing and Valuation	An organization's processes for defining and capturing 'as built', maintenance and renewal unit costs and the methods used by an organization for the valuation and depreciation of its assets.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	 The organisation has identified the need to address this subject, and there is evidence of intent to develop it. Processes are poorly controlled and reactive. Performance is unpredictable. Proposals may be under development and some basic requirements may be in place. 	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a reactive mode but able to achieve expected results on a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	 38.1 The organization determines the financial and tecassets. 38.2 The organization ensures that data and information and regulation determines that these data and a)legal and regulatory obligations b)stakeholder requirements c)needs to make informed decisions on asset managem 38.4 The organisation has an Asset valuation register at a 38.5 The organisation has documented processes for constrained qualitative analytical measures and also the import 38.7 The organization implements changes to the mean that support asset costing and valuation where it is bert 	
	20		The methods an organization uses to engage with stakeholders.	• The organisation has not recognised this subject and/or there is no evidence of commitment to develop it.	and reactive. Performance is	 The organisation has identified the means of systematically and consistently achieving competency in this subject, and can demonstrate that these are being progressed with credible and resourced plans. Processes may be planned, documented, applied and controlled at a local level or within functional departments, often in a repeatable basis. The processes are insufficiently integrated, with limited consistency or coordination across the organisation. 	39.1 The organization identifies the people and organizal) a) can have an impact on the asset management system b) can experience the consequences of actions and deci- c) perceive that they could be affected by actions and d 39.2 The organization has developed and implemented a) the needs and expectations of stakeholders with resp b) the criteria which are to be considered when making c) the range of asset management information that is no d) the necessary arrangements to report the informatio 39.3 The stakeholder identification process and engage account the organization's external and internal contex 39.4 The stakeholder identification process and engage internal conditions and updated to ensure it they rema 39.5 Consultation with, and reporting to, stakeholders to the needs of each of the stakeholders	

technical data and information that is necessary to enable the management of its

ation are aligned to the achievement of the organization's objectives. nd information enable the organization to fulfil its:

gement issues

r and a documented valuation methodology

r capturing 'as-built' capital costs.

nnical data and information periodically in the light of developments in quantitative portance and complexity of the decisions being made

neasurement, collection and analysis of financial and technical data and information beneficial

anizations that:

tem,

decisions arising from the asset management system,

decisions arising from the asset management system.

ted a strategy to engage with stakeholders. This includes determination of:

espect to asset management,

ing decisions in asset management,

necessary to support stakeholder relationships,

ation to internal and external stakeholders

agement strategy are aligned with the Asset Management System and takes into ntexts.

agement strategy is are reviewed periodically in light of changes to external and mains effective

ers is conducted at a frequency and in formats, language and level of detail suitable

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 67 of 166

Appendix B Records of Workshop and Meeting Notes

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 68 of 166

Jacobs

Meeting Minutes

245 Consumers Road, Suite 400 Toronto, Ontario M2J 1R3 Canada T + 1.416.499.9000

www.jacobs.com

Subject	GDS - Strategy and Planning Mee	ting Notes	
Project	Enbridge Asset Management Matu	rity Review	
Project No.	CE777500	File	2020-07-27 GDS Strategy and Planning - Meeting Notes
Prepared by	Catherine Simpson, RPP, MCIP	Phone No.	604-346-9428
Location	Web-based	Date/Time	July 27, 2020
Participants	Catherine McCowan, Manager Risk Danielle Turney, Specialist II AM In Erik Naczynski, Manager Asset Class Michael Vettese, Specialist II AM St Danielle Dreveny, Supervisor Capit Mike Hildebrand, Mgr Asset Classe Steve Dinopoulos, Specialist Proj P Kevin Bando, Manager Operations Angela Scott, Manager Integrity M	tegration ses Distribution ations al FP&A s Storage & Transm lan Design	iission
Observers	Rebecca Mayhew, EAM Governance	5	
Facilitators	Andy Whittaker, Jacobs Catherine Simpson, Jacobs		

Notes		Action
0	Introductions (Gas Distribution)	
	 Part of way through the second year of AM program 	
	 Did an assessment a couple years ago 	
	 Refocused plans and resources where needed 	
	 Objective is to hit targeted step changes within certain areas of EAM 	
	 Engaged Jacobs – endorsed IAM assessors 	
	 First chance to baseline as an integrated utility 	
	 Today: Run through IAM 39 elements (20 this morning focused on strategy and planning) 	
	 18 priority subjects previously identified which we will concentrate on more 	
	 Working towards a consensus 	
	 Wil document rationale behind score, and evidence 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 69 of 166



Meeting Minutes

Notes		Action
1	Asset Management Policy	
	Current Rating	
	- 3	
	 Rationale 	
	 Policy in place and updated annually to reflect organizational priorities 	
	 Incorporated in strategic asset management plan 	
	 Published in public record 	
	 Communication and training to lowest levels of the organization may not be all the way there 	
	 Field staff (such as, a meter reader) probably can't recite the policy 	
	 There is awareness more than being able to recite the policy; can find quickly when a search is done 	
	 There is a gap on processes being sufficiently implemented 	
	 Everything identified under maturity level 3 is applicable 	
	Evidence	
	- Policy	
2	Asset Management Strategy & Objectives	
	 Current Rating 	
	 2.5 SAMP 2 AM objectives 2 overall 	
	 Rationale 	
	– Have a SAMP	
	 Roadmap for target operating model but that's separate from SAMP and is not measurable 	
	 Measurability of some objectives a challenge 	
	 Need to re-think; not final or rolled out to organization 	
	 Have financials but not solid; have measures and pieces but two sides of the organizations coming together and still need work; can't get consensus on demonstrability of effectiveness of organization; work in progress 	
	 Have top level performance measures but not linked to asset base 	
	 Performance varies across asset classes: non-gas assets pretty clear; to a greater extent with distribution assets; fall down in other areas like tying compression reliability with criticality of specific assets 	
	 Process not integrated 	
		1

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 70 of 166



Meeting Minutes

GDS - Strategy and Planning Meeting Notes July 27, 2020

Notes		Action
	 Process documentation could be stronger Evidence SAMP Target Operating Model – Roadmap Top level performance measures 	
3	 Demand Analysis Current Rating 3 but will follow-up with some other individuals Rationale Area of strength – planning and network analysis both have annual processes that re-evaluate need for product Get expansion and growth projects into the plan for analysis We are very good at this as a core business; things we could do better would take us to a 4 This is an opportunity Evidence Other People to Engage Contract sales – Previously Ryan Oregon's team 	Rebecca to identify specific people for follow-up; Jacobs to follow-up
4	 Business development – Hillary System planning Distribution planning Storage planning Connected to network analysis Strategic Planning Current Rating 	
	 3 at least Rationale In good shape financially; taking inputs on demand forecasts and ensuring relationship to AM; from overall financial forecast ensuring alignment with strategic planning Various levels of risk-based analysis on parts of asset Asset plans for each asset class has a set of asset strategies: Section 5 of asset plan there is a set of documents and strategies that outline balancing risk and safety, capital and O&M, etc. All in alignment of business Have strategic planning processes in place for demand forecasts for growth and to address existing asset base 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 71 of 166



Meeting Minutes

Notes		Action
	 Documented growth and need to expand based on specific regulations (such as, energy board) Evidence Asset Plans Processes (such as, demand forecasts) 	
5	Asset Management Planning	
	 Current Rating 2.5+ 	
	 Rationale 	
	 Hitting most but missing resource requirements to get to plan (not understood or documented) / end state 	
	 Asset managers do review plan with executing groups to ensure ability to implement; and make changes if need 	
	 Connecting engineering resources to plan is cursory and room for improvements; don't have a direct line between \$s spent and number of engineering hours 	
	 Give and take; best is review with stakeholders after1st iteration of optimization and adjust accordingly; facilitate conversations 	
	 Focus on execution hours as opposed to things required to get projects ready 	
	 What new O&M requirements not consistently understood (based on new projects, there isn't a lot of rigor to O&M associated – S&T time for example there isn't a lot of solid analysis) 	
	Evidence	
	 AMP exists (latest edition to be published in Aug) 	
6	Capital Investment Decision-Making	
	Current Rating	
	2.5 or 3 during discussion2.5 consensus	
	 Rationale 	
	 Pretty strong with capital investment decision-making 	
	 Risk assessments with rules on when higher level assessments are undertaken 	
	 Effort on capital investment decisions high; have strong documentation and planning to inform decision-making 	
	 Not a well-oiled machine; road feels bumpy; have alignment and systematic method in place but fine tuning is needed 	
	 Using C55 but O&M is missing in part; more rigorous on capital 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 72 of 166



Meeting Minutes

Notes		Action
	 Depends on asset class 	
	 For some assets there is a need to improve clarity for process 	
	Evidence	
	 Business case processes - flow charts 	
8	Life Cycle Value Realization	
	 Current Rating 	
	 2 at best 	
	- 1.5 consensus	
	 Rationale 	
	 Not systematically and consistency achieving competency on O&M 	
	 Do in key areas and those with risk drivers 	
	 Unsure if this is done well in areas that aren't tied directly to capital spend projects 	
	 S&T side more reactive 	
	 Non-gas carrying assets are stronger 	
	 Know what we need to do in some cases 	
	 Explored ability to manage lifecycle costs; a lot of room for growth 	
	Evidence	
	 Example: fleet being done well 	
11	Technical Standards & Legislation	
	Current Rating	
	 2.5 to 3 during discussion 	
	 2.5 consensus A lot of evidence to point to a 3 	
	 Rationale 	
	 Note: Associated primarily with design phase of assets to apply to a 	
	design or modification to ensure meeting of external requirements (regs.) but also good practice	
	 Definitely have his for commodity carrying assets 	
	 Have for buildings also - have standardized documents to allow for consistent and repeatable design and execution of real estate 	
	 Higher level of maturity on gas carrying side and for engineering 	
	 Regulatory management of change with group that changes the standards and is sent through Maximo for determination about whether this affects asset management 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 73 of 166



Meeting Minutes

Notes		Action
	 In middle of integration so have 2 sets of standards, processes and procedures (each legacy company had this); this is a 3-4 year process to update documentation to one company 	
	 Exist in legacy organizations – whole change processes in place along with approach to use until transition is complete 	
	 Our maturity as one integrated organization is lower 	
	 Have had a mismatch in technical standards between head office, engineering office v. major/core projects; may not have a harmonized set of design standards and has been a struggle in the past 	
	 Some mismatch has been cleaned up; core project team is to build standards in place at that location (local legacy standards); not a consistent standard but do have a consistent process 	
	 Gaps: slight lack of clarity and integration of two organizations 	
	 Confirm that it's clear to construction groups what standard they are building to 	
	Evidence	
	 Standardized documents 	
	 A lot of evidence 	
12	Asset Creation & Acquisition	
	 Current Rating 	
	 1-2.25 during discussion 2.25 consensus 	
	 Rationale 	
	 Have a recent initiative to develop a standard and process for asset turnover between projects organization and operations 	
	 Great training plans, maintenance strategies, commissioning activities do a really great job 	
	 Do a good job but would have a hard time producing documentation on commissioning and back-end handover 	
	 Front end design processes with projects organization follows a project lifecycle gating controls process which is very robust 	
	 Need for more rigor with turnover 	
	 Do thousands every year and well laid out and understood (front end) for service installations 	
	 Changes and modifications are spotty 	
	 Evidence 	
	~ Training plans	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 74 of 166



Meeting Minutes

Notes		Action
	 Maintenance strategies Standards Handbook for service installations 	
21	Asset Decommissioning & Disposal	
	 Current Rating 	
	- 2 strong	
	 Rationale 	
	 Don't do a good job of planning for rotating asset with a costly inventory of spares 	
	 Decommissioning is when people start the discussion but have had challenges with people not wanting to take responsibility for cost of disposal 	
	 Not thinking about end of life when building new assets – this is an afterthought 	
	 Reasonably well accommodated from a financial aspect 	
	 Yes, there is a future abandonment cost assigned 	
	 A bit reactive when it actually happens 	
	 Part of standard processes – well built in for most of asset base 	
	Evidence	
	- Processes	
27	Asset Management Leadership	
	Current Rating	
	 3 strong, pushing beyond 	
	 Rationale 	
	 From the top down; senior levels of leadership are demonstrating leadership and commitment 	
	 Huge level of commitment to asset investment planning process, risk, decision-making 	
	 Have commitment for whole life approach for assets but we need to execute on this 	
	 Resources are there and support from top is there 	
	- We have an entire AM function for organization	
	 Can't go to average employee about AM and their support and connection to it; but it is there at the top 	
	Evidence	
	 Cynthia's webcast recently (presidential level down) Monthly steering committee VP of engineering and AM 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 75 of 166



Meeting Minutes

Notes		Action
	 President is head of EAM work President of GDS is supporting organizational AM 	
28	Organizational Structure	
	 Current Rating 	
	 3 or 2.5 during discussion 3 consensus 	
	 Rationale 	
	 AM structure is solid, but business has a different (lower) score 	
	 Path is generally well understood to organization 	
	 Asset plan is part of regulatory requirements and need to follow path to money 	
	 Key areas around risk assessments with lack of clarity has been identified and actively working to resolve 	
	 Integration and level of ambiguity still an issue; may be some areas that are ambiguous, but they are smaller 	
	 A couple areas around integration of legacy businesses are being sorted out, such as risk 	
	 Evidence 	
29	Organizational Culture	
	 Current Rating 	
	 2.5 or 3 during discussion 	
	– 3 consensus	
	 Rationale 	
	 For operations yes but there is room for improvement 	
	 Overall everyone follows process 	
	 Now that we're regional we don't meet with different groups the same way – hope what you're doing is aligned with what others are doing but seems pretty consistent from results that have been seen 	
	 Good culture and support from director level such as, asset investment planning process and capital portfolio 	
	- So deep into AM part of business but Kevin's opinion is a strong driver	
	Evidence	
30	Competence Management	Rebecca to confirm specific people sucl

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 76 of 166



Meeting Minutes

Notes		Action
	 Competent at creating a framework for what's needed and then going through process to recruit or train to move towards set of competencies looking broadly across core functions contributing to AM 	as Bridget (training) and HR; Jacobs to
	 Current Rating 	follow-up
	- 1.5 or 2 during discussion	
	 2 consensus with need for follow-up 	
	 Rationale 	
	 Well-developed training programs for critical roles, still working on others 	
	 Good practice in O&M where operator practices are well defined, but other parts of the organization are not as well defined due to high turnover rate 	
	 High turnover rate so don't stick around long enough to be competent; have defined job roles; prefer to leave Toronto to go to the regions 	
	 Is this a gap in marketplace (i.e. outside influence affecting this?) 	
	 Storage and transmission operations has a number of roles – don't hire someone into role, they must require a 4-year progression and hit benchmarks (don't have fully developed) 	
	 Yes, doing for other areas – we know what we want but it's finding the people 	
	 Integration complicates this 	
	 Very solid training program 	
	 Storage and transmission isn't to the same level 	
	 Quite a bit of variability across areas 	
	 Pretty good competency management system for operators (field workers) but integrity identified need for better competency within integrity team 	
	Evidence	
	-	
	 People to follow-up with 	
	 Bridget Sneedon – training 	
	 HR – how resource plans are developed, and skillsets are identified 	
31	Risk Assessment and Management	
	Current Rating	
	- 2-2.5 during discussion	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 77 of 166



Meeting Minutes

Notes		Action
	- 2.5 consensus	
	 Rationale 	
	 Risk assessments are identified 	
	 Region by region we're still reactionary 	
	 Have processes in place that are working, and things are happening 	
	 Have a consistent approach to what's being replaced 	
	 Both legacy organizations have had risk processes in place for years 	
	 Opportunity because people are doing risk in different ways 	
	 Starting to see a similar mindset but opportunity for growth 	
	 Have a centralized 7x7 matrix that's intended to capture opportunities as well as bad risk 	
	Evidence	
	 Centralized 7x7 matrix 	
33	Sustainable Development	
	Current Rating	
	 2.5 or 3 during discussion 	
	- 2.5 consensus	
	 Rationale 	
	 Take into account environmental concerns and public perception in risk matrix 	
	 Done customer surveys on drivers for spending more now or in the future 	
	 May not all be in SAMP and AMPs 	
	 Stuck on the term perpetuity – forever is an unobtainable 	
	 Really mean it when we set out environmental goals 	
	 C55 decision criteria we're genuinely putting projects in place to deliver on this 	
	 Trying to reduce GHGs and leakage rates 	
	Evidence	
	 Customer surveys on drivers for when to spend 	
	– SAMP	
34	Management of Change	
	 Current Rating 	
	- 2.5 or 3 during discussion	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 78 of 166



Meeting Minutes

Notes		Action
	- 2.5 consensus	
	 Rationale 	
	 Have process and may not be communicated to average employee 	
	 Have list of materials for replacement; need to follow process and it's pretty well understood 	
	 Can provide process and examples 	
	 Great for light changes 	
	 Better for material than for people 	
	 Documented for people but very unclear (such as, turnover) 	
	 MOC initiated recently for a new role 	
	 Are actively doing but maybe not for all levels and all areas 	
	Evidence	
	 MOC process supported by organization 	
36	Asset Management System Monitoring	
	Current Rating	
	- 2-2.5 during discussion	
	 2 consensus but pushing to 2.5 	
	 Rationale 	
	 Reporting up to top management 	
	 There are a series of measures being monitored 	
	 Struggle most with effectiveness 	
	 Overall well monitored 	
	 Part of integrated management system 	
	Evidence	
	 Regular meetings – program within integrated management system 	
	 Today's assessment 	
37	Management Review, Audit and Assurance	
	Current Rating	
	 1 or 1.5 during discussion 	
	– 1 consensus	
	 Rationale 	
	 Have an internal audit team 	
	 Have not directed them to asset management 	
	 AM not a regulatory requirement so instructed not to proceed with as part of internal audit 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 79 of 166



Meeting Minutes

Notes		Action
	 Instead will look towards an external reviewer 	
	Evidence	
	-	
38	Asset Costing and Valuation	
	 Current Rating 	
	- 1.5-2 during discussion	
	 1.5 strong consensus 	
	 Rationale 	
	 Depends: some very good – average cost for plastic service installation and assigning work in the field; fall down where we don't need to book time to work orders, or materials aren't put in work orders 	
	 SAP good on compression and those assets 	
	 Legacy union had cost of meter of installed pipe so in terms of construction costs we are doing well. 	
	 construction costs we are doing well Station related assets: pretty good since 2016 for commercial meter sets since SAP was implemented 	
	 Not sure about smaller assets such as residential meter sets 	
	 Non-gas carrying assets would be harder (such as, electronics on a station) 	
	 Fleet would be better 	
	 Each one is a fixed asset; on estimates to build we're pretty good; pretty good overall 	
	 Spotty on pulling together and using information; not well developed 	
	Evidence	
	-	
39	Stakeholder Engagement	
	Current Rating	
	- 1.5	
	 Rationale 	
	 Don't currently do a lot of formalized AM stakeholder engagement 	
	 Have done customer surveys but haven't shared back plans to get feedback because of recent integration 	
	 Stakeholder engagement not to par with other organizations 	
	 Do well with internal stakeholder engagement 	
	 Missing 'play back' to ensure that we're getting this right 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 80 of 166



Meeting Minutes

Notes			Action
		 Will likely undertake more stakeholder engagement in the future 	
	•	Evidence	
		a	

CREDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 81 of 166

Jacobs

Meeting Minutes

245 Consumers Road, Suite 400 Toronto, Ontario M2J 1R3 Canada T +1.416.499.9000

www.jacobs.com

Subject	GDS - Operations, Management a	nd Data Meeting No	otes
Project	Enbridge Asset Management Matu	rity Review	
Project No.	CE777500	File	2020-07-28 GDS Data and Operations - Meeting Notes CAS
Prepared by	Catherine Simpson, RPP, MCIP	Phone No.	604-346-9428
Location	Web-based	Date/Time	July 28, 2020
Participants	Catherine McCowan, Manager Risk Andrew Welburn, Manager Asset D Taylor Jones, Specialist II AM Distri Pamela Callow, Supervisor Process Jim Harradine, Mgr Operations & M Hugh MacMillan, Mgr Fin/Law/Aff Todd Piercey, Manager Pipeline En Ahmed Nossair, Mgr Stations & Uti Johanna Sanchez Gomez, Manager	ata & Information ibution Pipe Attachment & Cons Maintenance Engine /Data/Support gineering lizations Engineerin	ering
Observers	Rebecca Mayhew, EAM Governanco Caryn Campbell, Manager EAM Pro		
Facilitators	Andy Whittaker, Jacobs Catherine Simpson, Jacobs		
Apologies	Andrew Calder, Manager Fleet Erik Naczynski, Manager Asset Clas	ses Distribution	

Notes		Action
0	Introductions (Gas Distribution)	
	 Part of way through the second year of AM program 	
	 Executive leaders asked for a check-in 	
	 Did an assessment a couple years ago 	
	 Refocused plans and resources where needed 	
	 Part of a continuous improvement process 	
	 Objective is to hit targeted step changes within certain areas of AM 	
	 Engaged Jacobs – endorsed IAM assessors 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 82 of 166



Meeting Minutes

Notes		Action
	 First chance to do an assessment as an integrated utility 	
	 Today: Run through IAM 39 elements (19 this morning focused on operations and data) 	
	 18 priority subjects previously identified which we will concentrate on more 	
	 Working towards a consensus score on each subject 	
	 Will document rationale behind score, and evidence 	
7	Operations & Maintenance Decision-Making	Rebecca to
	Current Rating	identify
	 2 or 3 and beyond in some areas 	specific people for
	- 3 consensus	follow-up
		with, if
	 Reflective of IT asset class; O&M is based on business requirements; SAMP has documentation on lifecycle refresh on hardware but for software business requirements there is no documentation 	necessary; Jacobs to follow-up
	 Pipeline: key O&M is dictated by code (such as, leak management) 	
	 From an integration perspective moving towards having one set of documents to show how the company meets code requirements (frequency for assets; inspection frequency, established procedures for how to complete maintenance) 	
	 Different systems for record keeping but working towards one: legacy union uses SAP 	
	 Stations: most of maintenance and inspection frequencies are well defined in MSN procedure or CNN standard 	
	 Using two systems to manage work that will be integrated into one; will be in much better shape 	
	 Suite of things: regulatory requirements, manufacturers recommendations, RCM, etc. 	
	 Majority of assets has frequency for maintenance and inspection and working towards a common frequency as part of integration – not starting from scratch; are very well positioned 	
	 Taking a company-wide approach of preventative maintenance and protective maintenance through integrity program – both approaches defined by history of failure, manufacturers recommendations, etc. 	
	 World is changing and advancing but we are still using the same equipment 	
	 Distribution side – assets designed with a simple approach and high- level monitoring of how process is managed 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 83 of 166



Meeting Minutes

tes			Action
	-	Gas turbine is more complicated with monitoring to show degradation	
	-	Changes in frequency would be based on learning out of industry	
	-	Assets aren't undergoing significant technological changes	
	-	Drive a lot by Canadian code and legislative requirements; standards get updated every 5 years, but O&M hasn't changed significantly; documents and practices are reviewed, and this is triggered when a standard is changed	
	-	Clear suite of methods in place to drive maintenance, regulatory requirements, RCM processes, manufacturer's recommendations	
	-	Are monitoring what's going on with performance, and changes in standards as well as in industry	
	-	Storage: engineering group focuses on compression within stations but also appurtenances; different than traditional gas carrying assets but do support the gas carrying system;	
	-	Looking after rotating assets it's a blend of predictive and reactive maintenance but moving more towards predictive maintenance	
	-	Have piloted some stations for predictive and found that predictive isn't a good fit for the whole facility – looking at extremely high reliability at the best cost	
	-	Have a score card and requirement to meet reliability levels	
	~	Will use predictive outlooks where it makes sense and working to expand across all systems	
	-	Do run to end of life where possible	
	-	Front line staff do day-to-day work and flag anomalies back into work order system	
	-	Track anomalies and respond where necessary, engaging the OEM and engineering group where necessary	
	-	6 engineers that provide support to the field	
	_	Have root cause failure when complex failures occur	
	-		
	-	Siemens was doing live monitoring on a turbine for a year but found cost didn't derive the anticipated value but did learn things from it	
	-	Have old equipment from 50s that's running reliably but coming up for replacement; have replaced some units from 70s and 80s because they have become obsolete	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 84 of 166



Meeting Minutes

Notes			Action
		 Still harmonizing; maintenance schedules are working and effective but opportunity to be consistent across both legacy organizations 	
		 Most of risk is coming from damages and third-party intervention; based on results we are not lacking 	
		 Both legacy companies rate high so even though still bringing them together that will enhance business and risk management; it's been successful so far 	
		 Value package; a lot of maintenance and rotating equipment for larger assets; smaller asset maintenance addressed based on appropriate scale; geared appropriately for varying asset types 	
	-	Evidence	
		- MSN procedure	
		~ CNN standard	
	=	Other People to Engage	
		 Steve Party – storage element (integrity program designed around that); Angela was on yesterday's call and touched on this 	
9	Res	sourcing Strategy	
	E	Current Rating	
		- 1 to 2 during discussion	
		- 1.5 consensus	
	E	Rationale	
		 From a pipeline standpoint it's hit and miss 	
		 Don't often have a clear view of resourcing – made aware of projects as they come in for approval and hard to look at smaller jobs and tie that to specific requirements within asset plan 	
		 Larger projects provide a better view 	
		 More reactive than proactive 	
		 From an executability perspective we work to ensure balance across Regions but from a supporting perspective there are gaps (engineering, drafting, planning, etc.) 	
		 Have plans in place and talk about this but reliance of third-party contractors is high 	
		 Hiring practices are interesting because focus is on future leaders but not hiring consistent people that will become subject matter experts 	
		 Resources to execute work in asset plan? Yes 	
		 Have a great tool to manage asset plan; lacks identification of resources from engineering to execution 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 85 of 166



Meeting Minutes

Notes		Action
	 Made a lot of progress in looking towards risk and from a planning perspective, but recognize that growth is reactive Limited consistency across organization Strong for 1st year but weaker longer term Evidence 	
10	 Shutdowns & Outage Strategy Current Rating 2 to 3 during discussion 2.5 consensus but will do some follow-up Rationale Storage and transmission: well defined process led by operations group – done at the beginning of construction year for current year; annual maintenance schedule is recurring with related outages; construction outages sit on top of that; have had some very complex outages over last few years and have addressed well Reliance on people but processes aren't as well documented Applicable in some cases; no major outages for distribution We design for minimal planned shutdowns, if any Have redundancy at 100% in summer; construction requires some shutdowns Extensive planning around overall shutdown strategy Designs ensure minimal outages Agree it's very reliant on people Used to be a weekly meeting on planed outages Evidence Cother People to Engage Follow-up re: redundancy, reliance of people and specifically details 	Rebecca to identify specific people for follow-up regarding reliability and specifically operations meetings as evidence; Jacobs to follow-up
13	regarding operations meetings Systems Engineering Current Rating Rationale Svidence	For follow-up

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 86 of 166

Jacobs

Meeting Minutes

Notes		Action
	e de la companya de la	
14	Configuration Management	For follow-up
	Current Rating	
	-	
	 Rationale 	
	-	
	Evidence	
	-	
15	Maintenance Delivery	
	 Current Rating 	
	 2 or 3 during discussion 	
	- 3 consensus	
	 Rationale 	
	 Have work plans in place (in SAP and Maximo) to manage annual maintenance 	
	 Blend of proactive, predictive and reactive maintenance 	
	 Review plans as OAMs change things - showing that we're achieving system equipment reliability for business 	
	 Do safety, on time and on budget, but adjust as required 	
	 Do a good job in 100% compliance of maintenance schedule 	
	 From a predictive and proactive approach there is more that we can do 	
	 All tracked through Maximo for legacy EDG 	
	 Get involved with non-conformance 	
	 On legacy union side there was a robust non-conformance process with heavy mitigations plans in place 	
	Evidence	
	 Score card on system equipment reliability 	
16	Reliability Engineering	
	Current Rating	
	- 2.5 consensus	
	 Rationale 	
	 Primarily distribution: legacy EDG had more robust procedures around equipment failures (such as, regulator valves) 	
	 Now there are triggers on failures for MEC lab with full-blown analysis resulting in a report to determine if it's a systemic issue 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 87 of 166



Meeting Minutes

GDS - Operations, Management and Data Meeting Notes July 28, 2020

Notes		Action
	 Can only be scaled for certain sized assets – may distribution assets 	
	 On compressor side the root cause analysis is managed and follow a similar process 	
	 Have changed maintenance practices based on failure analysis in some instances in the past 	
	 We go too far for some assets 	
	 Don't cover all of the asset base 	
	 Some processes new 	
	Evidence	
	-	
17	Asset Operation	
	 Current Rating 	
	- 2 or 2.5 during discussion	
	- 2 consensus moving towards 2.5	
	 Rationale 	
	 STO side yes, have operators, mechanics, plant operators and gas controllers and technicians that direct how we operate equipment 	
	 Have documented procedures 	
	 Working on a more robust training program 	
	 Successfully operating system and not seeing failures due to sloppy operations 	
	 Sit on operations manager committee; do often comment on resource challenges 	
	 Definitely competing priorities during summer months 	
	 Going through integration and adapting as we go 	
	 Are updating procedures and training; heavy reliance on subject matter expertise 	
	 Lost a lot of field experience with VWO 	
	 VWO: voluntary workforce options (approach to shedding 800 staff most left June 27 or July 10 with a few more leaving); starting to see impact of that 	
	 Strains on operations and reliance on knowledge 	
	 Evidence 	
	-	
18	Resource Management	
	 Current Rating 	
	- 2.5 consensus	
		1

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 88 of 166



Meeting Minutes

Notes		Actio
	 Rationale 	
	 Good on execution (O&M) but on support functions we're lacking (engineering, etc.) 	
	 Pretty solid at getting it done (delivering on plan) whether internal or outsourced resources 	
	 Very good on executing capital plan for the most part 	
	 Legacy union was stronger 	
	 Both good at executing on capital plan 	
	 There are few projects outside this year that are deferred because of resourcing, usually permitting, etc. 	
	 Skillset boundaries, for example overcommitting engineering and drafting resources 	
	 Run into challenges there and will outsource when that happens 	
	 Done a good job looking for \$s across organization to address needs 	
	 Better at managing than predicting resource needs 	
	 Emergencies are prioritized and everyone comes together to mitigate 	
	 Good at managing and bring in resources when needed 	
	Evidence	
	-	
19	Shutdown & Outage Management	
	 Current Rating 	
	 2.5 to 3 during discussion 	
	 2.5 moving towards 3 	
	 Rationale 	
	 More prevalent in STO division: robust plans in place built into annual maintenance plans (such as, turbines taken offline during off season); coordinated with operations and discussed in meetings; tentative dates and allowances for each plant; work planning group ensures package of permitting, etc.; execution group undertakes work 	
	 Planned release of gas – working to recover for a more environmental perspective 	
	 Within compression stations it's part of the maintenance program and built into procedures 	
	 Do best we can with equipment available 	
	 Have procedures in place for safe shutdowns of pipelines, how to properly blow down a pipeline, blowdown times, etc. 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 89 of 166



Meeting Minutes

Notes		Action
	 Safe procedures have quite a bit of documentation 	
	 A lot still falls on individuals 	
	 Emissions control and environmental performance linked to sustainability question from yesterday 	
	Evidence	
	~	
20	Fault & Incident Response	Jim Harradine
	Current Rating	to follow-up
	 2.5 to 3 during discussion 	re: reliability
	 2.5 approaching 3 consensus 	individuals; Jacobs to
	 Rationale 	follow-up
	 Other companies would have a reliability division; we do this with individual expertise as a function within the organization as opposed to a department 	with further discussion
	 SGO primarily leads this however safety and reliability group (incident management group) is adding additional discussion around review 	
	 Reliability group doesn't get into FMEA and RCA; they oversee review process 	
	 Individuals with a range of related backgrounds (such as, process safety and analysis) 	
	 Not a finely tuned machine; can be hit and miss because not all the right people are involved; things can sit for a bit 	
	 Very robust emergency response protocol; one of first things to be integrated – how to set up local groups and escalate up 	
	 Culture around safety is quite good 	
	 Corporate memory re: major incidents is good 	
	 Incident reviews – a lot of robust processes and procedures but opportunity to continue to improve (such as, getting right people at the table to ensure focus on the right things) 	
	 Great process of incident investigation 	
	 Area of opportunity to bring right people together 	
	 Don't have an RCA mechanism to address failures 	
	 We do look at failures to understand systematic issues and then feedback to determine if a program is needed to be more proactive; components in place 	
	 Missing a dedicated reliability function to drive significant improvement in design 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 90 of 166



Meeting Minutes

Notes		Action
	 Great way to report and capture learning; certain failures that don't become incidents; don't have a reliability function which would drive significant improvements 	
	 Response is good, backed by strong safety culture. Do investigations – thorough - but maybe not everyone is involved and may not do to desired level of rigor 	
	 Majority of incidents have a thorough incident analysis: respond to emergencies within 30 min, and achieve 99% of time 	
	 All involved in reliability 	
	 More work needed on incident investigation side 	
	 Evidence 	
	-	
	 Other People to Engage 	
	 Mike Scarland – incident management group 	
	 JH will look into who specifically is involved further 	
22	Asset Information Strategy	
	 Current Rating 	
	 1 to 2 during discussion 	
	 1.5 moving towards 2 (updating with corporate approach and wider range of info types and systems) consensus 	
	 Rationale 	
	 Strategic documents put together with asset information strategy 	
	 A lot of work over last few years as AM program initiated 	
	 Big focus recently on enterprise-level 	
	 Shifted back to business unit level, with a big push initially before integration 	
	 Now moving back to this strategy 	
	 Have been maturing 	
	 Information is used in a consistent manner: have standard queries; a lot of work to pull similar info from legacy companies 	
	 Still working on pulling info systematically and consistently 	
	 Have competency and well adept resources 	
	 Challenge is that information is not always readily available 	
	 Plan is in place, but timelines look out to 2023 	
	 Putting in an appropriate governance framework 	
	 Strategy in place at higher level about what's going to happen with Unify 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 91 of 166



Meeting Minutes

Notes		Action
	 Bringing in a new work management system 	
	 A financial system for Oracle has been brought in 	
	 Strategy for other systems is a work in progress – have had roadmaps developed but need to revisit based on new landscape with Unify roadmap 	
	 Eventually a lot of subsystems will be rolled into Maximo and are working on a roadmap to put those in place 	
	 Good pieces in place for the AIS, but there are gaps 	
	 Not aware of (for GDS) a specific asset information strategy document; each legacy company has own work management system and they have challenges 	1
	 Some maintenance work is done on the fly as found, without a work order 	
	 Robust system in place with a lot of systems and records documents elements in place but not aware of 1 document in place that brings it together 	
	 For the asset information strategy there is the technology as well as the processes and procedures and data and information and records; look at broader umbrella 	
	 Need work on how it knits together 	
	 There are discrepancies between legacy organizations and how things are brought together consistently, particularly on the data side 	
	 Had a strategy document but not well communicated and maybe not current or detailed enough 	
	 Worse than 2018 or same? A lot of challenges using the system without processes and procedures this year; not clear on transition to vision 	
	 Not worse, advancements made on enterprise front from unify and EAM and AIS 	
	 Have high level roadmap with timelines, etc. but they haven't been maintained as well as they could be 	
	 Have an AIS in place: perhaps narrow focus but doesn't have roadmap with breadth and longer term; hasn't been broadly communicated; needs updates 	
	Evidence	
	-	
23	Asset Information Standards	
	 Current Rating 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 92 of 166

Jacobs

Meeting Minutes

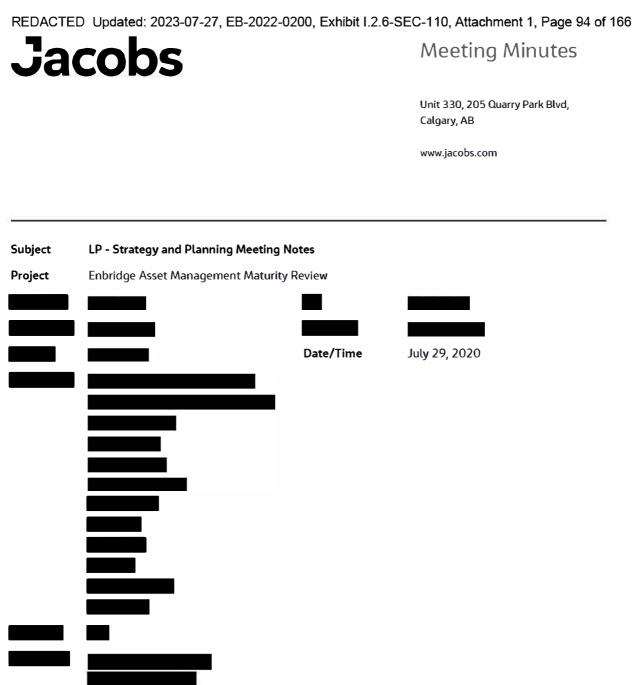
Notes		Action
	- 2 • Rationale	
	 Records side of things well defied – records from corporate level has guidelines, policies and procedures 	
	 Work to implement standards within gas distribution 	
	 Well off from a records perspective but gaps with things like system or record for storing records and will address over next year or so (some records on share point, personal storage, etc.); working to standardize 	
	 Data perspective: attributes collected consistently; systems in place but not necessarily enforced; mechanism there but not capturing some things 	
	 Data quality standards: work underway to put in place and address data quality; a lot of areas for improvement; in process of amalgamating information collection into one system 	
	 Quite a clear idea of where we're going 	
	 A lot of standards are defined in existing systems 	
	 Data standards aren't always adhered to with variability 	
	 Work in progress around integrating legacy businesses together 	
	Evidence	
	-	
24	Asset Information Systems	Remainder
	 Current Rating 	for follow-up
	-	
	Rationale	
	-	
	Evidence	
	-	
25	Data & Information	
	Current Rating	
	-	
	 Rationale 	
	ž	
	Evidence	
	-	
	Procurement and supply chain management	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 93 of 166



Meeting Minutes

Notes		Action
	 Current Rating 	
	-	
	 Rationale 	
	=	
	 Evidence 	
	-	
32	Contingency Planning & Resilience Analysis	
	 Current Rating 	
	-	
	 Rationale 	
	-	
	 Evidence 	
	175.	
34	Management of Change	
	 Current Rating 	
	-	
	 Rationale 	
	-	
	 Evidence 	
	-	
35	Assets Performance & Health Monitoring	
	 Current Rating 	
	 Rationale 	
	-	
	 Evidence 	

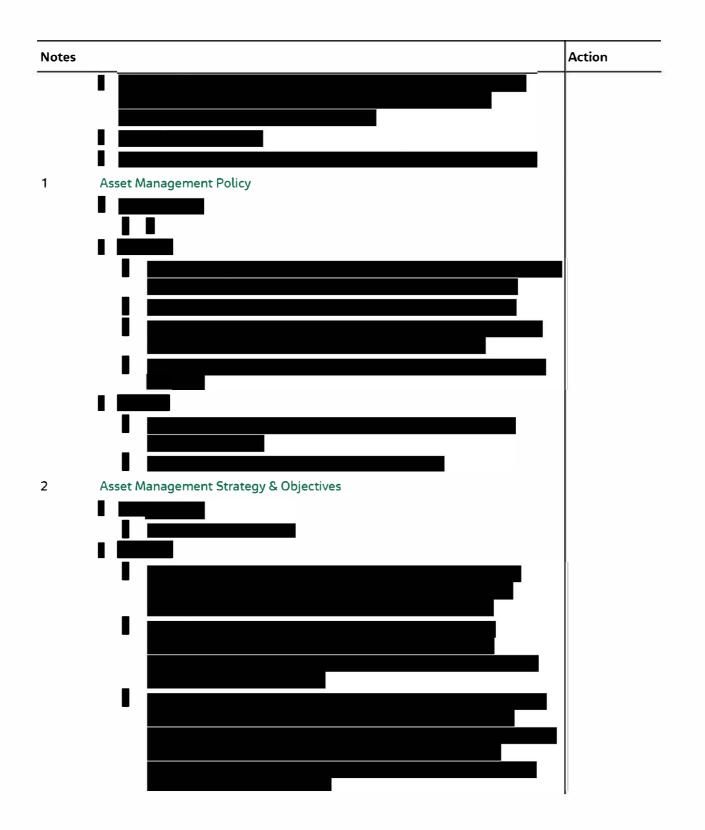


Notes		Action
0	Introductions (LP)	
		2

REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 95 of 166



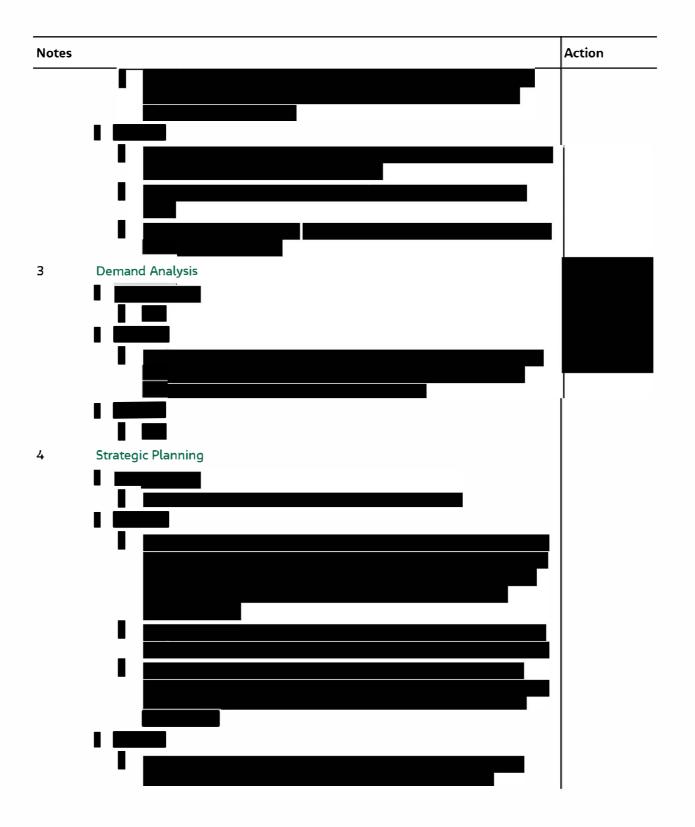
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 96 of 166



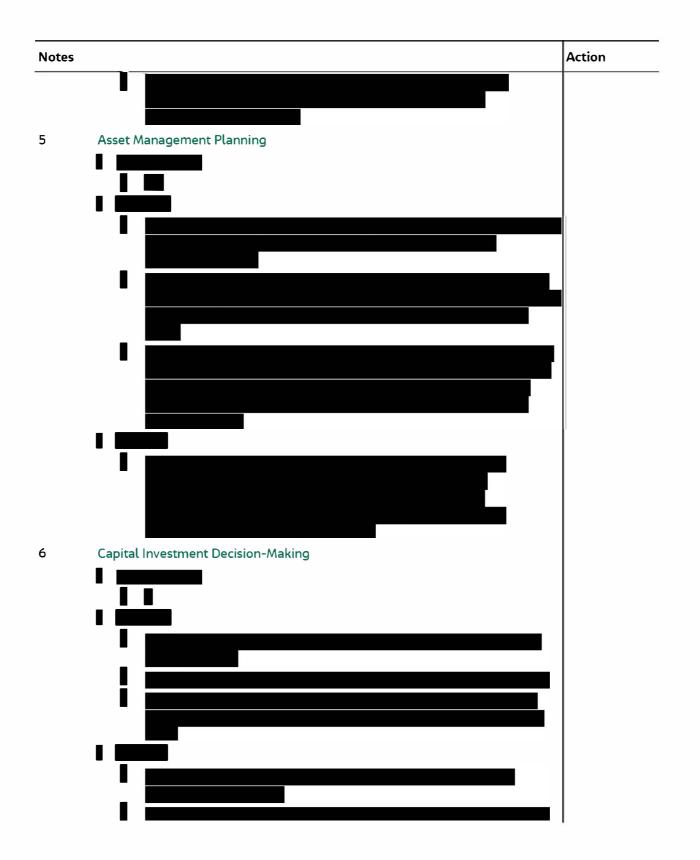
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 97 of 166



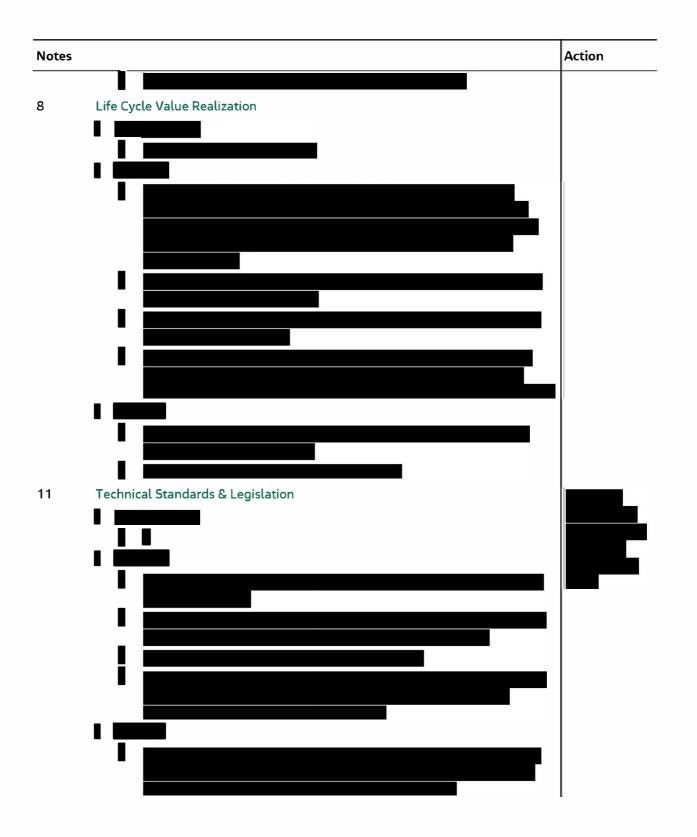
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 98 of 166



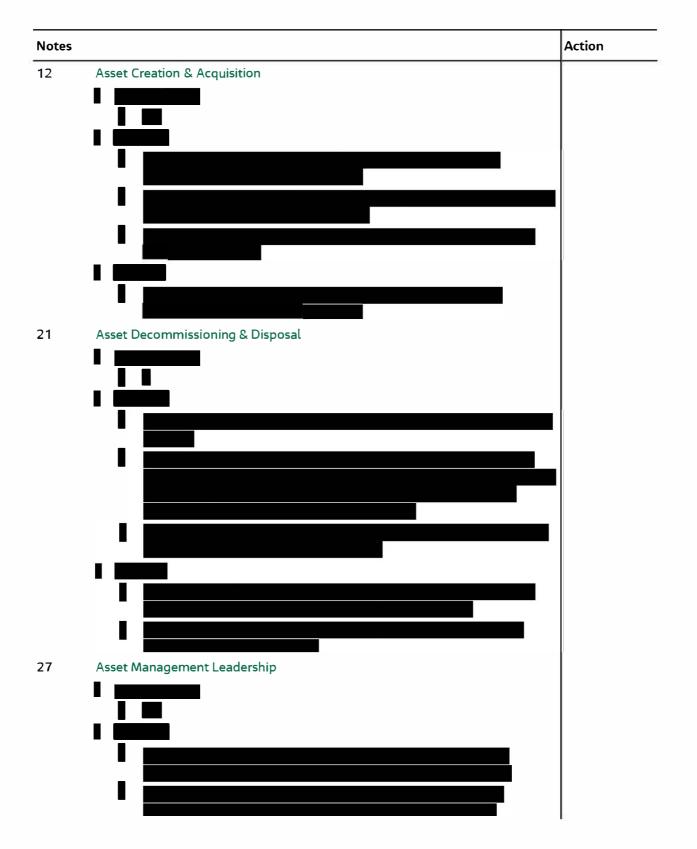
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 99 of 166



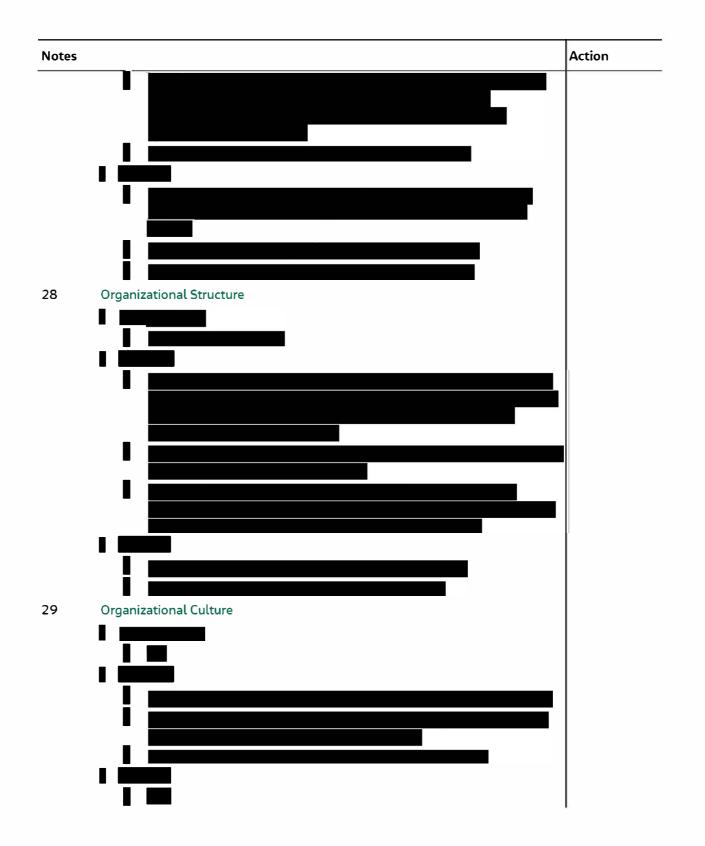
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 100 of 166



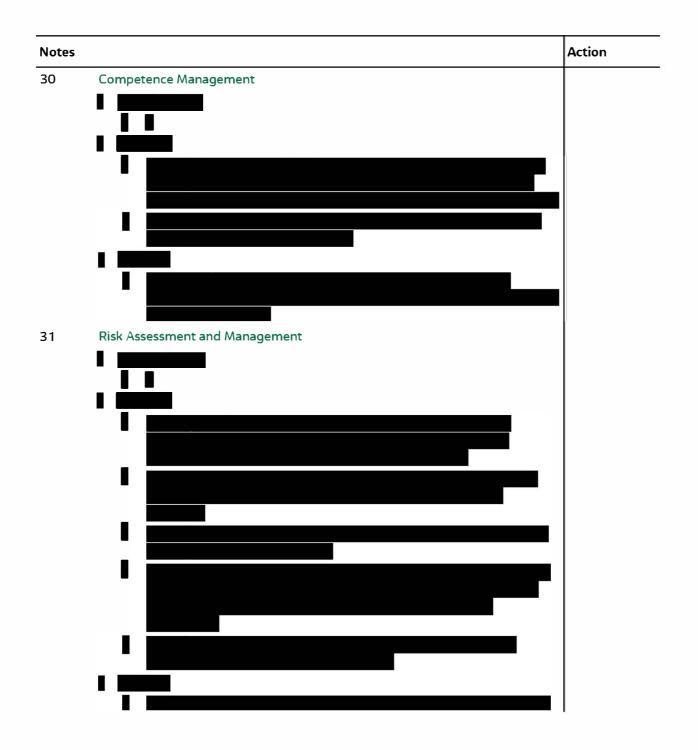
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 101 of 166



Meeting Minutes



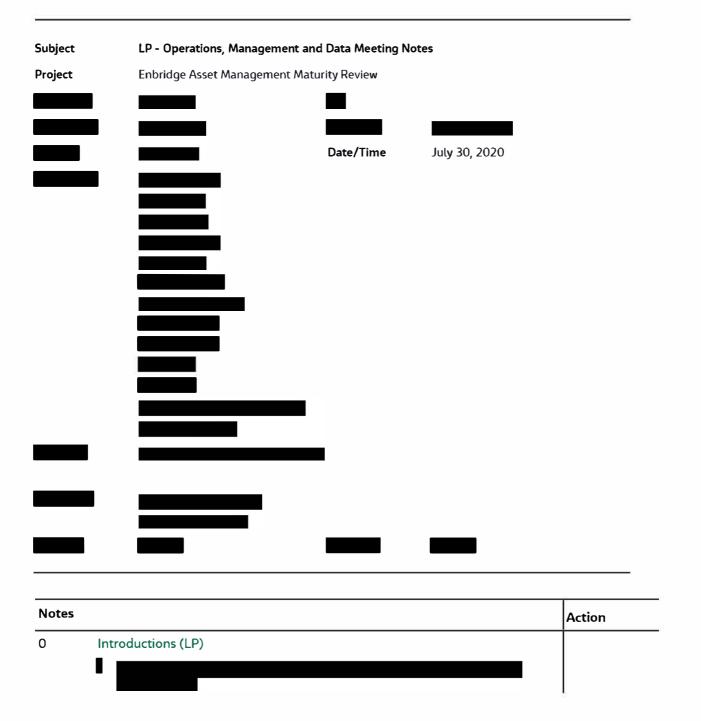
REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 102 of 166



Meeting Minutes

Unit 330, 205 Quarry Park Blvd Calgary, AB

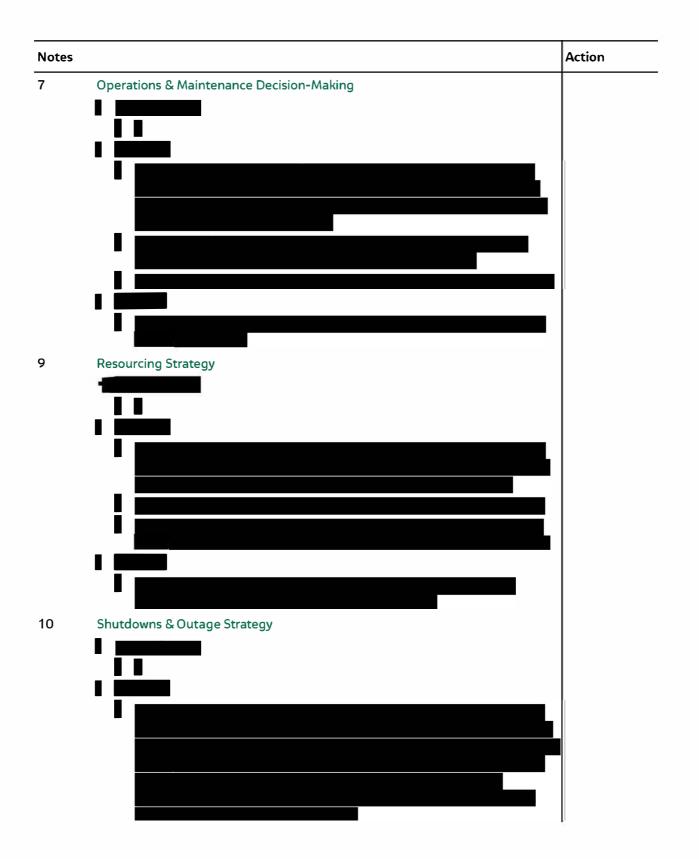
www.jacobs.com



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 103 of 166



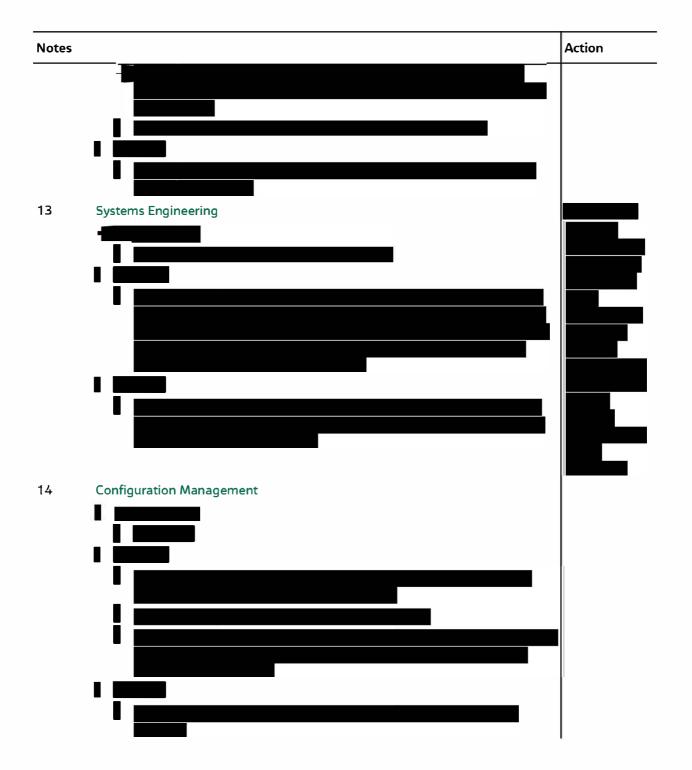
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 104 of 166



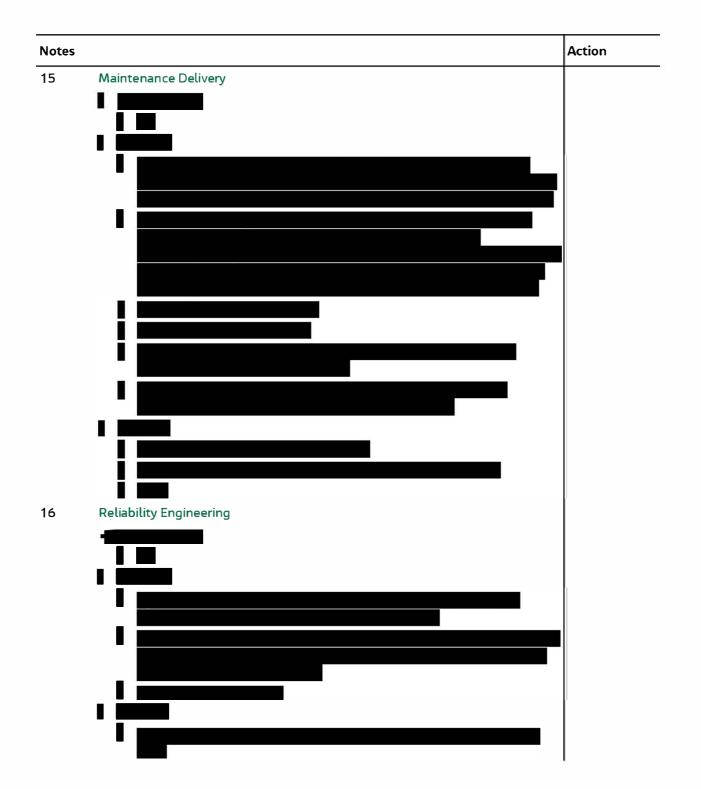
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 105 of 166



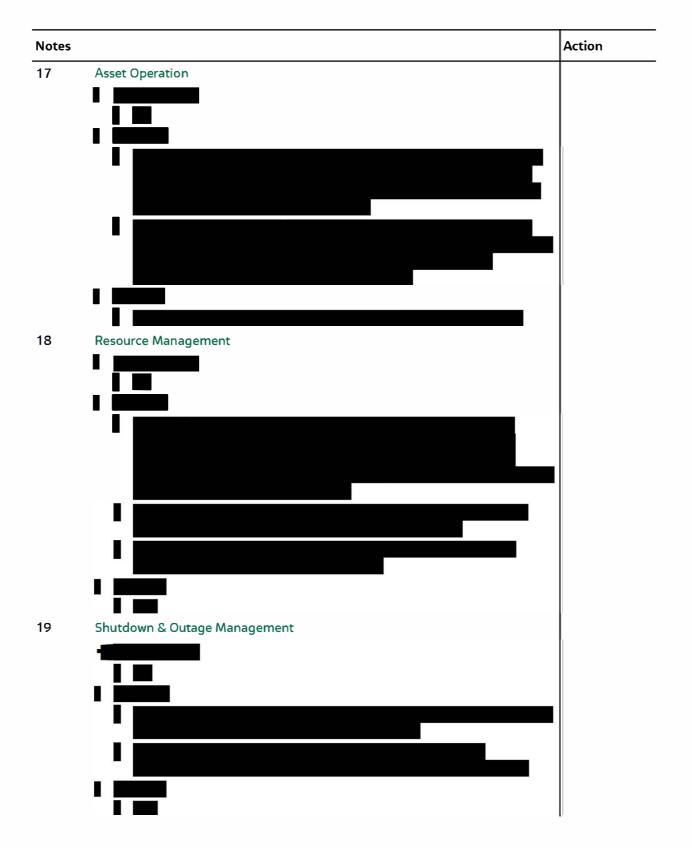
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 106 of 166



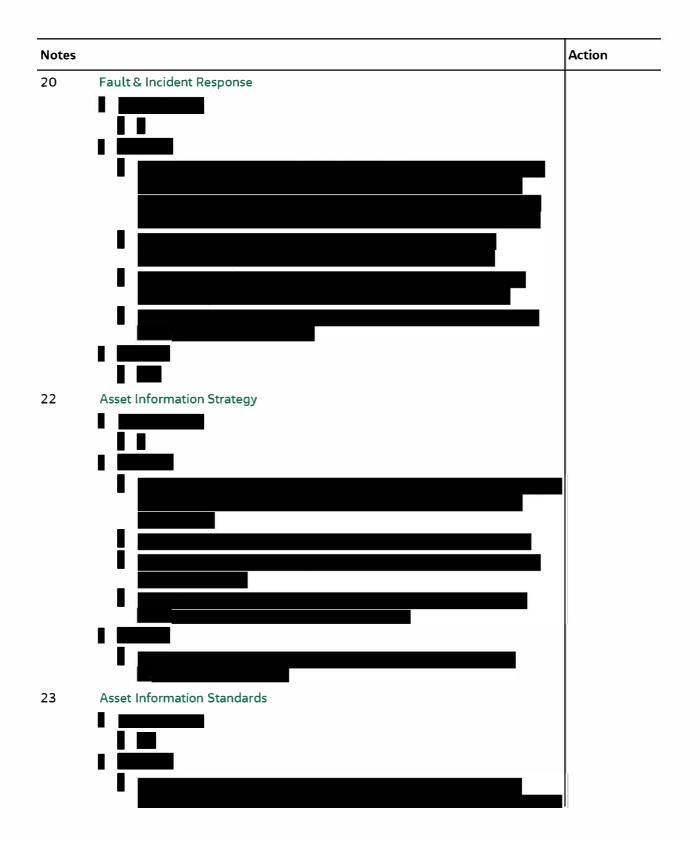
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 107 of 166



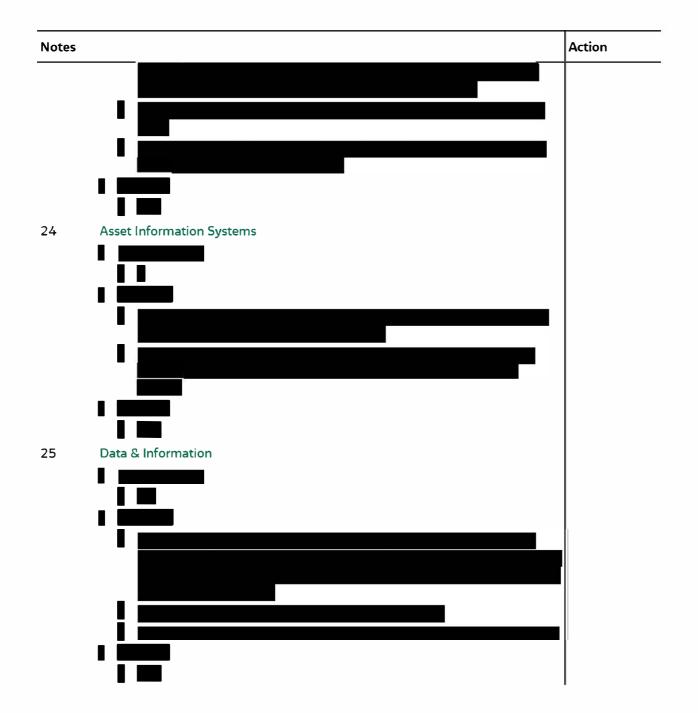
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 108 of 166



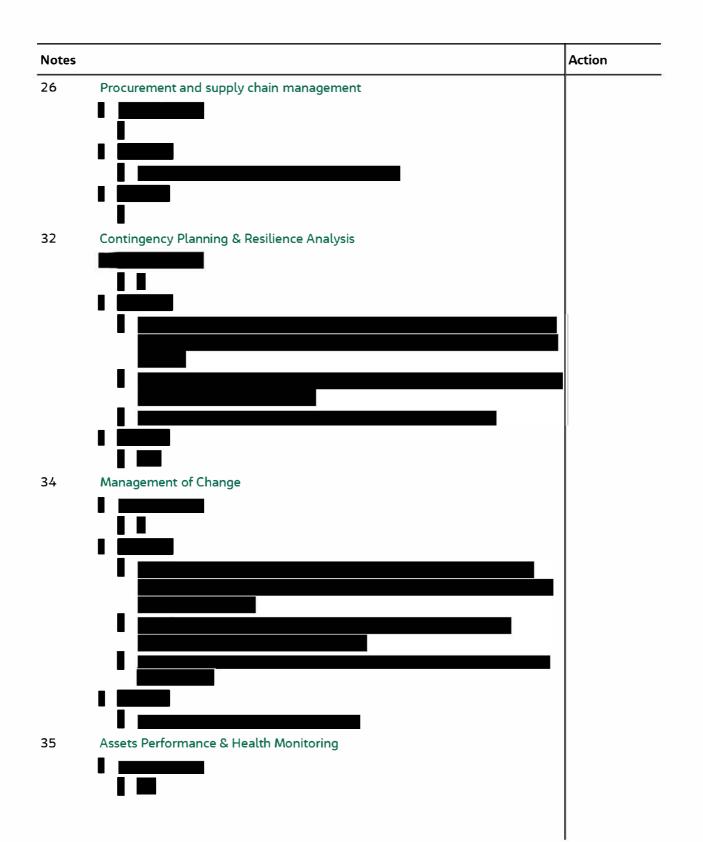
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 109 of 166



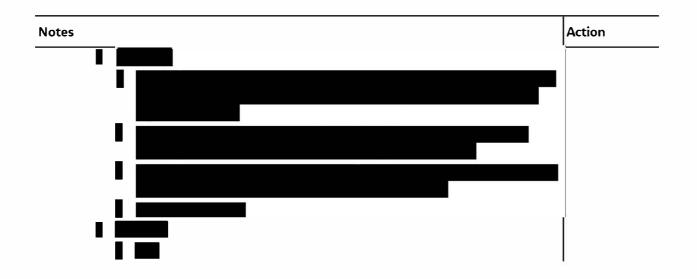
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 110 of 166



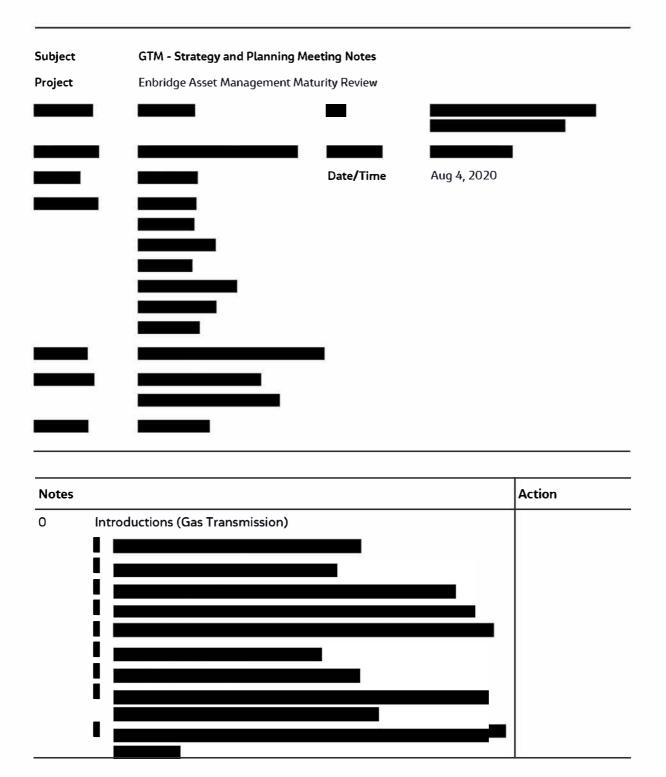
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 111 of 166



www.jacobs.com



Jacobs Consultancy Canada Inc. FES0827201538CGY REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 112 of 166



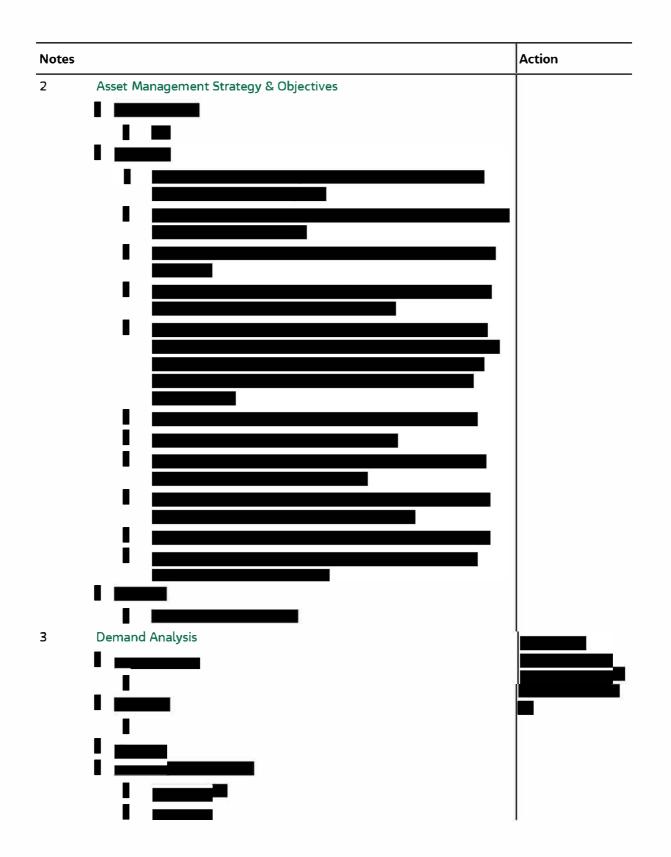
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 113 of 166



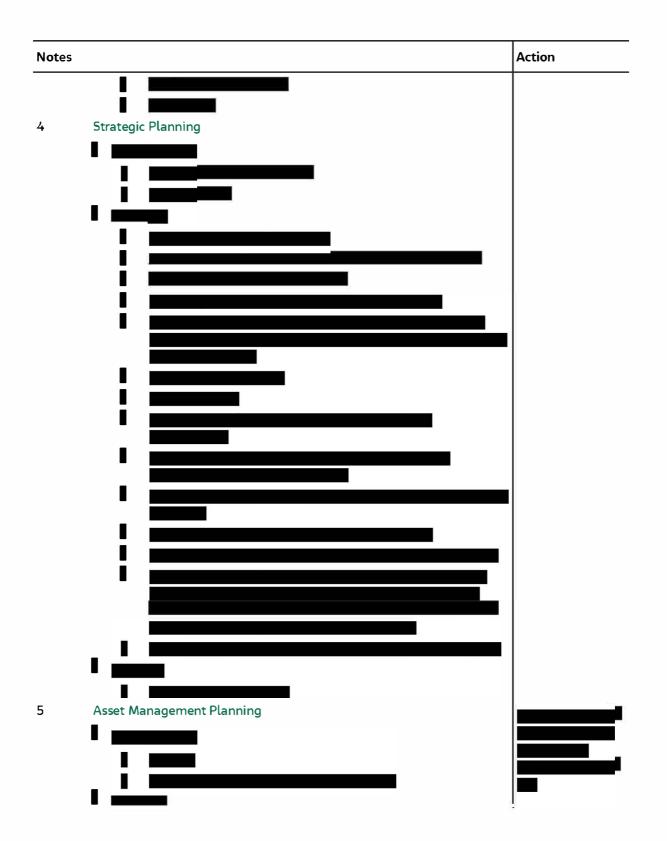
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 114 of 166

Jacobs

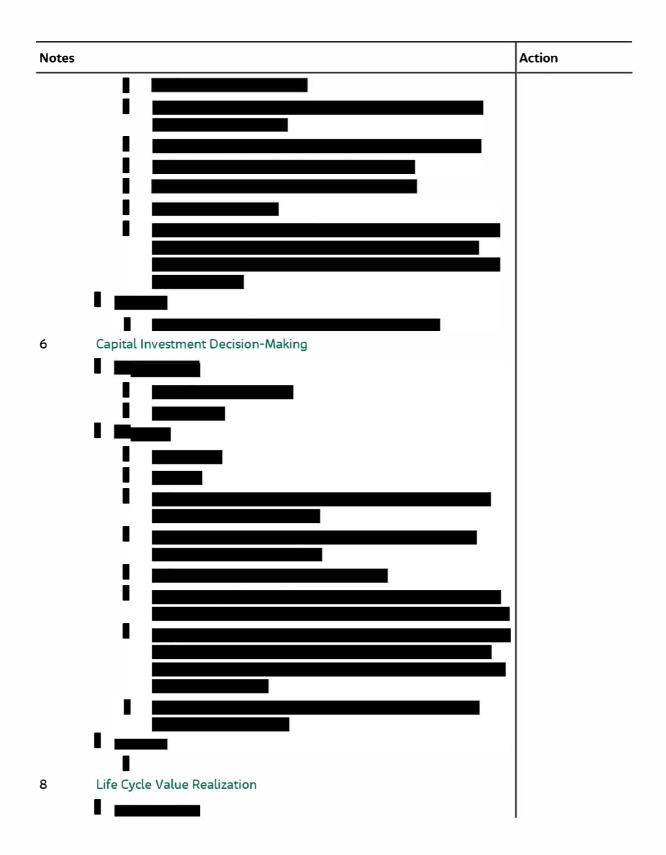
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 115 of 166



Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 116 of 166



Meeting Minutes



REDACTED Updated: 2023-07-27 EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 117 of 166



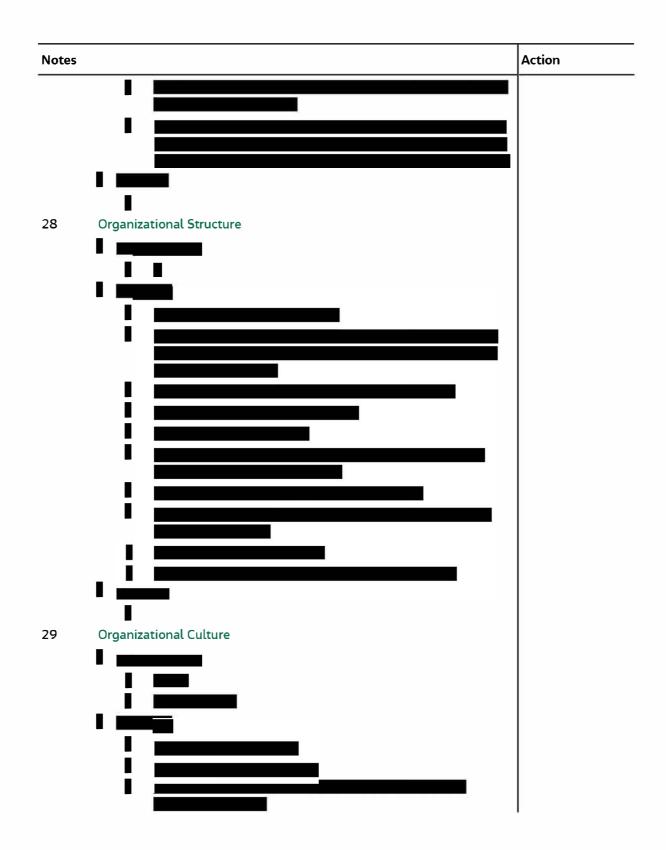
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 118 of 166



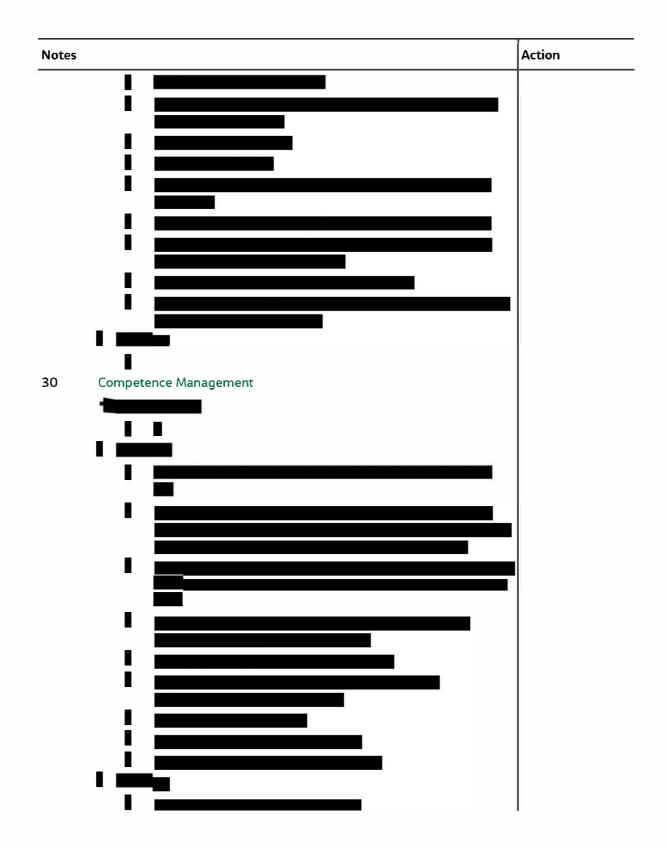
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 119 of 166



Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 120 of 166



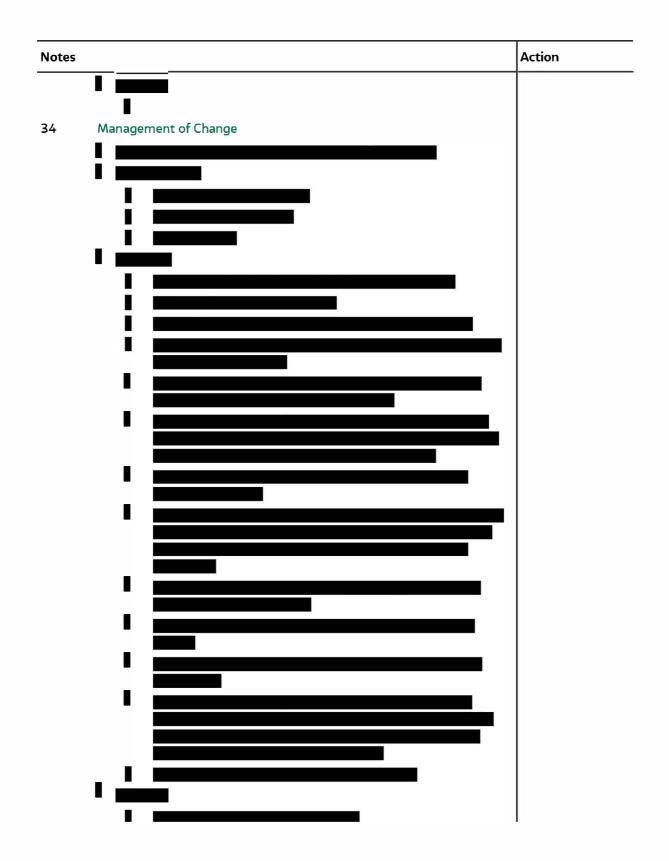
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 121 of 166



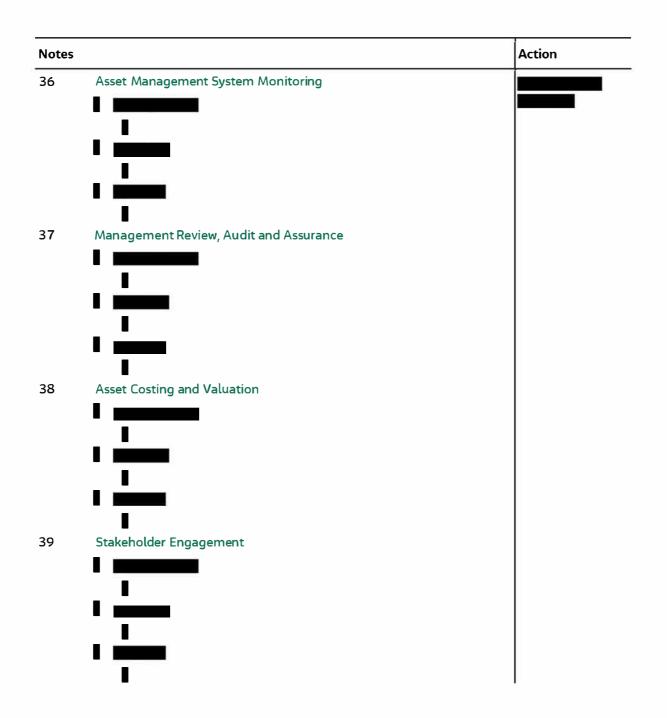
Meeting Minutes



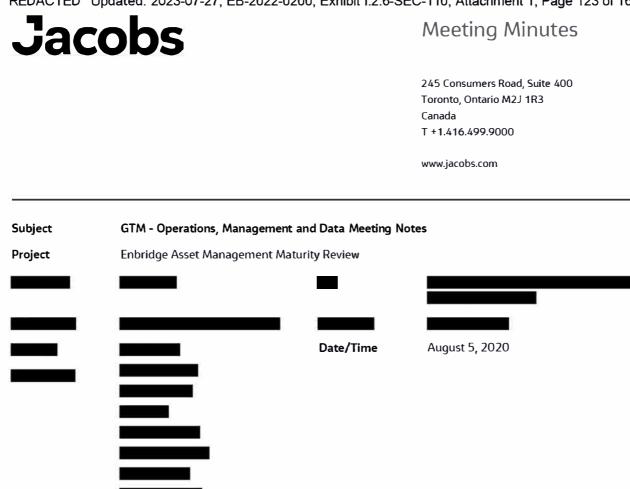
REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 122 of 166



Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 123 of 166



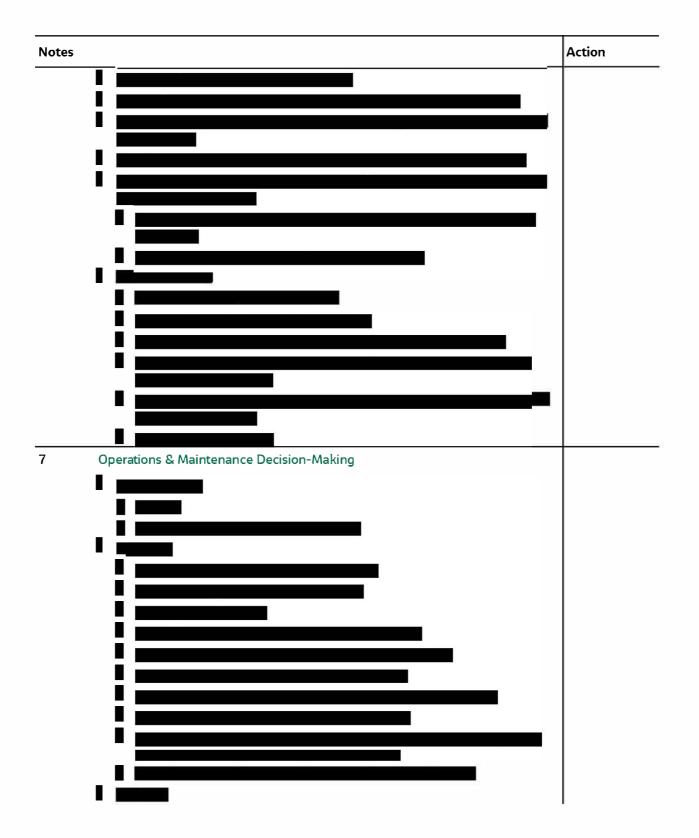
Notes	Action
0 Introductions (Gas Distribution)	

Jacobs Consultancy Canada Inc. FES0827201555CGY

REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 124 of 166



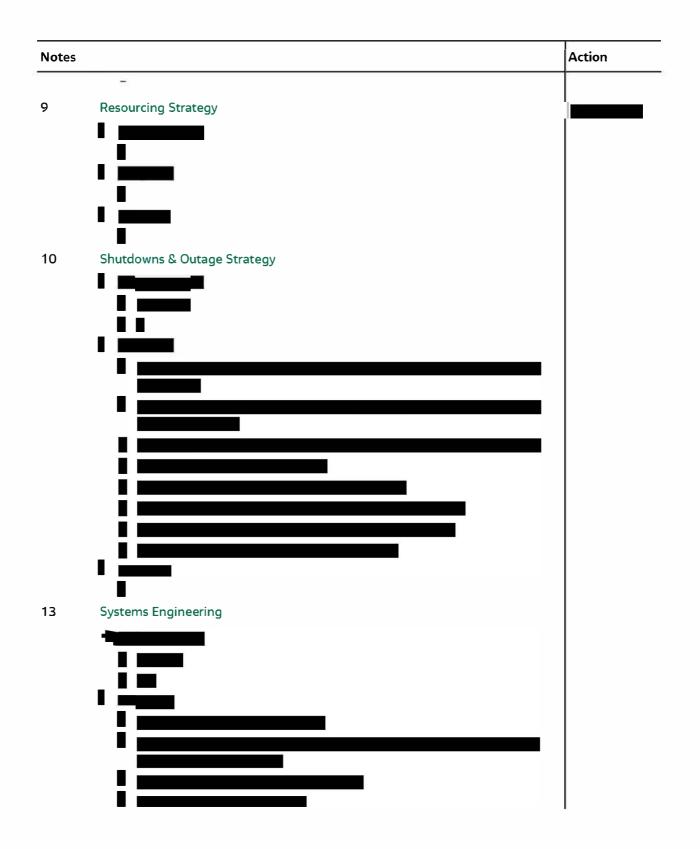
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 125 of 166



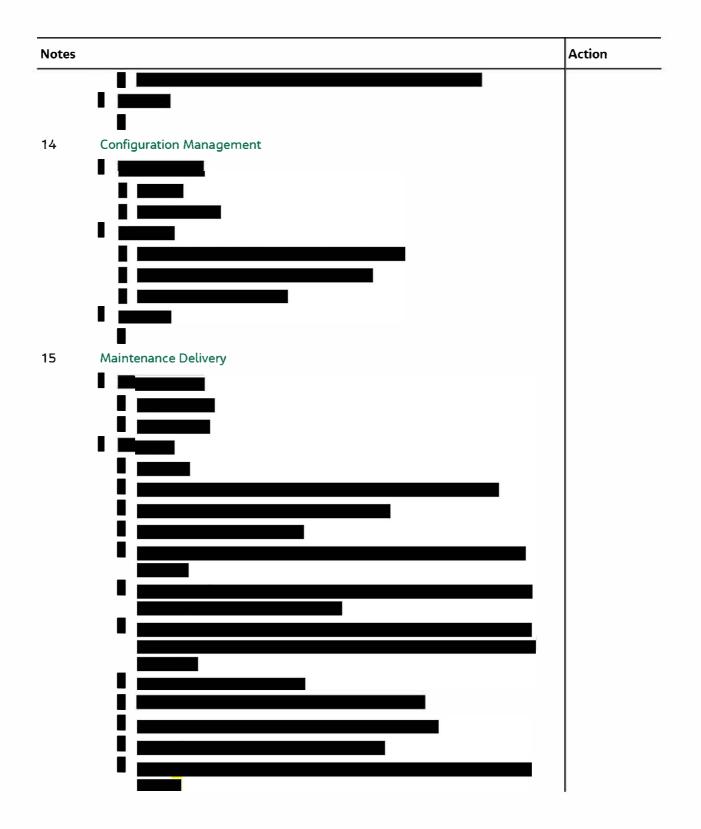
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 126 of 166



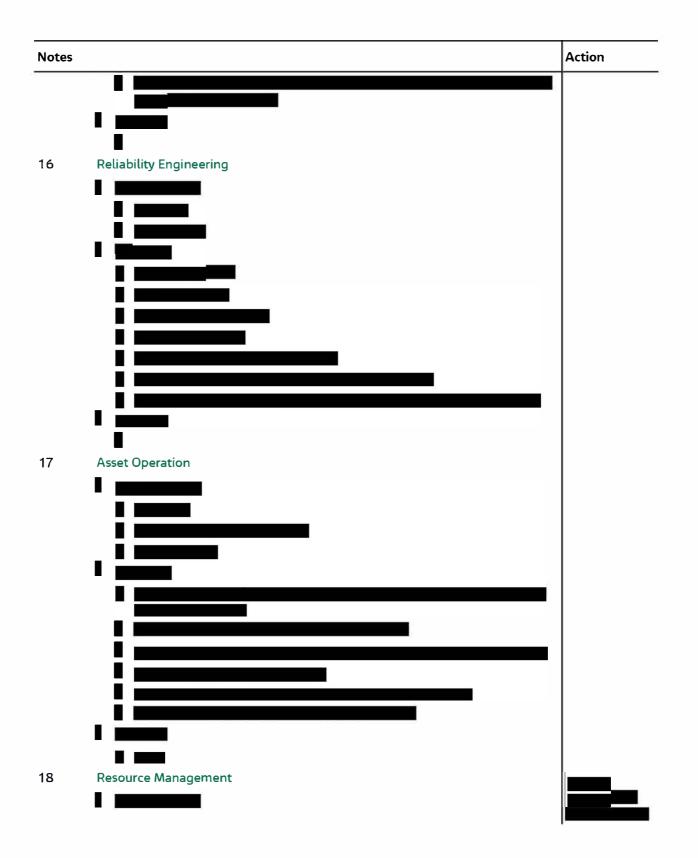
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 127 of 166



Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 128 of 166



Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 129 of 166



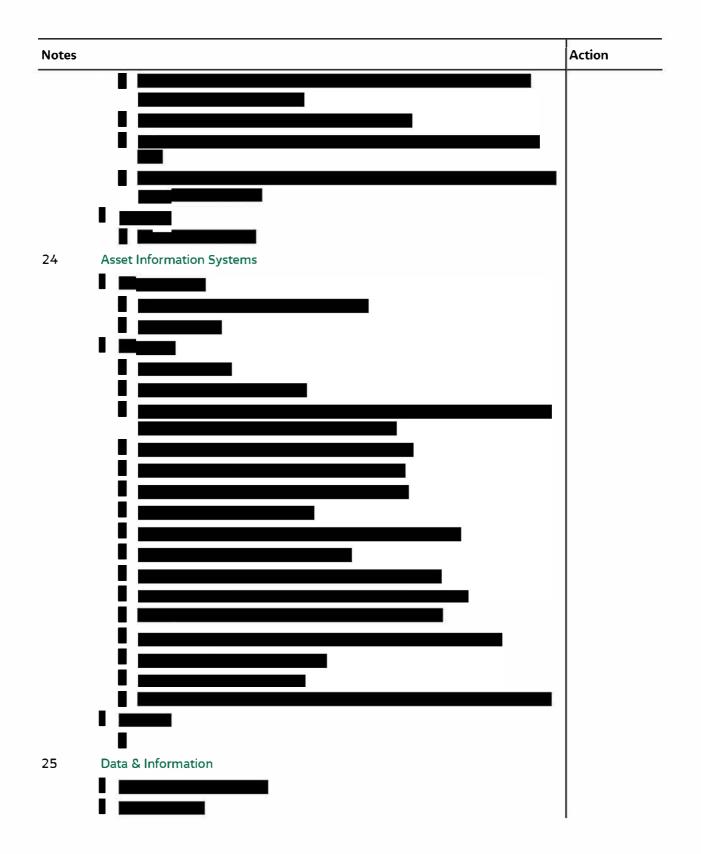
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 130 of 166



Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 131 of 166



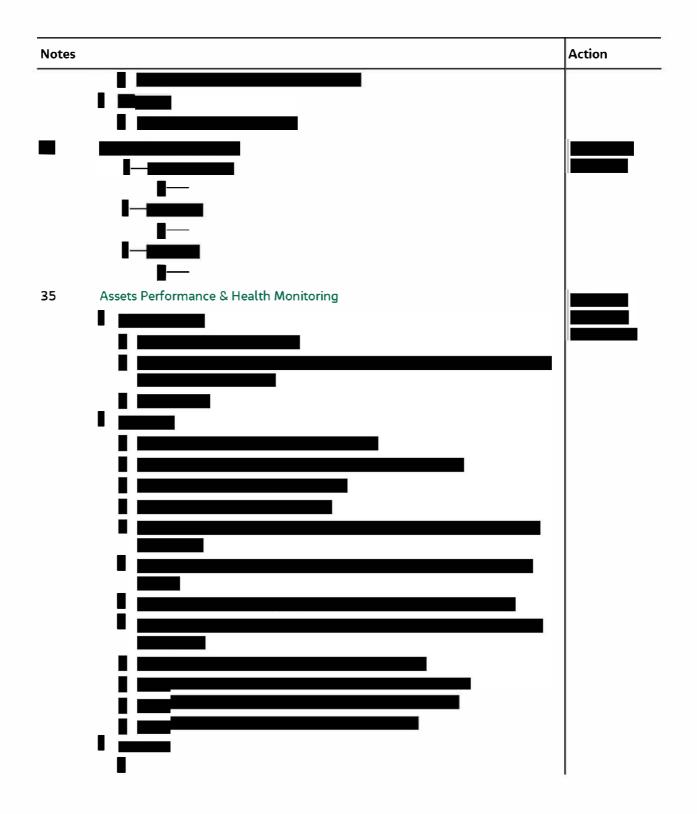
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 132 of 166



Meeting Minutes



REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 133 of 166

Jacobs

Meeting Minutes

245 Consumers Road, Suite 400 Toronto, Ontario M2J 1R3 Canada T + 1.416.499.9000

www.jacobs.com

Subject	GDS - Strategy and Planning Follow	w-up Meeting Notes	
Project	Enbridge Asset Management Maturi	ity Review	
Project No.	CE777500	File	2020-08-10 GDS SP Q30 Competence Management - Meeting Notes
Prepared by	Catherine Simpson, RPP, MCIP	Phone No.	604-346-9428
Location	Web-based	Date/Time	August 10, 2020
Participants	Catherine McCowan, Manager Risk, S Bridget Sneddon, Manager of Techr	5	
Regrets	Rebecca Mayhew, EAM Governance		
Facilitators	Andy Whittaker, Jacobs Catherine Simpson, Jacobs		

Notes		Action
0	Introductions (Gas Distribution)	
	 Doing a maturity assessment 	
	 39 questions for evaluating 	
	 One question about having the competence around the board to management AM – from front line field workers to analyzing data 	
	 You handle the field and training work 	
	 Assessment across 3 business units (GDS, GTM, LP) 	
	 Level 3 is alignment with international good practices – plan, do, check 	
	 Not a regulatory review – it's self-imposed 	
	 Did a maturity assessment done about 3 years ago before integration 	
	 Jacobs brought on to do a second assessment 	
	 Looking to rebase ourselves 	
30	Competence Management	Bridget to
	 Q: specific to AM, from field work to ensuring capabilities to set standards, etc. but defines everything we do from end to end of the lifecycle (operations, maintenance, capital, renewal, planning) 	share evidence with Rebecca
	 Have functions, and look at the roles and what's required – experience and certification or equivalent 	Flag for follow-up with GTM: Kim

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 134 of 166



Meeting Minutes

GDS - Strategy and Planning Follow-up Meeting Notes August 10, 2020

lotes			Action
	•	Professional and front-line roles	Jackson
	•	1) Setting out a competence management system	(rating too
	•	2) Utilize the competence management system to identify areas to fill gaps through recruitment, development of staff, training needs	high)
	•	3) review competence management system and check that it's relevant and that strategic documents guide this including understanding forecasting of staff requirements	
	•	Current Rating	
		 3 with scope caveat so maybe 2.5 	
		 2.5 because strong with program in place but scope focused on field staff 	
	•	Rationale	
		 Scope does not include professional realm of employees 	
		 Includes process safety management 	
		 Very robust program for the front line – touching pipe or making decisions on 	
		 Kicked off technical competency management program 3 years ago and making more progress 	
		 1) not fully integrated with EGI yet (another year and a half – integrating procedures and assets in distribution systems from legacy companies) 	
		 Goal is to have a learning path/journey with competencies 	
		 - 2) on professional side, left out lawyers, financial/budgeting experts, etc. BUT did include engineering 	
		 Don't train integrity engineers but have taken program model and are preparing their own technical competency learning map – consistent and aligned process 	
		 Program – 17 technical competency learning maps 	
		 Shows learning journey from beginning to specialized 	
		 Lists all competencies and a learning chapter/module for each 	
		 Also in the job training and mentorship 	
		 Do assessments and evaluations with module tests 	
		 Can see learning journey end to end – technical and health and safety and system courses 	
		 A very laid out journey – think of a placemat 	
		 Part 2 and Part 3 of Questions Description: other side of 'placemat' is what drives the continual capability and competency management – names of everyone and rate annually against competency (needs 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 135 of 166



Meeting Minutes

GDS - Strategy and Planning Follow-up Meeting Notes August 10, 2020

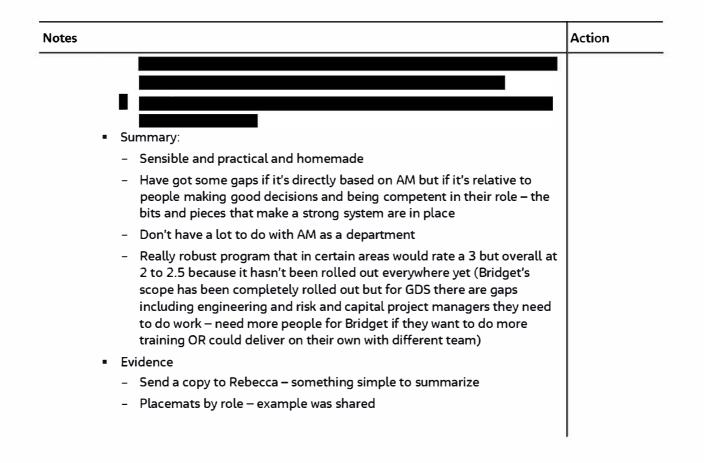
Notes		Action
	formal training, needs informal training, don't need competency, masters, etc.)	
	 An analysis of all training requirements 	
	 Part 4 – review competency managements system annually to ensur these are still the right competencies; continually done each year for business 	
	 Have an annual training council meeting with directors (1h) to provide stats and an opportunity for directors to ask what is needed next and confirm that the right things are being focused on – Bridget gets direction from Council and it's important for planning the future 	
	 Summary: robust program in palace; being implemented in field and engineering; good coverage of front-line staff integrity going to pick for their staff 	
	 Integrity and folks in AM aren't necessarily trained but they are adop the technical competency learning path layout to build out their expectations, but they own the training component 	oting
	 Have a new video to orientate new leaders coming into a supervisor a so they can perform this annually 	area
	 Assessment levels 1-4 or N/A 	
	 Do an annual report to directors to show progress, recognizing transition of staff 	
	 Anything in risk, project management? No, although project management is a requirement for planners in their role. Very focused technical training to field and office technical systems. Model lends itself to be able to do risk assessments but don't currently train for the system of the system of	
	 Not aware of EAM framework – Catherine is interface with Bridget – there is a framework that can be used 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 136 of 166



Meeting Minutes

GDS - Strategy and Planning Follow-up Meeting Notes August 10, 2020



REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 137 of 166

Jacobs

Meeting Minutes

245 Consumers Road, Suite 400 Toronto, Ontario M2J 1R3 Canada T + 1.416.499.9000

www.jacobs.com

Subject	GDS - Operations, Management and	d Data Follow-up Me	eeting Notes
Project	Enbridge Asset Management Maturi	ty Review	
Project No.	CE777500	File	2020-08-17 GDS Data and Operations Follow-up - Meeting Notes
Prepared by	Catherine Simpson, RPP, MCIP	Phone No.	604-346-9428
Location	Web-based	Date/Time	August 17, 2020
Participants	Catherine McCowan, Manager Risk, S Erik Naczynski, Manager Asset Class Angela Scott, Manager Integrity Mar Mike Hildebrand, Mgr Asset Classes Andrew Welburn, Manager Asset Da	es Distribution nagement Storage & Transmiss	sion
Observers	Rebecca Mayhew, EAM Governance Caryn Campbell, Manager EAM Proj	Mgmt	
Facilitators	Andy Whittaker, Jacobs Catherine Simpson, Jacobs		

Notes		Action
0	Introductions (Gas Distribution)	
	 Within second year of EAM program 	
	 Executive would like to see adjustments to ensure targets can be hit 	
	 Set the stage for continual improvement 	
	 Engaged Jacobs to facilitate sessions – IAM endorsed assessor 	
	 Not a formal audit 	
	 This is a follow-up to the previous conversation 	
	 8 questions to go through today 	
13	Systems Engineering	
	Current Rating	
	 Network analysis is a 3 	
	 2 (solid, leading into a 3) 	
	 Rationale 	
	 Have the demand analysis that we've already spoken about 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 138 of 166



Meeting Minutes

GDS - Operations, Management and Data Follow-up Meeting Notes August 17, 2020

Notes		Action
	 From a distribution analysis perspective – there is a team of network modelers with regions they manage; using Synergy; using cascading models with multiple pressure classes; evidence 	
	 A number of different planning groups with monthly meetings (such network analysis, transmission engineering and optimization, storage planning) and looking at the entire system to make decisions on the right solutions 	·
	 The right people are getting together but there aren't any process ma documented 	aps
	 Documented processes around how these planning groups is an opportunity to improve 	
	 Evidence to show consistency in how work is done 	
	 Maybe perceived assumptions that are documented in the model but the rationale for those assumptions may not be documented 	
	 Well-established practices in place including resources, system analy tools and functionality; used on a consistent basis 	sis
	 Require more documentation around process 	
	 Network analysis is well documented – and tracked in Maximo – because it's transaction based (so the rating is higher in this area, a 3)
	 Interaction between 2 groups (there is an annual meeting but don't have a formal process for hand-off so not fully mature) 	
	 Next step: a process to tie existing practices together would get to a 3 	3
	Evidence	
	 Leave to Construct Application – for large projects provides justificati alternatives and analysis to Ontario Energy Board 	on,
	 Facilities Business Plan 	
	 Network Analysis Documented Process 	
4	Configuration Management	
	 Current Rating 	
	- 1	
	 Rationale 	
	 With the Dawn De-hydration plant we have seen performance issues over the years which is traced back to changing expectations over the year and expectations exceeding capabilities 	
	 Have tried to do RCM analysis in the past and don't have expectation written down – relies on people's memories and perception 	s
	 Could do better on documentation 	
		1

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 139 of 166

Jacobs

Meeting Minutes

GDS - Operations, Management and Data Follow-up Meeting Notes August 17, 2020

Notes		Action
	 It would allow us to flag when changes occur such as performance degrading or when it's not functionally possible to achieve expectations For thousands of distribution stations, have records for mop in and mop out, capacity, performance; processes are documented Evidence 	
24	Asset Information Systems	
24	 Current Rating 1 to 2 during discussion, with a solid 2 in some cases 1.5 consensus Rationale Have maps of systems and interfaces with a variety of levels of detail Systems managed well Change processes in place for upgrades Testing done Roadmaps are in place, but challenge is that landscape is changing rapidly (month to month) with critical timelines; have to constantly go back and revisit these Roadmaps are integrated into processes, utility integrations, unify and asset management Challenging to pull out a 10-year roadmap because of evolution of utilities Are implementation plans sufficiently comprehensive, or more broadly focused on major initiatives? AWS is being well planned, implemented, resourced, and tested. Challenge with other systems that we haven't turned our attention to yet. Sort term planning is done well (such as, upgrading to Windows 10 and linking to application updates required) Unify is underway Do have a system map and implementation plan (a bit fluid and it doesn't necessarily cover everything) but have good evidence and 	
	 systems there Scope doesn't include all systems on the documented roadmap; some fluidity Not talking about alignment with C55 alignment with Encompass and 	
	 Oracle Opportunities longer term 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 140 of 166



Meeting Minutes

Notes		Action
	 1-2 year horizon is focused; 2-3 years less focused 	
	 Roadmaps for 5-year implementation exist but are high level (but more focused on LP or GTM) 	
	 Acknowledgement of need for consistency and work is being undertaken to address gaps 	
	 Challenging to look at data and integration across legacy systems because it's a complex landscape 	
	 Know where data is and the system of record for particular data but getting access to the data can be difficult where experts have moved on to different roles 	
	 Consistency of information in systems is sometimes challenging 	
	Evidence	
25	Data & Information	
	Current Rating	
	– More than a 1	
	- Close to a 2	
	- 1.5 consensus	
	 Rationale 	
	 Clear where data is stored 	
	 Systems in place are doing jobs well 	
	 May not be consistent across legacy companies 	
	 Causing us some growing pains 	
	 It is clear what data is created and where 	
	 Most data issues are related to historical data 	
	 In good shape for moving forward 	
	 Consistency on capturing information to meet the needs of the business is an ongoing challenge 	
	 Have data stewards identified 	
	 Level of awareness about data integrity and stewardship has increased significantly over last year or two 	
	 In many cases have two different processes, but identified and consistent within individual ecosystems 	
	 Structure and processes exist: well developed processes and procedures and acknowledgement of level of rigour to be applied 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 141 of 166



Meeting Minutes

Notes		Action
	 Overall consistency can be a challenge sometimes even with new projects (such as, new pipeline built and significant missing attributes) so not meeting level of rigour in some places Did a Fitness for Purpose Study before integration and it showed that most data was in reasonably good shape for operating and maintaining pipelines. Some problems with integrity management (such as, if you want to locate pipes, data is good; if you want to know the grade of material, etc. the data isn't easily accessible and needs to be taken from as-built drawings) Station assets are a bit further behind at least on legacy Union side Reporting of leaks are lacking day-to-day reporting Overall: variability across asset and datasets; clear holes 	
	 Fitness for Purpose Study 	
26	Procurement and Supply Chain Management	
	 Current Rating 2.5 	
	Rationale	
	 Pretty strong Developed really stringent processes 	
	 Standard to which service provers are being held to has increased 	
	 Controls in place that have continued to improve over time 	
	 Seen the results of contractors not meeting expectations (being removed from the preferred list) 	
	 Have come a long way, but still opportunities for improvement Centralized through Enterprise 	
	 Controlled so that you can't get a contract for anything independently – now a very structured process to go through to ensure the right people and right prices 	
	 Track service level agreements and metrics 	
	Evidence	
	 Process documentation 	
32	Contingency Planning & Resilience Analysis	
	Current Rating	
	- 3	
	 Rationale 	
	 We do quite well in this area 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 142 of 166



Meeting Minutes

Notes		Action
	 Spend a lot of time on mock emergencies 	1
	 Set up an entire process and accountabilities in regard to emergency response 	
	 Have resources outside organization to share resources in an emergency 	
	 Look at all kinds of thins that could happen within distribution, storage and transmission systems 	
	- Test on a regular basis	
	 Very structured and staffed and forward-looking 	
	 Are quite mature here – emergency response planning and business continuity planning 	
	 Well documented, structured and good process 	
	 Get tested on this pretty regularly 	
	Evidence	
35	Assets Performance & Health Monitoring	
	 Current Rating 	
	 3 (gas carrying assets - integrity) 	
	 2 (stations and facilities) 	
	- 2 consensus	
	 Rationale 	
	 Integrity – all gas carrying assets in scope are at level 3 	
	 Aware of all assets 	
	 Distribution asset health perspective: do condition monitoring; use historical failure data to forecast 	
	 On facilities side moving towards that 	
	 Have inspection data on transmission pipelines to determine the life of the assets 	
	 Went through a 3rd party assurance exercise indicating that we're industry leading in this area, and certain aspects of the transmission program is industry leading 	
	 For stations assets (recognize some variability), information is gathered (condition and performance) but don't have a good understanding of how to utilize this data to inform decisions 	
	 Opportunities for further improvement with storage and transmission facilities – good on inspection routines but not sure about best measures of condition and performance and how to become more predictive using that information 	

REDACTED Filed: 2023-03-08, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 143 of 166



Meeting Minutes

Notes	Action
 Summary: integrity: have defined what is needed to collect, co and have review processes; stations and other assets: have col lot of data but need to work on lining up with what's really need 	llected a
 Evidence 3rd Party Assurance Exercise 	

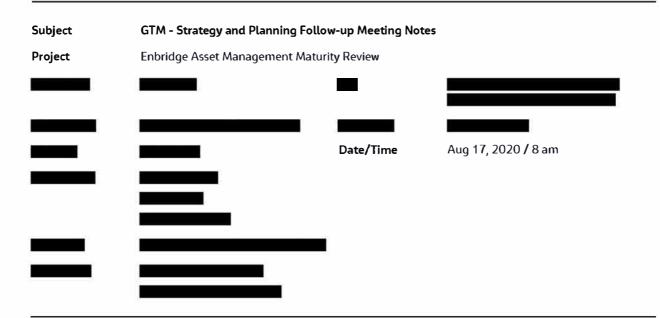
REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 144 of 166

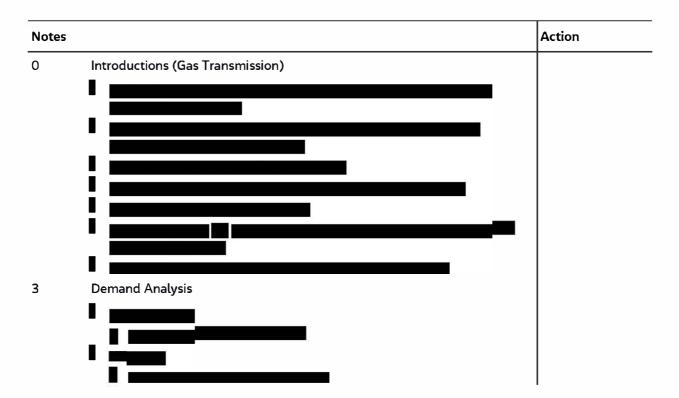


Meeting Minutes

245 Consumers Road, Suite 400 Toronto, Ontario M2J 1R3 Canada T +1.416.499.9000

www.jacobs.com

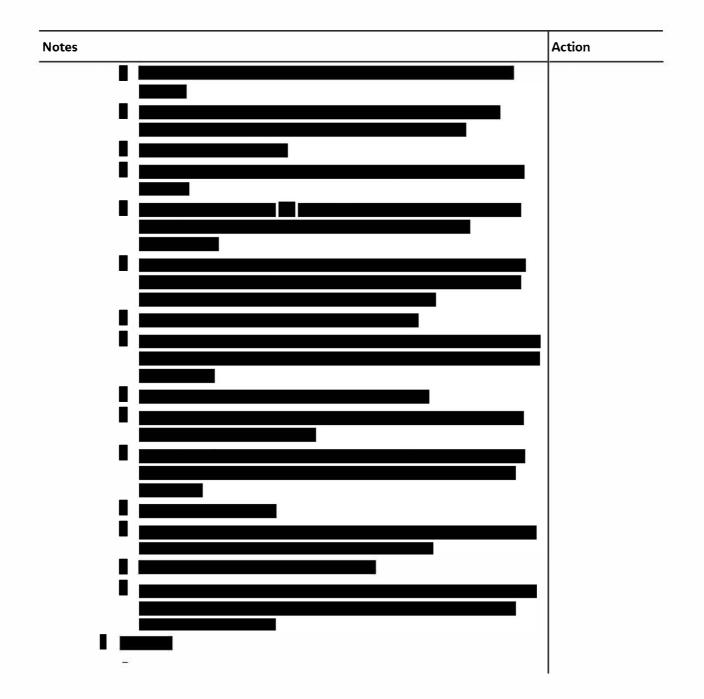




REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 145 of 166



Meeting Minutes



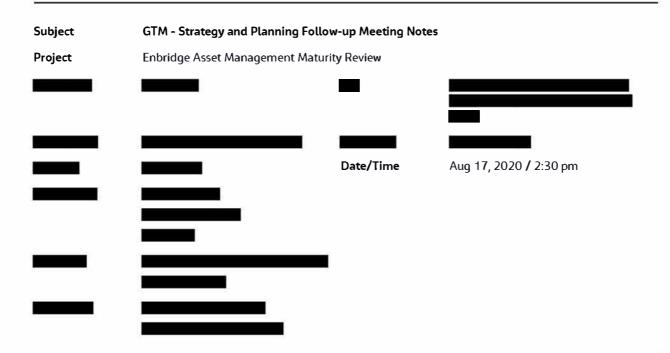
REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 146 of 166

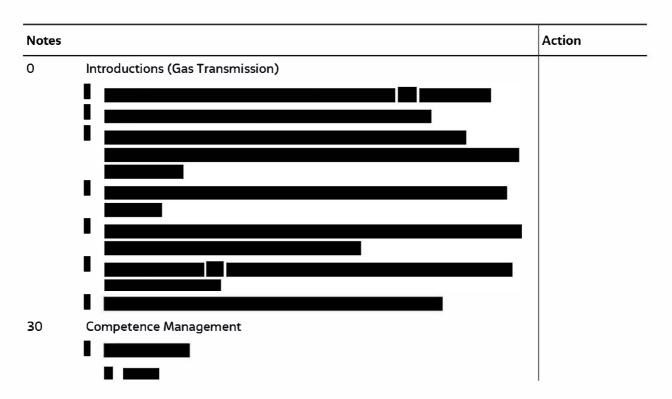


Meeting Minutes

245 Consumers Road, Suite 400 Toronto, Ontario M2J 1R3 Canada T + 1.416.499.9000

www.jacobs.com

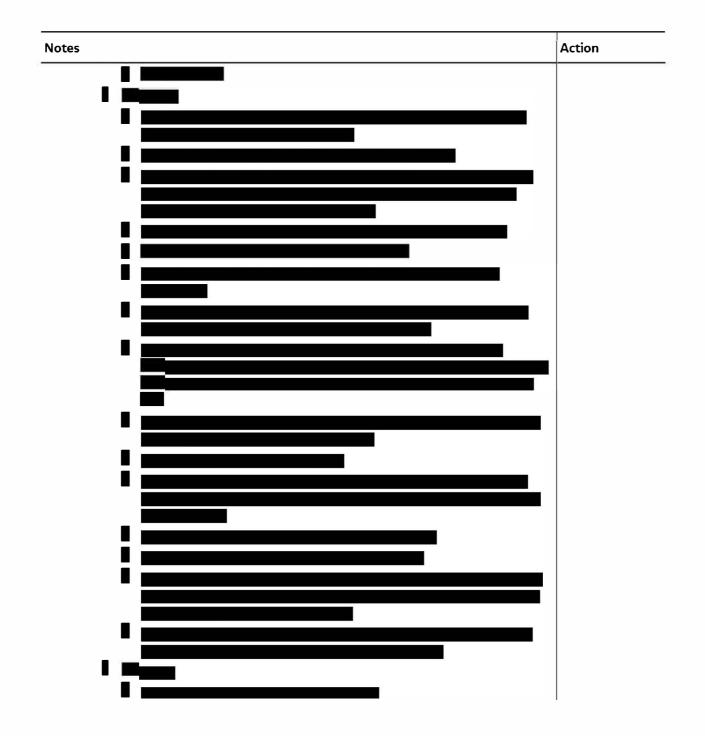




Jacobs Consultancy Canada Inc. FES0827201636CGY REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 147 of 166



Meeting Minutes



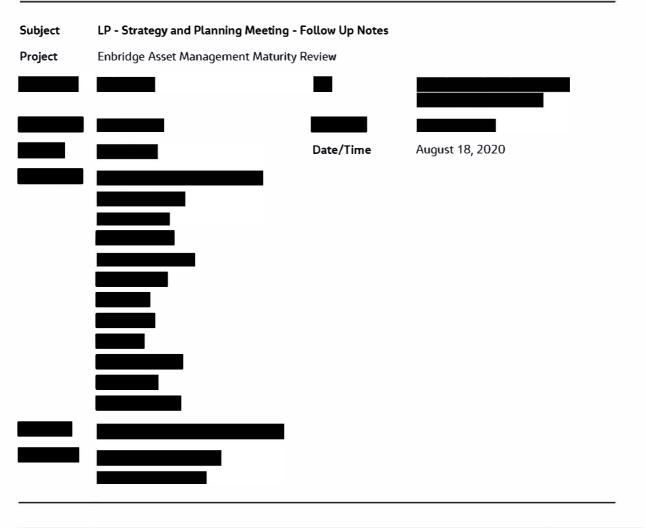
REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 148 of 166



Meeting Minutes

Unit 330, 205 Quarry Park Blvd, Calgary, AB

www.jacobs.com



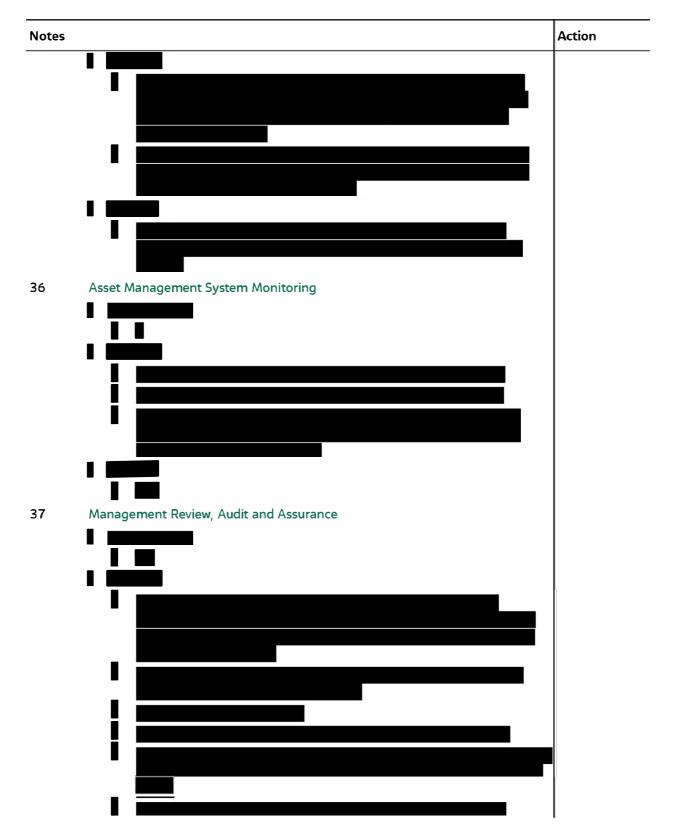
Notes		Action
0	Introductions (LP)	
33	Sustainable Development	

REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 149 of 166



Meeting Minutes

LP - Strategy and Planning Meeting - Follow Up Notes August 18, 2020

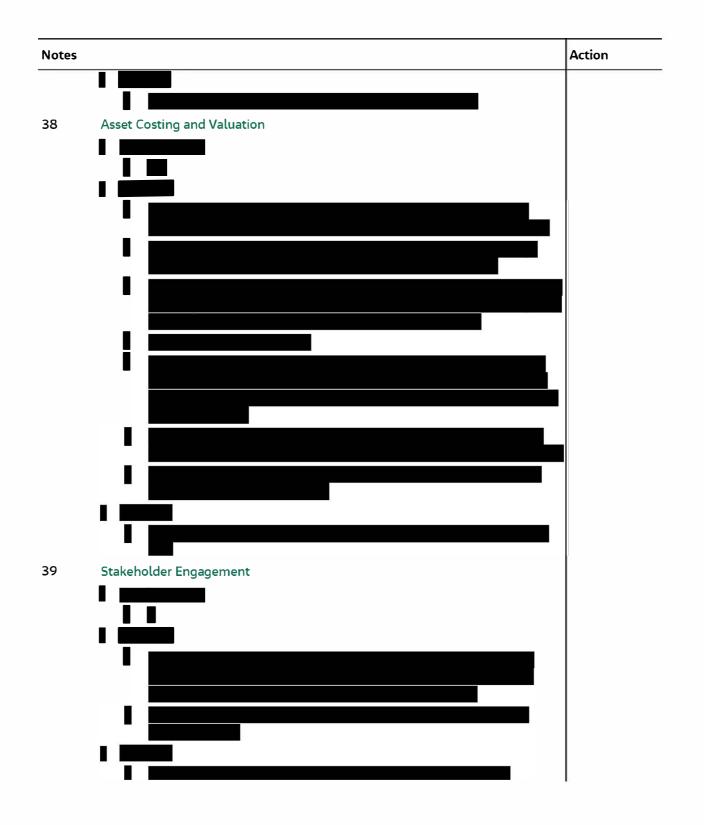


REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 150 of 166



Meeting Minutes

LP - Strategy and Planning Meeting - Follow Up Notes August 18, 2020



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 151 of 166

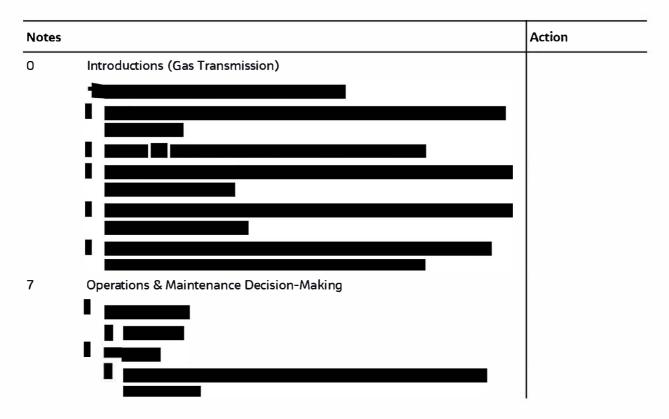


Meeting Minutes

245 Consumers Road, Suite 400 Toronto, Ontario M2J 1R3 Canada T + 1.416.499.9000

www.jacobs.com

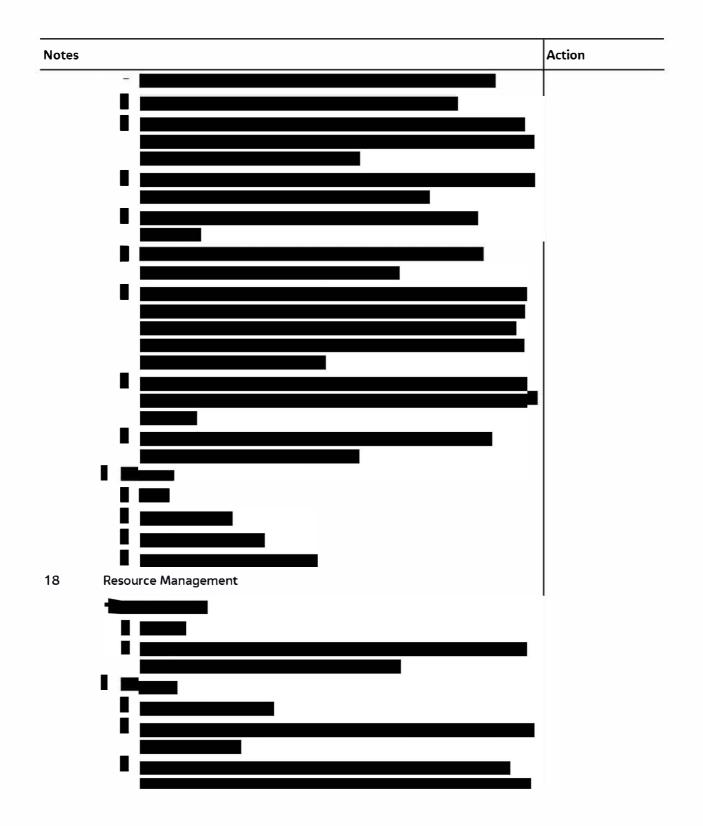




Jacobs Consultancy Canada Inc. FES0827201642CGY REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 152 of 166



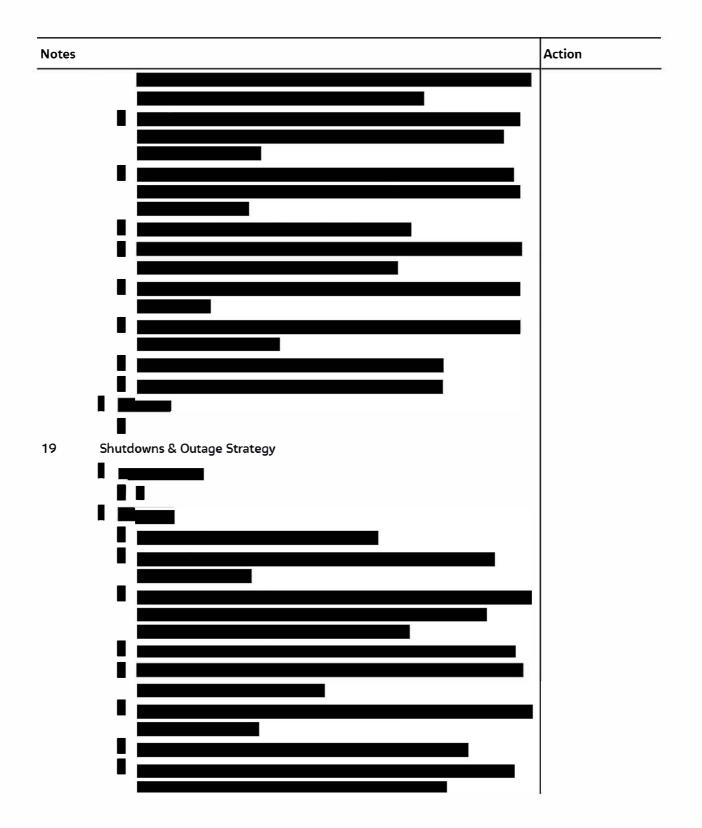
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 153 of 166



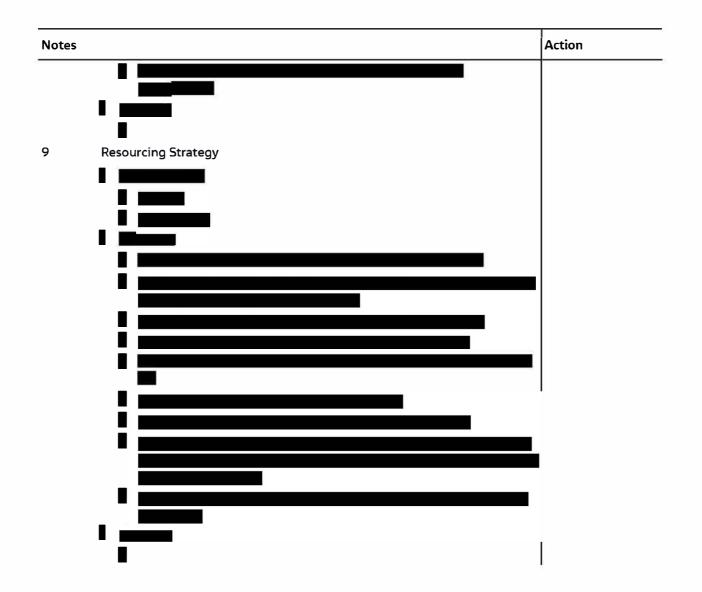
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 154 of 166



Meeting Minutes



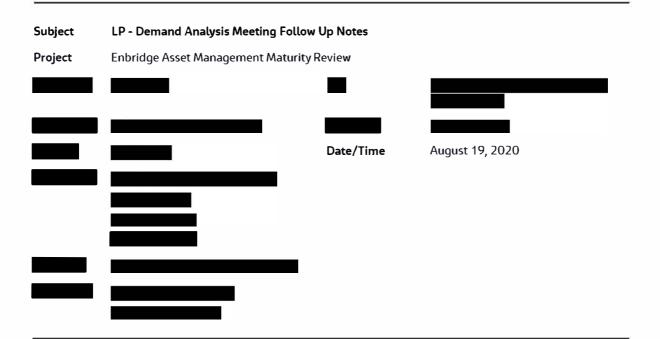
REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 155 of 166

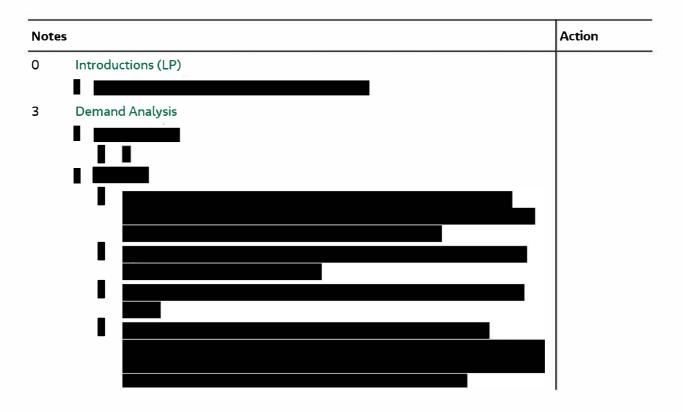


Meeting Minutes

Unit 330, 205 Quarry Park Blvd, Calgary, AB

www.jacobs.com





REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 156 of 166



Meeting Minutes

LP - Demand Analysis Meeting Follow Up Notes August 19, 2020



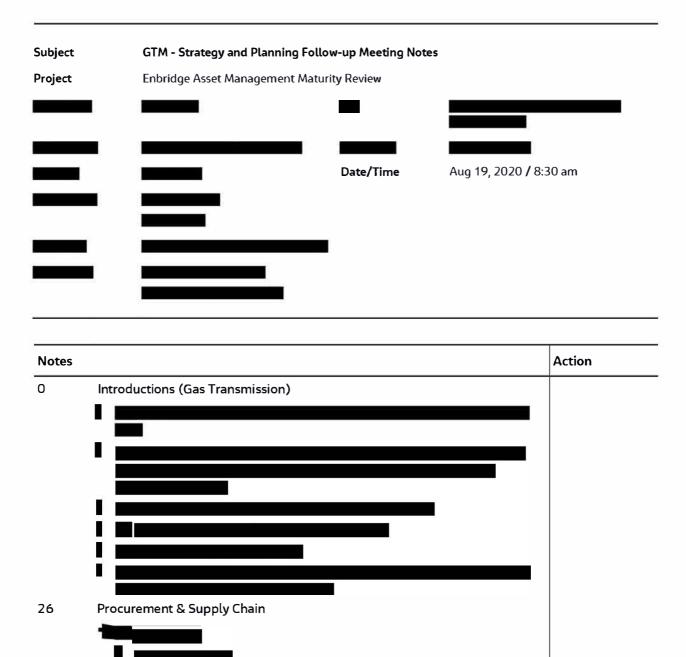
REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 157 of 166



Meeting Minutes

245 Consumers Road, Suite 400 Toronto, Ontario M2J 1R3 Canada T + 1.416.499.9000

www.jacobs.com



Jacobs Consultancy Canada Inc. FES0827201642CGY REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 158 of 166



Meeting Minutes



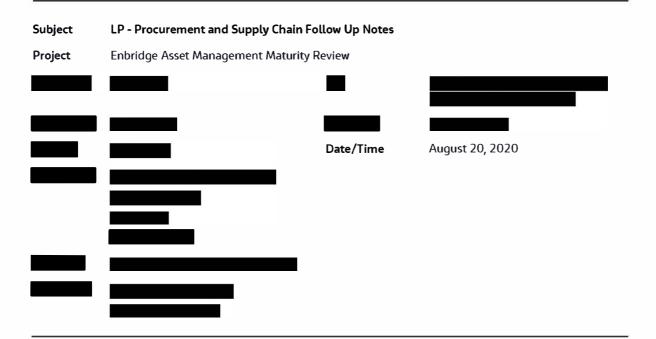
REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 159 of 166

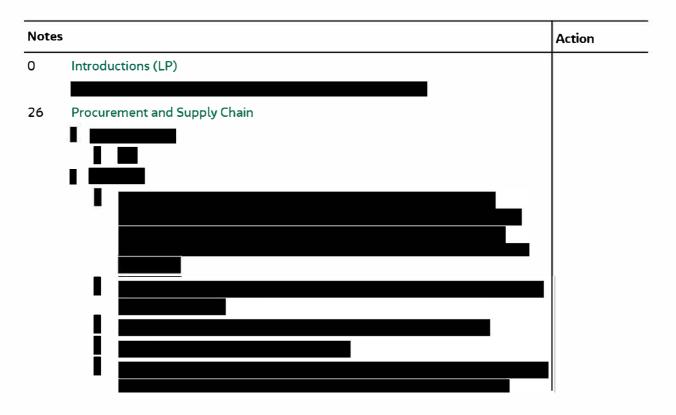


Meeting Minutes

Unit 330, 205 Quarry Park Blvd, Calgary, AB

www.jacobs.com



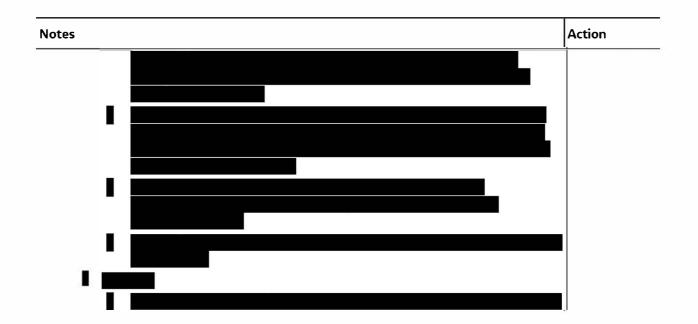


REDACTED Updated: 2023-07-27, Exhibit I.2.6-SEC-110, Attachment 1, Page 160 of 166



Meeting Minutes

LP - Procurement and Supply Chain Follow Up Notes August 20, 2020



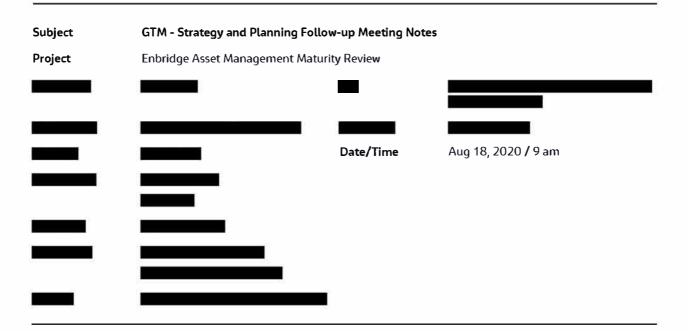
REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 161 of 166

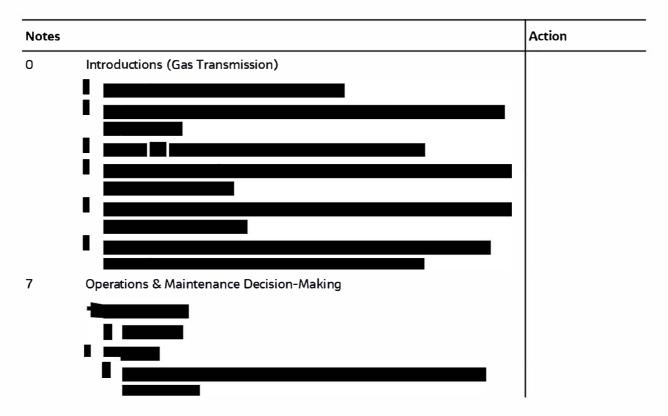


Meeting Minutes

245 Consumers Road, Suite 400 Toronto, Ontario M2J 1R3 Canada T + 1.416.499.9000

www.jacobs.com

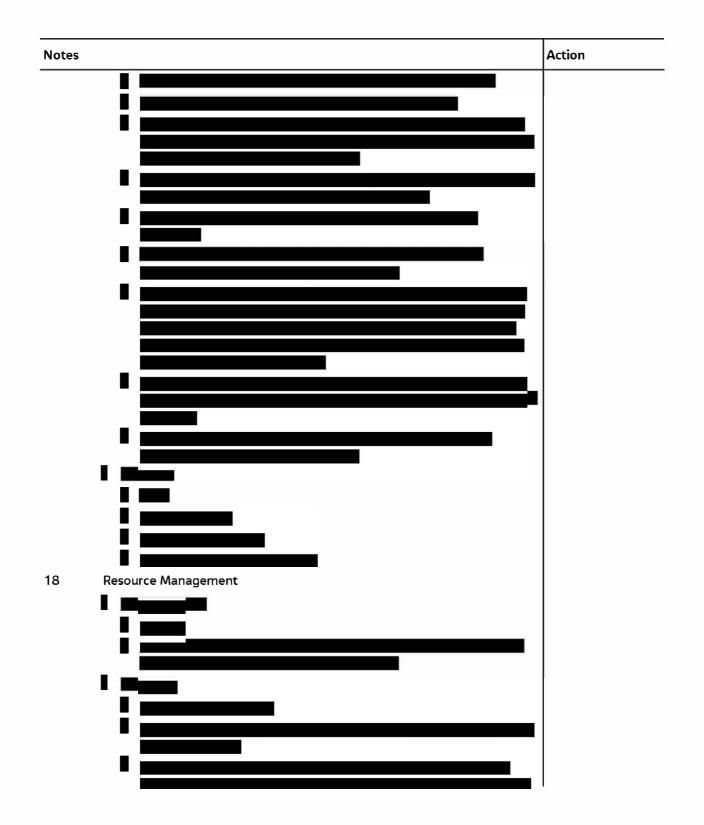




Jacobs Consultancy Canada Inc. FES0827201642CGY REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 162 of 166



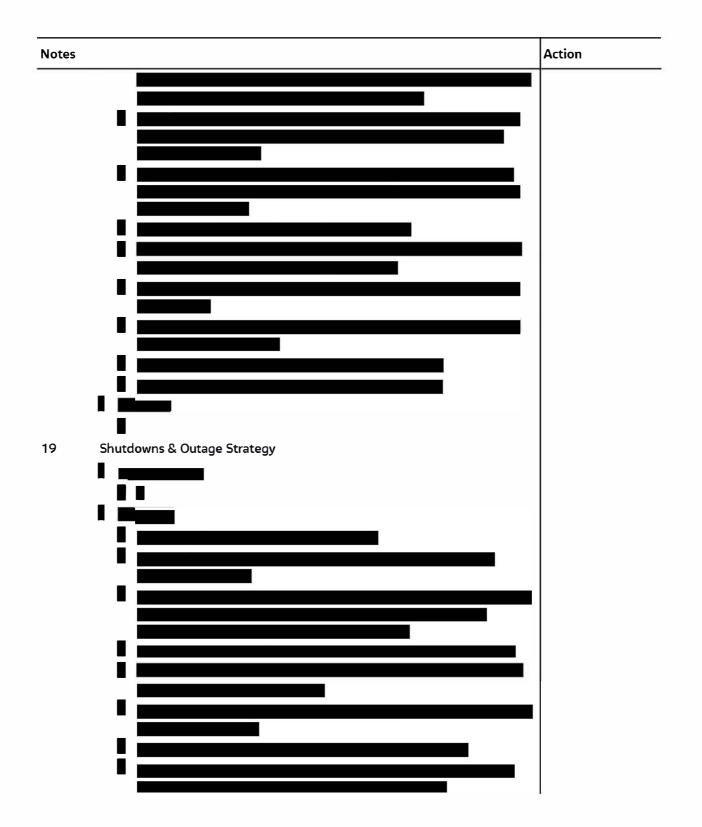
Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 163 of 166



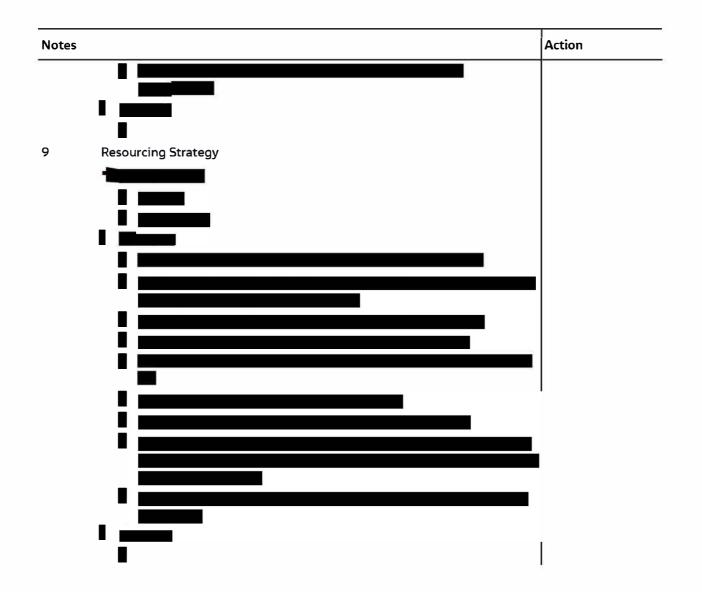
Meeting Minutes



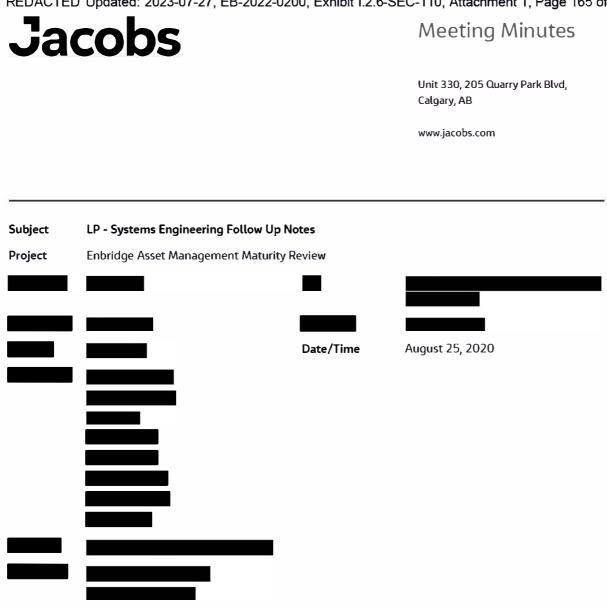
REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 164 of 166



Meeting Minutes



REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 165 of 166



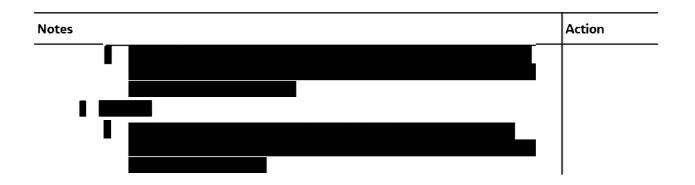
Note	25	Action
0	Introductions (LP)	
13	Systems Engineering	

REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit I.2.6-SEC-110, Attachment 1, Page 166 of 166



Meeting Minutes

LP - Systems Engineering Follow Up Notes August 25, 2020



C55

VALUE FRAMEWORK DEFINITION DOCUMENT v8.1A

March 14th, 2023



Enbridge Asset Management



Statement of Confidentiality

The information contained is this document is covered by Copperleaf Technology's Statement of Confidentiality featured in earlier versions: "The contents of this document are extremely valuable and could cause irreparable harm to Copperleaf Technologies if revealed directly or indirectly to its competitors. Accordingly, all pages of this document are considered confidential. The confidential information presented herein contains trade secrets, privileged, financial, and proprietary information."

REVISION HISTORY

Version	Author	Date Revised	Comments
1	Keenan Findlay Sarah Ziegler	5-Feb-19	First Draft
1.1	Keenan Findlay Renbo Huang	11-Feb-19	Changes to value models from first draft sent to Enbridge
1.5	Keenan Findlay	18-Feb-19	Minor changes
1.7	Sarah Ziegler	21-Feb-19	Minor changes
1.8			
2	Renbo Huang	24-Feb-19	Reviewed and added detailed design comments
2.1	Keenan Findlay	25-Feb-19	Changes based on workshops and comments
2.5	Keenan Findlay	2-Mar-19	Updates based on BU Reviews
3	Renbo Huang	3-Mar-19	Cleaned up comments.
3.5	Keenan Findlay	8-Mar-19	Updates based on review feedback
3.8	Renbo Huang Keenan Findlay	12-Mar-19	Feedback and corrections
4	Keenan Findlay Renbo Huang	17-Mar-19	Post Toronto workshop reviews and calibration
4.5			
4.9	Keenan Findlay	2-Apr-19	Changes from EGI Value Model Review sent by Muna Mar 26 Changes from Batch 3 Model Send Off Mar 27
5	Robert Gooding- Townsend Keenan Findlay	29-Apr-19	 Minor formatting changes for consistency Text color, font size, alignment Some model description tweaks and identification of constants Updates to Value Framework from Value Framework Calibration workshops in Calgary



5.1	Keenan Findlay	5-May-19	Updates to Obsolescence Risk from Review Added Frequency to External Risks – Investment General Updates
5.2	Keenan Findlay	5-Jun-19	Updates from Bus Value Framework Approval Reviews
5.3	Keenan Findlay	6-Jun-19	Formatting and Minor Changes
5.5	Keenan Findlay	7-Jun-19	June 7th VFDD Release
6	Keenan Findlay	28-Jun-19	Final Changes from BUs and formatting
6.1	Keenan Findlay	11-Jul-19	Minor spelling and formatting updates
6.2	Keenan Findlay	8-Aug-19	Investment Cost Updates for Base CAPEX O
6.3	Keenan Findlay	26-Aug-19	Review updates and removing \$ from Value Measures
7	Keenan Findlay	3-Sep-19	Investment Cost changes for negative Contributions
7.1	Keenan Findlay	18-Sep-19	Add Public Safety Risk and Employee and Contractor Risk people harmed questions Add additional Investment Cost Value Measures Set Geographic Region to required in Enterprise General Risks
7.5	Keenan Findlay	18-Oct-19	Formatting Changes for Release 7.5
8			
8.1	Virag Rokde	25-Aug-21	Addition of new All-Time question for user feedback Updated EGI Operational Disruption Risk and EGI Station Capacity value model calculation formula
8.1a	Andy Ridpath	14-Mar-23	Restored statement of confidentiality present in earlier versions



TABLE OF CONTENTS

1 Valu	ue-based Decision Making	11
1.1	Introduction to Value-Based Decision Making	11
1.2	Value Measure Types & Criteria	13
1.3	Assessing & Optimizing Investments	14
1.4	Intent	15
2 Ora	anizational Objectives	
2.1	Strategic Objectives and Value Measures	
3 Ris	k Matrix	18
3.1	Consequence Definition	
3.1.1	Consequence Scale	
3.1.2	Consequence Levels	20
3.2	Frequency Definition	22
3.3	Risk Matrix	24
3.4	Risk Value Measure Calculations	25
4 Valu	ue Models and Value Measures	27
4.1	Value Measure and Value Model Types	
4.1.1	Value Measures and Units	
4.1.2	Baselines and Outcomes	
4.1.3	Use of Value Models	
4.1.4	Risk Light, Risk Medium, and Risk Heavy Value Models	40
4.1.5	Time Varying Values	
4.1.6	Value Measure Calculations	41
4.2	User Selected (Optional) Models	41
4.2.1	Avoided Reactive Replacement	41
4.2.2	Customer Retention	43
4.2.3	EGI Gas Commodity Loss	47
4.2.4	EGI Operational Disruption Risk	51
4.2.5	EGI Station Capacity	60
4.2.6	EGI System Reinforcement	
4.2.7	Employee and Contractor Safety Risk	
4.2.8	Employee Productivity	
4.2.9	Energy Efficiency	
4.2.10	Enterprise General Risks	
4.2.2	4.2.11 Environmental Risk and Remediation	
4.2.12	External Risks Investment	108



4.2	.13	Financial Benefits and Costs	117
4.2	.14	Financial Risk	122
4.2	.15	Gas Storage Reliability	125
4.2	.16	GHG Emissions	129
4.2	.17	GTM Asset Sustainment	134
4.2	.18	IT and Facilities Capacity Risk	145
4.2	.19	LP Asset Sustainment	148
4.2	.20	LP System Optimization	163
4.2	.21	LP Throughput Impact Risk	171
4.2	.22	Obsolescence Risk	180
4.2	.23	Operational Risk	185
4.2	.24	Public Safety Risk	188
4.2	.25	Reputational Risk	190
4	.3	Investment Cost (Prescribed)	193
5	Fina	ancial Parameters & Key Assumptions	206
5	.1	Risk Consequence Multipliers	206
5	.2	Environmental Benefits	206
5.2	.1	CO2 Value by Region	206
5.2	.2	CO2 Emissions per MWh by Region	
6	Heu	ristic Failure Frequency Estimation Tool	212
7	Defi	initions	216

FIGURES

Figure 1: Value-based Decision Making Approach	12
Figure 2: Copperleaf Value Framework	12
Figure 3: Copperleaf Value Measure Types	
Figure 4: Example of How Value is Calculated within a Portfolio	14
Figure 5: Example of How Value is Calculated within an Investment	
Figure 6: Mitigated Risk Over Time	18
Figure 7: Enbridge's Operational Risk Matrix	24
Figure 8: Value Models and Value Measures	27
Figure 9: Time Varying Risk Matrix Model	40
Figure 10: Avoided Reactive Replacement Value Model	43
Figure 11: Customer Retention Value Model	46



Figure 12: EGI Gas Commodity Loss Value Model	50
Figure 13: EGI Operational Disruption Risk Value Model	56
Figure 14: EGI Station Capacity Value Model	65
Figure 15: EGI System Reinforcement Value Model	73
Figure 16: Employee and Contractor Safety Risk Value Model	80
Figure 17: Employee Productivity Value Model	82
Figure 18: Energy Efficiency Value Model	87
Figure 19: Enterprise General Risks Loss Value Model	
Figure 20: Environmental Risk and Remediation Value Model	107
Figure 21: External Risks Investment - Value Model	113
Figure 22: Financial Benefits and Costs Value Model	120
Figure 23: Financial Risk Value Model	124
Figure 24: Gas Storage Reliability Value Model	127
Figure 25: GHG Emissions Value Model	133
Figure 26: GTM Asset Sustainment Value Model	143
Figure 27: IT and Facilities Capacity Risk Value Model	147
Figure 28: LP Asset Sustainment Value Model	161
Figure 29: LP System Optimization Value Model	169
Figure 30: LP Throughput Impact Risk Value Model	179
Figure 31: Obsolescence Risk Value Model	
Figure 32: Operational Risk Value Model	
Figure 33: Public Safety Risk Value Model	
Figure 34: Reputational Risk Value Model	192
Figure 35: Investment Cost Value Model	195
Figure 36: Probability Distribution Functions for Estimation Tool	212
Figure 37: Annual Probability of Failure vs Fiscal Year	213
Figure 38: Discounted Benefit for FY19 Replacement	213
Figure 39: Discounted Benefit for FY23 Replacement	214

TABLES

Table 1: Consequence Scale in Value Units – all Value Measures	19
Table 2: Consequence Levels	22



Table 3: Frequency Levels – All Risk Types	23
Table 4: Summary of Value Models and Output Measures	33
Table 5: Value Measure Definitions and Owners	39
Table 6: Avoided Reactive Replacement Questionnaire – Outcome All Time	42
Table 7: Avoided Reactive Replacement System Parameters	42
Table 8: Customer Retention Questionnaire – Outcome All Time	44
Table 9: Customer Retention Questionnaire – Outcome Time Varying	45
Table 10: Customer Retention Investment Configurable Fields	45
Table 11: Customer Retention System Parameters	45
Table 12: EGI Gas Commodity Loss Questionnaire – Outcome All Time	48
Table 13: EGI Gas Commodity Loss Questionnaire – Outcome Time Varying	49
Table 14: EGI Gas Commodity Loss System Parameters	49
Table 15: EGI Operational Disruption Risk – Baseline All Time	52
Table 16: EGI Operational Disruption Risk – Baseline Time Varying	53
Table 17: EGI Operational Disruption Risk – Outcome All Time	53
Table 18: EGI Operational Disruption Risk – Outcome Time Varying	54
Table 19: EGI Operational Disruption Risk System Parameters	56
Table 20: EGI Station Capacity – Baseline All Time	60
Table 21: EGI Station Capacity – Baseline Time Varying	62
Table 22: EGI Station Capacity – Outcome All Time	62
Table 23: EGI Station Capacity – Outcome Time Varying	63
Table 24: EGI Station Capacity System Parameters	65
Table 25: EGI System Reinforcement Questionnaire – Baseline All Time	70
Table 26: EGI System Reinforcement Questionnaire – Baseline Time Varying	70
Table 27: EGI System Reinforcement Questionnaire – Outcome All Time	70
Table 28: EGI System Reinforcement Questionnaire – Outcome Time Varying	71
Table 29: EGI System Reinforcement System Parameters	72
Table 30: Employee and Contractor Safety Risk Questionnaire – Baseline and Outcome All Time	78
Table 31: Employee and Contractor Safety Risk Questionnaire – Baseline and Outcome Time Varying	79
Table 32: Employee and Contractor Safety Risk System Parameters	79
Table 33: Employee Productivity Questionnaire – Outcome All Time	81
Table 34: Employee Productivity Questionnaire – Outcome Time Varying	82
Table 35: Employee Productivity System Parameters	82
Table 36: Energy Efficiency Questionnaire – Outcome All Time	85



Table 37: Energy Efficiency Questionnaire – Outcome Time Varying	85
Table 38: Energy Efficiency Investment Configurable Fields	86
Table 39: Energy Efficiency System Parameters	86
Table 40: Enterprise General Risks Questionnaire – Baseline All Time	90
Table 41: Enterprise General Risks Questionnaire – Baseline Time Varying	93
Table 42: Enterprise General Risks Questionnaire – Fully Mitigated Risk Outcome All Time	94
Table 43: Enterprise General Risks Questionnaire – Fully Mitigated Risk Outcome Time Varying	95
Table 44: Enterprise General Risks Questionnaire – Outcome Override All Time	95
Table 45: Enterprise General Risks Questionnaire – Partially Mitigated Risk Outcome Time Varying	100
Table 46: Enterprise General Risks Investment Configurable Fields	100
Table 47: Enterprise General Risks System Parameters	101
Table 48: Environmental Risk and Remediation Questionnaire – Baseline and Outcome All Time	105
Table 49: Environmental Risk and Remediation Questionnaire – Baseline and Outcome	106
Table 50: Environmental Risk and Remediation Investment Configurable Fields	106
Table 51: Environmental Risk and Remediation System Parameters	106
Table 52: External Risks – Investment Questionnaire – Baseline and Outcome All Time	108
Table 53: External Risks – Investment Questionnaire – Baseline Time Varying	109
Table 54: External Risks – Investment Questionnaire – Outcome Time Varying	110
Table 55: External Risks – Investment - Investment Configurable Fields	110
Table 56: External Risks - Investment System Parameters	111
Table 57: Financial Benefits and Costs Questionnaire – Outcome All Time	118
Table 58: Financial Benefits and Costs Questionnaire – Outcome Time Varying	119
Table 59: Financial Benefits and Costs Investment Configurable Fields	119
Table 60: Financial Benefits and Costs System Parameters	119
Table 61: Financial Risk Questionnaire – Baseline and Outcome All Time	123
Table 62: Financial Risk Questionnaire – Baseline and Outcome Time Varying	123
Table 63: Financial Risk Investment Configurable Fields	123
Table 64: Financial Risk System Parameters	123
Table 65: Gas Storage Reliability Questionnaire – Baseline and Outcome All Time	126
Table 66: Gas Storage Reliability Questionnaire – Baseline & Outcome Time Varying	126
Table 67: Gas Storage Reliability Investment Configurable Fields	127
Table 68: Gas Storage Reliability System Parameters	127
Table 69: GHG Emissions Questionnaire – Outcome All Time	131
Table 70: GHG Emissions Questionnaire – Outcome Time Varying	132



Table 71: GHG Emissions Investment Configurable Fields	132
Table 72: GHG Emissions System Parameters	132
Table 73: GTM Asset Sustainment Questionnaire – Baseline All Time	136
Table 74: GTM Asset Sustainment Questionnaire – Baseline Time Varying	138
Table 75: GTM Asset Sustainment Questionnaire – Fully Mitigated Risk Outcome All Time	139
Table 76: GTM Asset Sustainment Questionnaire – Fully Mitigated Risk Outcome Time Varying	139
Table 77: GTM Asset Sustainment Questionnaire – Partially Mitigated Risk Outcome All Time	139
Table 78: GTM Asset Sustainment Questionnaire – Partially Mitigated Risk Outcome Time Varying	142
Table 79: GTM Asset Sustainment Investment Configurable Fields	142
Table 80: GTM Asset Sustainment System Parameters	143
Table 81: IT and Facilities Capacity Risk Questionnaire – Baseline and Outcome All Time	146
Table 82: IT and Facilities Capacity Risk Questionnaire – Baseline and Outcome Time Varying	146
Table 83: IT and Facilities Capacity Risk System Parameters	147
Table 84: LP Asset Sustainment Questionnaire – Baseline All Time	152
Table 85: LP Asset Sustainment Questionnaire – Baseline Time Varying	155
Table 86: LP Asset Sustainment Questionnaire – Fully Mitigated Risk Outcome All Time	155
Table 87: LP Asset Sustainment Questionnaire – Partially Mitigated Risk Outcome All Time	156
Table 88: LP Asset Sustainment Questionnaire – Partially Mitigated Risk Outcome Time Varying	159
Table 89: LP Asset Sustainment Investment Configurable Fields	160
Table 90: LP Asset Sustainment System Parameters	160
Table 91: LP System Optimization Questionnaire – Outcome All Time	167
Table 92: LP System Optimization Questionnaire – Outcome Time Varying	168
Table 93: LP System Optimization System Parameters	168
Table 94: LP Throughput Impact Risk Questionnaire – Baseline All Time	175
Table 95: LP Throughput Impact Risk Questionnaire – Baseline Time Varying	176
Table 96: LP Throughput Impact Risk Questionnaire – Fully Mitigated Risk Outcome All Time	176
Table 97: LP Throughput Impact Risk Questionnaire – Partially Mitigated Risk Outcome All Time	176
Table 98: LP Throughput Impact Risk Questionnaire – Partially Mitigated Risk Outcome Time Varying	177
Table 99: LP Throughput Impact Risk Investment Configurable Fields	178
Table 100: LP Throughput Impact Risk System Parameters	178
Table 101: Obsolescence Risk Questionnaire – Baseline All Time	181
Table 102: Obsolescence Risk Questionnaire – Baseline Time Varying	183
Table 103: Obsolescence Risk Investment Configurable Fields	183
Table 104: Obsolescence Risk System Parameters	183



Table 105: Operational Risk Questionnaire – Baseline and Outcome All Time	
Table 106: Operational Risk Questionnaire – Baseline and Outcome Time Varying	
Table 107: Operational Risk Investment Configurable Fields	186
Table 108: Operational Risk System Parameters	
Table 109: Public Safety Risk Questionnaire – Baseline and Outcome All Time	
Table 110: Public Safety Risk Questionnaire – Baseline and Outcome Time Varying	189
Table 111: Public Safety Risk System Parameters	
Table 112: Reputational Risk Questionnaire – Baseline and Outcome All Time	191
Table 113: Reputational Risk Questionnaire – Baseline and Outcome Time Varying	191
Table 114: Reputational Risk Investment Configurable Fields	192
Table 115: Reputational Risk System Parameters	192
Table 116: Investment Cost Investment Configurable Fields	194
Table 117: Risk Consequence Multipliers	206
Table 118: CO2e Value by Region	209
Table 119: eGRID Factors for gCO2e Per MWh Value by Region	211
Table 120: Terminology Definitions	216



1 VALUE-BASED DECISION MAKING

1.1 Introduction to Value-Based Decision Making

For an organization to optimize the use of its limited resources, it must have a mechanism to determine the relative value of each Investment. There are several elements that can contribute to the overall value of an Investment, such as:

- Risks mitigated by an Investment
- Consequences of a given risk, if they were not mitigated
- Financial impacts such as cost savings
- Overall cost of the Investment
- Impacts to Key Performance Indicators (KPIs)
- Service measures
- Overall organizational value adds

An Investment's net value is then used to determine both its independent merit and its standing among other Investments competing for resources in a constrained optimization process.

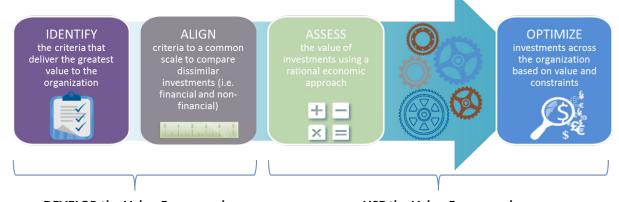
The process used to generate the Value Framework captured in this document is called Value-Based Decision Making (VDM) and is an implementation of Multi-Criteria Decision Analysis (MCDA). The VDM approach (Figure 1. Value-based Decision-Making Approach) is a best practice in Asset Investment Planning and Management (AIPM) and encourages organizations to:

- Use a value-based approach to guide the development of the decision criteria and the relative weighting of the criteria to one another.
- Use a rational economic approach calibrated to a common scale so dissimilar Investments can be compared based on a wide range of criteria.
- Align this model to the objectives and values of the organization to ensure that higher value translates into more success for the organization sooner.
- Use a quantitative, consistent, and repeatable approach to assess all benefits.
- Use a risk-informed approach, facilitated by aligning a standardized Risk Matrix to align the mitigation of risk to the common scale ensuring risk is factored into decision-making.
- Ensure that both financial and non-financial benefits are included and that their contributions are aligned to the common scale.
- Use a time-sensitive approach to planning Investments that considers differing costs and consequences resulting from deferral or acceleration of Investments. Timing is crucial.
- Optimize Investments across the entire organization to determine the highest total value that can be achieved with the available resources.
- Employ a decision-support solution that delivers transparency, consistency, accuracy, repeatability, and rigor to your organization in an efficient and collaborative manner.
- Provide an efficient mechanism to communicate and defend the recommended Investment decisions.



The VDM approach can be simplified into two primary activities:

- Develop a unique Value Framework that captures the organization's key Value Measures, financial parameters, and Risk Matrix, and are aligned with the overall organizational goals; and
- Use the Value Framework to evaluate and optimize potential Investments.



DEVELOP the Value Framework

USE the Value Framework

Figure 1: Value-based Decision Making Approach

The Copperleaf Value Framework itself (Figure 2: Copperleaf Value Framework) starts with the organization's strategic objectives and the scope of the Investments being considered which guide the definition of Value Measures, a Risk Matrix and, ultimately, the Value Function. It is also necessary to define and document the financial parameters to be used in evaluating Investments as well as any detailed supporting calculations, supporting processes, and related assumptions.

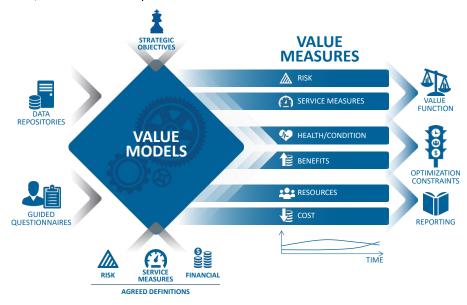


Figure 2: Copperleaf Value Framework



1.2 Value Measure Types & Criteria

Value Measures used at Enbridge Inc. can be classified into six main types: Condition, Risk Mitigation, Benefits, Cost, Service Measures, and Resources. Only value measures that are part of the value function are used to evaluate investment value. Typically, service measures, resources measures and condition measures are excluded.

Risk Value Measures are typically configured with a baseline and an outcome calculation and are mainly used to capture the Value of an Investment in avoiding undesirable events. For example, an Investment might be targeted to mitigate safety and reliability consequences linked to the in-service failure of an Asset. Risk mitigation is included in the Value Function as a positive contributor to Investment Value.

Benefits Value Measures capture desirable outcomes that are created by an Investment such as improvements in revenue or in customer service. As with all Value Measures, Benefits may be configured to have both a baseline and an outcome, but it is most typical for a Benefit Value Measure to have only an outcome. Benefits are typically included in the Value Function as a positive contributor to Investment Value.

Cost Value Measures represent the money that must be spent to execute the Investment. There is an Investment Cost Value Measure that is used as a negative contributor to Investment Value and then there are Value Measures that represent the breakdown of the Investment Cost into individual Account Types that can be used as Constraints and for reporting (Capital Spend or OPEX Spend). These measures are not typically included in the Value Function as they would duplicate the Value expressed by the Total Cost Value Measure.

Service Measures capture how an Investment contributes to targets or objectives at the Portfolio level. For example, the organization may wish to improve a reliability metric by a certain number of units or ensure that a certain number of assets in a class are replaced in each year. Service measures are evaluated in each Investment and then constrained or reported on to ensure that the Portfolio is achieving the desired level of overall performance regardless of the details around individual Investment timing or Alternative selection. Service Measures are typically measured in the native unit of the metric to be targeted (e.g. age) and are not included in the Value Function.

Resource Value Measures capture Resources used by an Investment (e.g.: hours of design engineering required). Resource Value Measures are typically used as constraints and for reporting and are not included in the Value Function as they would duplicate the Value expressed by the total cost Value Measure.

Condition Value Measures are used to capture the health of an Asset and are used as inputs to other Value Measures (i.e. to calculate the probability of failure of an Asset) and for reporting.

VALUE MEASURE CATEGORIES



Figure 3: Copperleaf Value Measure Types



1.3 Assessing & Optimizing Investments

The Value Function combines all the Value Measures required to assess and compute the overall value that each Investment is bringing to the organization, considering its financial and non-financial benefits, Risk Mitigation, and cost. All Investments are then optimized automatically by selecting the combination of start dates and Investment Alternatives that will bring the highest total value to the organization while satisfying financial, resource, service measure and timing constraints.

While each Investment may bring value to the organization, it isn't until the Investments are compared to one another and financial constraints are applied that it is known whether a specific Investment will be funded or not, and in what timeframe. A lower value Investment may be delayed in lieu of other, more urgent Investments, or may ultimately be deemed unnecessary. Listed below are some general guidelines to help determine the relative value of an Investment:

- Value. The net value of the Investment as well as the breakdown of components making up that value are visible to the Investment owner. An Investment with a net value less than zero, is an Investment in which all the benefits specified for the Investment have a present value <u>less</u> than the present value of the cost. Investments with a net value less than zero should be reconsidered and re-evaluated for other value opportunities.
- 2. Value/\$. An Investment with a larger net value is bringing more value to the organization; however larger Investments typically bring more value than smaller Investments. Therefore Value/\$, (i.e., net value/cost of the Investment) can help to compare the effectiveness of Investments of different sizes.

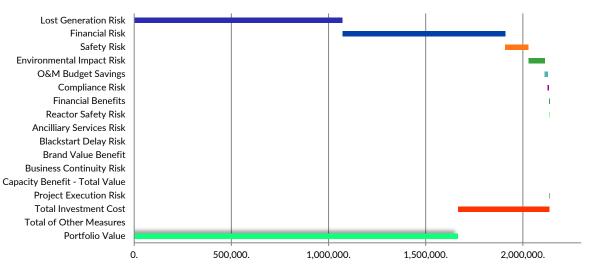


Figure 4: Example of How Value is Calculated within a Portfolio

Figure 4: Example of How Value is Calculated shows how various types of value measures are added together to a net present value in dollar terms. Similarly, within an investment, each value measure is also totaled and captured:



Value Measure	Value	
Lost Generation Ri	70,724.78	*
Compliance Risk	2,786.05	
Environmental Im	1,907.83	
O&M Budget Savi	677.23	
Financial Benefits	457.67	
Safety Risk	190.78	
Project Execution	(1,147.93)	
📕 🕏 Total Investment C	(13,674.12)	-
Total	61,922.29	

Figure 5: Example of How Value is Calculated within an Investment

Some of the measures are dollar measures while others are in value units. In the end, they are standardized and measured in value units.

1.4 Intent

The following Value Framework Definition Document (VFDD) is intended to capture the information needed to specify the risk mitigation and benefit values associated with Investments for Enbridge Inc. This document captures the relevant processes, methodologies and key assumptions that were used to develop the Value Framework and briefly reviews how the Value Framework is used to evaluate Investments and arrive at optimized recommendations.



2 ORGANIZATIONAL OBJECTIVES

2.1 Strategic Objectives and Value Measures

Eight strategic priorities have been identified in alignment with Enbridge's vision. The strategic priorities represent the areas where value can be created by Investments, as follows:

- Safety & Operational Reliability
- Extend Growth Beyond 2020
- Maintain the Foundation
- Execute Capital Program
- Move to Pure Pipeline & Utility Model
- Achieve Budgeted Financial Results
- Strengthen Financial Position
- Complete Integration and Transformation

These strategic priorities from Enbridge Inc. have been logically regrouped within Copperleaf Value as seen below:

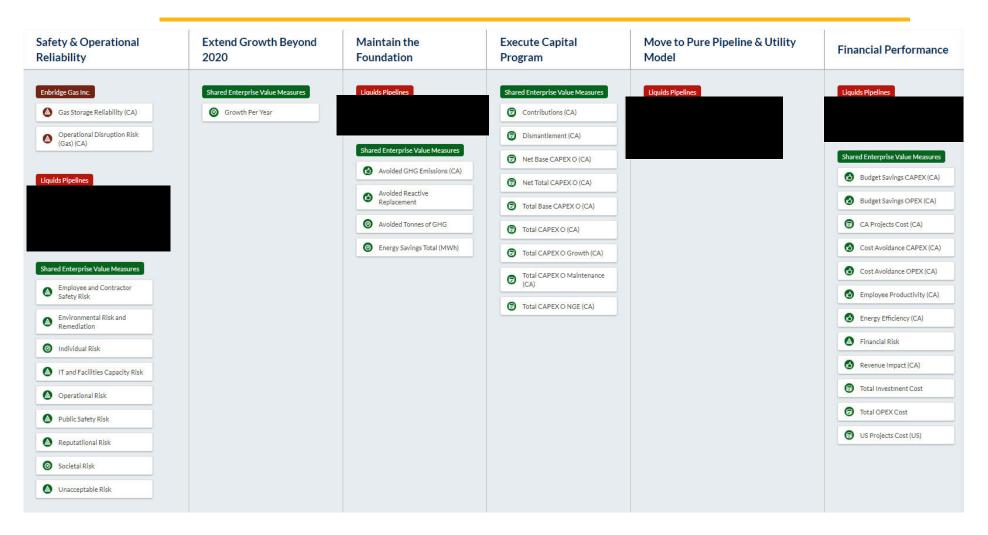
- Safety & Operations Reliability
- Extended Growth Beyond 2020
- Maintain the Foundation
- Execute Capital Program
- Move to Pure Pipeline & Utility Model
- Financial Performance

Each Strategic Priorities is comprised of one or more Value Measures. (Asset Management and Technical Capability will span the Value Measures). Value Measures are the specific attributes of an Investment that will be evaluated objectively to determine how the Investment delivers value to Enbridge Inc. The Value Measures are then placed on an economic scale to assist in optimization.

The following sections detail the Value Measures for each Strategic Objective as well as the Value Models that are used to calculate them.

The figure below shows the key Value Measures to be used at Enbridge Inc. for evaluating Investments, and how they align with strategic priorities







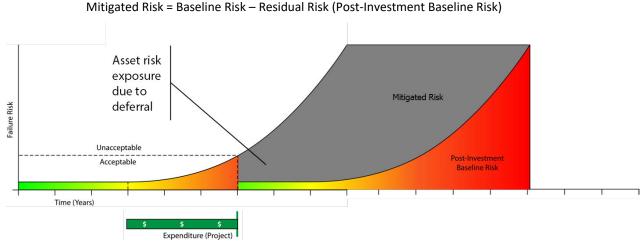
3 RISK MATRIX

Many of Enbridge's Value Measures use the standard Enterprise Operational Risk Matrix model to quantify the impact of a given Investment. Risk is defined as the likelihood of an event occurring multiplied by the consequence of that event. The Risk Matrix was built around the risk types that are important to the Enbridge (e.g., financial, health and safety, environmental, operational and reputational) and the associated consequences by severity level.

The Investment owner specifies:

- Baseline Risk: The risk present if the Investment is not completed.
- Residual Risk: The risk present after the Investment is completed.

Value of Risk Mitigated is computed as:





Risks may be calculated automatically based on a combination of user entered data and Asset Attributes or may be specified based on the probability and consequence levels defined in the Risk Matrix. When risks are specified using the Risk Matrix, the value of each risk is evaluated based on the definitions provided in Consequence Definition and Probability Definition sections of this document.

For calculated risks, the precise calculated value is used and the alignment of that value to the corresponding level in the Risk Matrix is displayed for information. In either case, the Mitigated Risk value is computed per month (aggregated and displayed per year) and the total value is determined by taking the present value of the stream using the Discount Rate configured in the system.

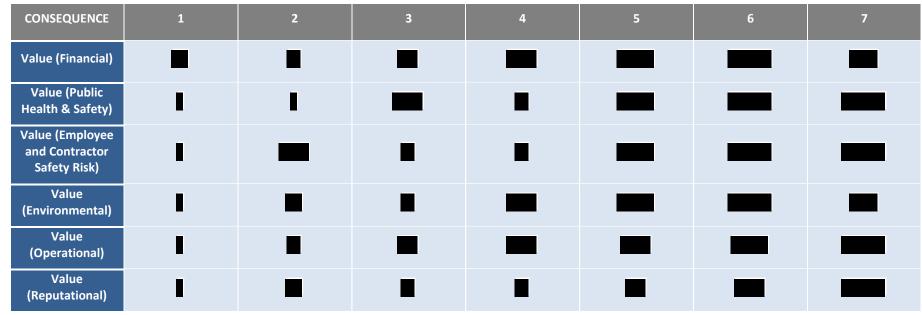


3.1 Consequence Definition

Consequence Levels are defined in Value Units where each Value Unit is equivalent to \$1,000 CA\$.

The definition of the Consequence Levels was developed by looking at the overall range of consequences that Enbridge Inc. would typically expect to mitigate through an Investment. Once the range was established, Consequence Levels were created to provide the desired degree of granularity such that each level increases in a roughly logarithmic fashion. This provides a clear progression between levels where changing a Consequence Level results in a meaningful, conclusive change.

Some Value Measures use a questionnaire and corresponding calculation formula rather than a Risk Matrix prompt to determine consequence values. These calculations are described in the description for each individual Value Measure.



3.1.1 Consequence Scale

Table 1: Consequence Scale in Value Units – all Value Measures



3.1.2 Consequence Levels

Category	1	2	3	4	5	6	7
Financial Risk	Total financial impact ≤ \$10,000 Local Dollars	Total financial impact > \$10k and ≤ \$100k Local Dollars	•	Total financial impact > \$1M and ≤ \$10M Local Dollars	•	Total financial impact >\$100M and ≤\$1B Local Dollars	Total financial impact of >\$1B Local Dollars
Public Safety Risk	No Public Safety impact.	No Public Safety impact.	Minor injuries and/or reversible health impacts to members of the public.	Requires hospitalization and/or long-term care to members of the public.	One fatality and/or permanent disability affecting one person.	Two to ten (2-10) fatalities and/or permanent disability affecting two to ten (2-10) people.	 > 10 fatalities and/or permanent disability affecting >10 people.
Contractor	No employee or contractor safety risk	Illness/injury requiring medical treatment; or highly elevated stress levels.	Illness / injury requiring medical aid; OSHA recordable; modified work restriction or stress-related leave of absence.	Incident resulting in injury or occupational illness requiring long-term rehabilitation (physical or psychological); lost time injury (LTI) or equivalent; overnight hospitalization.	permanent disability affecting	Two to ten (2-10) fatalities and/or permanent disability affecting two to ten (2-10) people.	 > 10 fatalities and/or permanent disability affecting >10 people
Environmental Risk and Remediation	No environment risk or remediation	•	environmental damage covering 100m ² (1080 ft ²) to	Offsite impact resulting in environmental damage covering 1000m ² (0.25 acre) to 1.0 ha (2.5 acre). Impact to uplands and confined wetland.	•	Offsite impact resulting in environmental damage covering 10 ha (25 acres) to 1 km ² (250 acres). Impact to uplands and lake or river; sensitive	Offsite impact resulting in extreme environmental damage (>1 km ²). Irreparable damage to lands or waterways; irreparable damage to sensitive



		quality.	farm field, forest, etc.)		no sensitive environmental receptors impacted (animal or plant species).	environmental receptors impacted (animal or plant species).	or plant species).
Operational Risk	No diversion of Enbridge resources No disruption to transportation customers No utility customer impact	Minor transportation customer disruption which	Moderate diversion of Enbridge resources Transportation customers impacted for a day or more to as much as one week. Utility customer impact 100-499 customers	diverted and operational capability is significantly impacted. Short term disruption to transportation	Extended period of Enbridge resource diversion and operational capability impact (1-3 months) Considerable disruption and inconvenience to transportation customers (1-3 months) Utility customer impact 1000 - 4999 customers; or category B major customer	Enbridge resource diversion and operational capability impact (3-6 months) Long-term impact to transportation customers (3-6 months) Utility customer impact 5000 - 20,000 customers;	Enbridge resource diversion and operational capability impact exceeds 6 months. Indefinite unavailability of transportation assets (> 6 months) Utility customer impact > 20,000 customers; or multiple category A major customers
Reputational Risk	No known media coverage. No unplanned regulatory engagement. No public disruption.	Isolated individual concern; at a municipal/county level. no media attention. Regulator notification and/or informal and unplanned	with short term local media and interest group concerns. A non- compliance issue identified by a regulator in writing	State/Provincial concern, public and media attention beyond local area, Customer attention on the issue. A non- compliance issue identified by a regulator in writing	media coverage; significant public response causing major impact on current and prospective	Extended national media coverage; significant public response causing major long-term impact on customers; damaging reputation and	Extended national media coverage; severe public response causing potentially permanent impact on customers; irreparable reputation damage

ENBRIDGE

OUPPEREEAP VALUE I RAMEWORK DESIG	N DOCOMENT		i	
		Evacuation of 100 - 1,000 persons.	resulting in the inability to expand operations. A non- compliance issue identified by a regulator in writing and directs Enbridge to stop operating specific assets; includes criminal prosecutions. Operating permit/approval canceled causing indefinite suspension to operations. Disruption or inconvenience affecting > 50,000 persons. Evacuation of > 1,000 persons.	operation; may require decommissioning of major facilities. Criminal prosecution of Enbridge leadership.

Table 2: Consequence Levels

3.2 Frequency Definition

COPPERLEAF VALUE FRAMEWORK DESIGN DOCUMENT

The following annual frequency of failure levels have been defined for use at Enbridge Inc. Annual frequency of failure and annual failure rate are synonymous and represent how many failure events are expected per year.

Frequency Level Description Range Representative Value Value Value Value
--





Table 3: Frequency Levels – All Risk Types

The frequency values displayed in the Range and Representative Value column of Table 3 represent the occurrence of failures or incidents.



3.3 Risk Matrix

The Risk Matrix below illustrates the consequence and frequency values discussed in collaboration with the Enbridge Inc. team.



Figure 7: Enbridge's Operational Risk Matrix

The values shown in the Risk Matrix are computed by multiplying the representative value of the consequence level by the representative value of the frequency level. For example, if a "4" consequence has a representative value of 3200, and a "5" frequency event has a frequency of 0.01. The result is that a "4" consequence event with a "5" frequency of occurrence is valued at 32 Value Units.



3.4 Risk Value Measure Calculations

Enbridge has defined different consequence values for each of the risk value measures. In C55, only one Risk Matrix with a single set of frequency and consequence values is possible. To get the different consequence values required for each value measure as seen in <u>Table 1: Consequence Scale in Value Units – all Value Measures</u>, multipliers have been defined for each of the value measures to convert the base Risk Matrix consequence values into the unique consequence values for the risk measures. A complete list of the multipliers can be found in Table 117: Risk Consequence Multipliers. For example, the calculation of the Public Safety Risk consequence is as follows, where **Risk Matrix Consequence** values are taken from the Risk Matrix and the **PublicSafetyRiskMultiplier** multipliers are the conversion factors for each consequence level:

RiskConsequence



This calculation is performed each time the Risk Matrix is used in the calculation of a value measure. The only value measure where the calculation isn't applied is Financial Risk. This is because Financial Risk uses the same consequence values as the base Risk Matrix.

Precise Dollar Override

The Financial Risk, Environmental Risk and Remediation, Operational Risk, and Reputational Risk value models have an optional override for the consequence. If a precise dollar value is known, the user can input the dollar amount. The value model will use this value as the consequence value instead of the Risk Matrix, allowing for greater precision when available. The dollar value can be entered in CA\$ or US\$, depending on the unit selection in the Investment Details. The calculation for risk value measures with an override is as follows:







People Harmed Override

For the Employee and Contractor Safety Risk and Public Safety Risk value measures, there is an optional override where the precise number of people that would be harmed can be entered. This provides increased granularity than using the ranges on the risk matrix.

If the number of people harmed has been specified and the consequence level is 5 or less, the number of people



4 VALUE MODELS AND VALUE MEASURES

Whereas Value Measures cover the different types of value that a given Investment can bring to Enbridge, Value Models capture the way in which these measures are calculated. A Value Model can be used to calculate one or more Value Measures as shown in the figure below:

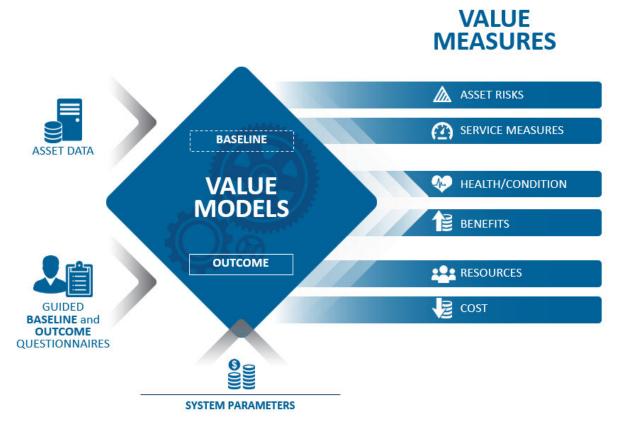


Figure 8: Value Models and Value Measures

Value Models can be driven by pre-existing data in the system, and/or require manual data entry into a questionnaire. Some questionnaires may ask for inputs relating to the matrix, while others may include a more complex set of questions that feeds a calculation. All approaches are discussed in the following sections.

Table 4: Summary of Value Models and Output Measures provides a summary of the Value Models and their corresponding Value Measure outputs.



Value Model	Usage	Output Value Measures
Avoided Reactive Replacement	Optional. May be manually added to Investments.	Avoided Reactive Replacement
		Customer Retention (CA)
Customer Detention	Optional.	Customer Retention (US)
Customer Retention	May be manually added to Investments.	Cost Avoidance OPEX (CA)
		Cost Avoidance OPEX (US)
	Ortional	Budget Savings OPEX (CA)
EGI Gas Commodity Loss	Optional.	Avoided GHG Emissions (CA)
	May be manually added to Investments.	Avoided Tonnes of GHG
		Financial Risk
EGI Operational	Optional.	Operational Disruption Risk (Gas) (CA)
Disruption Risk	May be manually added to Investments.	Public Safety Risk
		Unacceptable Risk
		Unacceptable Risk
FCI Station Conscitu	Optional.	Operational Disruption Risk (Gas) (CA)
EGI Station Capacity	May be manually added to Investments.	Public Safety Risk
		Financial Risk
		Growth Per Year
		Budget Savings OPEX (CA)
EGI System	Optional.	Financial Risk
Reinforcement	May be manually added to Investments.	Revenue Impact (CA)
		Public Safety Risk
		Unacceptable Risk
Employee and	Optional.	Employee and Contractor Safety Risk
Contractor Safety Risk	May be manually added to Investments.	Unacceptable Risk
Employee Productivity	Optional.	Employee Productivity (CA)
Employee Froductivity	May be manually added to Investments.	Employee Productivity (US)
		Avoided Tonnes of GHG
	Optional.	Avoided Tons of GHG
Energy Efficiency	May be manually added to Investments.	Energy Efficiency (CA)
		Energy Efficiency (US)
		Energy Savings Total (MWh)



Value Model	Usage	Output Value Measures	
		Avoided GHG Emissions (CA)	
		Avoided GHG Emissions (US)	
		Avoided GHG Emissions (CA)	
		Avoided Tonnes of GHG	
		Budget Savings OPEX (CA)	
		Cost Avoidance CAPEX (CA)	
		Cost Avoidance OPEX (CA)	
	Ontingel	Cost Avoidance CAPEX (US)	
Enterprise General Risks	Optional. May be manually added to Investments	Cost Avoidance OPEX (US)	
	May be manually added to investments	Employee and Contractor Safety Risk	
		Environmental Risk and Remediation	
		Financial Risk	
		Public Safety Risk	
		Reputational Risk	
		Unacceptable Risk	
Environmental Risk	Optional.	Environmental Risk and Remediation	
and Remediation	May be manually added to Investments.	Unacceptable Risk	
		Budget Savings CAPEX (CA)	
		Budget Savings CAPEX (US)	
		Budget Savings OPEX (CA)	
		Budget Savings OPEX (US)	
		Cost Avoidance CAPEX (CA)	
		Cost Avoidance CAPEX (US)	
	Optional.	Cost Avoidance OPEX (CA)	
External Risks – Investment	May be manually added to Investments.	Cost Avoidance OPEX (US)	
	Way be manually added to investments.	Financial Risk	
		Avoided GHG Emissions (CA)	
		Avoided GHG Emissions (US)	
		Energy Efficiency (CA)	
		Energy Efficiency (US)	
		Gas Storage Reliability (CA)	
		Gas Storage Reliability (US)	



Value Model	Usage	Output Value Measures
		Environmental Risk and Remediation
		Revenue Impact (CA)
		Revenue Impact (US)
		Operational Risk
		Reputational Risk
		Public Safety Risk
		Employee and Contractor Safety Risk
		Individual Risk
		Societal Risk
		Operational Disruption Risk (Gas) (CA)
		Operational Disruption Risk (Gas) (US)
		Unacceptable Risk
		Budget Savings CAPEX (CA)
		Budget Savings CAPEX (US)
		Budget Savings OPEX (CA)
		Budget Savings OPEX (US)
Financial Benefits and	Optional.	Cost Avoidance CAPEX (CA)
Costs	May be manually added to Investments.	Cost Avoidance CAPEX (US)
		Cost Avoidance OPEX (CA)
		Cost Avoidance OPEX (US)
		Revenue Impact (CA)
		Revenue Impact (US)
Financial Risk	Optional.	Financial Risk
	May be manually added to Investments.	Unacceptable Risk
	Optional.	Gas Storage Reliability (CA)
Gas Storage Reliability	May be manually added to Investments.	Gas Storage Reliability (US)
		Unacceptable Risk
GHG Emissions	Optional.	Avoided GHG Emissions (CA)
	May be manually added to Investments	Avoided GHG Emissions (US)



Value Model	Usage	Output Value Measures
		Avoided Tonnes of GHG
		Avoided Tons of GHG
GTM Asset		
Sustainment		
		CA Projects Cost (CA)
		Contributions (CA)
		Contributions (US)
		Total CAPEX O (CA)
		Total CAPEX O (US)
		Total CAPEX O Growth (CA)
		Total CAPEX O Growth (US)
		Total CAPEX O Maintenance (CA)
		Total CAPEX O Maintenance (US)
Investment Cost	Prescribed.	Total CAPEX O Enhancement (CA)
investment cost	Automatically added to all Investments.	Total CAPEX O Enhancement (US)
		Net Base CAPEX O (CA)
		Net Base CAPEX O (US)
		Net Base CAPEX O Growth (CA)
		Net Base CAPEX O Growth (US)
		Net Base CAPEX O Maintenance (CA)
		Net Base CAPEX O Maintenance (US)
		Net Base CAPEX O Enhancement (CA)
		Net Base CAPEX O Enhancement (US)
		Net Total CAPEX O (CA)



IT and Facilities Capacity Risk Optional. It P Asset Sustainment Optional. It P Asset Sustainment Optional. It P Asset Sustainment Optional.	
IT and Facilities Optional. IT and Facilities Optional. IT and Facilities Optional. IIT and Facilities IIT and Facilities Capacity Risk	
Image:)
IT and Facilities Optional. IT and Facilities Capacity Risk Optional. IT and Facilities Capacity Risk IIT and Facilities Optional. IIT and Facilities IIT and Facilities IIT and Facilities Optional. IIT and Facilities IIT and Facilities Capacity Risk)
IT and Facilities Optional. IT and Facilities Capacity Risk Optional. IT and Facilities Capacity Risk IT and Facilities Optional. IT and Facilities IT and Facilities Capacity Risk	CA)
IT and Facilities Optional. IT and Facilities Capacity Risk Optional. IT and Facilities Capacity Risk IIT and Facilities Optional. IIT and Facilities IIT and Facilities Capacity Risk	US)
Image: constraint of the constraint	CA)
IT and Facilities Optional. IT and Facilities Capacity Risk Optional. IT and Facilities Capacity Risk May be manually added to Investments. Unacceptable Risk III and Facilities Capacity Risk III and Facilities Capacity Risk	US)
IT and Facilities Optional. IT and Facilities Capacity Risk May be manually added to Investments. Unacceptable Risk III and Facilities Capacity Risk III and Facilities Capacity Risk	
Image: Cape of the system o	
IT and Facilities Optional. IT and Facilities Capacity Risk Capacity Risk Optional. IT and Facilities Capacity Risk May be manually added to Investments. Unacceptable Risk III and Facilities Capacity Risk III and Facilities Capacity Risk	
IT and Facilities Optional. IT and Facilities Capacity Risk May be manually added to Investments. IIT and Facilities Capacity Risk III and Facilities III and Facilities Capacity Risk May be manually added to Investments. III and Facilities Capacity Risk III and Facilities III and Facilities Capacity Risk	
IT and Facilities Capacity Risk Optional. May be manually added to Investments. Optional. Unacceptable Risk Unacceptable Risk II and Facilities Capacity Risk	
IT and Facilities Optional. IT and Facilities Capacity Risk May be manually added to Investments. Unacceptable Risk Image: Capacity Risk Image: Capacity Risk<	
IT and Facilities Optional. IT and Facilities Capacity Risk Capacity Risk May be manually added to Investments. Unacceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk Indeceptable Risk Indeceptable Risk IT and Facilities Capacity Risk	
IT and Facilities Capacity Risk Optional. May be manually added to Investments. Unacceptable Risk I I I I I I I I I I I I I I I I I I I	
Capacity Risk May be manually added to Investments. Unacceptable Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk Image: Capacity Risk <	
LP Asset Sustainment	



Value Model	Usage	Output Value Measures
LP System Optimization		
LP Throughput Impact Risk		
Obsolescence Risk	Optional. May be manually added to Investments.	Financial Risk Operational Risk Reputational Risk Unacceptable Risk
Operational Risk	Optional. May be manually added to Investments.	Operational Risk Unacceptable Risk
Public Safety Risk	Optional. May be manually added to Investments.	Public Safety Risk Unacceptable Risk
Reputational Risk	Optional. May be manually added to Investments.	Reputational Risk Unacceptable Risk

Table 4: Summary of Value Models and Output Measures

The list of Value Measures used to determine the value of each Investment with their descriptions and alignment with Enbridge's Strategic Priorities can be found in Table 5: Value Measure Definitions and Owners.



Strategic Priorities	Value Measure	Description			
	Employee and Contractor Safety Risk	Measures the risk of employee & contractor safety incidents that will be mitigated through the completion of an investment.			
	Public Safety Risk	Measures the risk of public safety incidents that will be mitigated through the completion of an investment.			
	IT and Facilities Capacity Risk	Measures the risk that the organization would not be capable of continued service at acceptable levels following a disruptive incident.			
	Operational Risk	Measures the mitigation of the risk of disruptive incidents preventing Enbridge to operate or serve its customers.			
	Unacceptable Risk	Serves as a flag to prevent a risk from exceeding an unacceptable threshold as defined by Enbridge Inc. Unacceptable risk is one flag used on Risk Value Models, but tolerances for unacceptable risk are configured for each type of risk.			
Safety & Operational Reliability	Reputational Risk	Measures the mitigation of the risk of incidents that would be perceived poorly by customers, the media, and stakeholders through the completion of an investment.			
	Individual Risk	Measures the mitigation of safety risks. Legacy risk measure kept for reporting purposes.			
	Societal Risk	Measures the mitigation of societal risks. Legacy risk measure kept for reporting purposes.			
	Gas Storage Reliability (CA)	Measures the financial benefits of investments that increase the reliability of gas storage assets to prevent supply interruptions.			
	Gas Storage Reliability (US)	Measures the financial benefits of investments that increase the reliability of gas storage assets to prevent supply interruptions.			
	Environmental Risk and Remediation	Measures the mitigation of risk of environmental incidents through the completion of an investment.			
	Operational Disruption Risk (Gas) (CA)	Measures the societal cost of a disruption in the distribution of gas to customers.			
	Operational Disruption Risk (Gas) (US)	Measures the societal cost of a disruption in the distribution of gas to customers.			
	Unexpected Outage Duration	Measures the downtime (hours) in operation after an unplanned outage.			



Strategic Priorities	Value Measure	Description
Extend Growth Beyond 2020	Growth Per Year	Measures the expected customer growth per year the system serves.
	Avoided Tonnes of GHG	Measures the amount (metric tonnes) of greenhouse gases avoided through the completion of an investment. Used for constraining and reporting.
	Avoided Tons of GHG	Measures the amount (imperial tons) of greenhouse gases avoided through the completion of an investment. Used for constraining and reporting.
	Avoided GHG Emissions (CA)	Measures the monetary value of reducing CO ₂ greenhouse gas emissions through the completion of an investment.
Maintain the Foundation	Avoided GHG Emissions (US)	Measures the monetary value of reducing CO ₂ greenhouse gas emissions through the completion of an investment.
	Energy Savings Total (MWh)	Measures the amount of energy savings in MWh through the completion of the investment.
	Customer Retention (CA)	The economic impact of potentially losing business in the event a project is not completed.
	Customer Retention (US)	The economic impact of potentially losing business in the event a project is not completed.
	Avoided Reactive Replacement	The financial savings of replacing an asset proactively before it fails, and not having to pay the higher, reactive replacement costs.
	Contributions (CA)	The total amount of capital contributed by the customer for the investment.
	Contributions (US)	The total amount of capital contributed by the customer for the investment.
	Total CAPEX O Growth (CA)	Measures the total CAPEX and Dismantlement costs to complete the investment alternative if the alternative is specified to be a Growth project.
Execute Capital	Total CAPEX O Growth (US)	Measures the total CAPEX and Dismantlement costs to complete the investment alternative if the alternative is specified to be a Growth project.
Program	Total CAPEX O Maintenance (CA)	Measures the total CAPEX and Dismantlement costs to complete the investment alternative if the alternative is specified to be Maintenance project.
	Total CAPEX O Maintenance (US)	Measures the total CAPEX and Dismantlement costs to complete the investment alternative if the alternative is specified to be a Maintenance project.
	Total CAPEX O Enhancement (CA)	Measures the total CAPEX and Dismantlement costs to complete the investment alternative if the alternative is specified to be a Non-Growth Enhancement project.



Strategic Priorities	Value Measure	Description
	Total CAPEX O Enhancement (US)	Measures the total CAPEX and Dismantlement costs to complete the investment alternative if the alternative is specified to be a Non-Growth Enhancement project.
	Dismantlement (CA)	The total costs resulting from decommissioning/retiring an asset and the costs associated with retiring assets that have reached their end of life.
	Dismantlement (US)	The total costs resulting from decommissioning/retiring an asset and the costs associated with retiring assets that have reached their end of life.
	Total CAPEX O (CA)	Measures the total CAPEX and Dismantlement costs to complete the investment alternative.
	Total CAPEX O (US)	Measures the total CAPEX and Dismantlement costs necessary to complete the investment alternative.
	Net Base CAPEX O (CA)	Measures the total CAPEX minus the amount of Contributions necessary to complete the investment alternative.
	Net Base CAPEX O (US)	Measures the total CAPEX minus the amount of Contributions necessary to complete the investment alternative.
	Net Base CAPEX O Growth (CA)	Measures the total CAPEX minus the amount of Contributions necessary to complete the investment alternative if the alternative is specified to be a Growth project.
	Net Base CAPEX O Growth (US)	Measures the total CAPEX minus the amount of Contributions necessary to complete the investment alternative if the alternative is specified to be a Growth project.
	Net Base CAPEX O Maintenance (CA)	Measures the total CAPEX minus the amount of Contributions necessary to complete the investment alternative if the alternative is specified to be a Maintenance project.
	Net Base CAPEX O Maintenance (US)	Measures the total CAPEX minus the amount of Contributions necessary to complete the investment alternative if the alternative is specified to be a Maintenance project.
	Net Base CAPEX O Enhancement (CA)	Measures the total CAPEX minus the amount of Contributions necessary to complete the investment alternative if the alternative is specified to be a Enhancement project.
	Net Base CAPEX O Enhancement (US)	Measures the total CAPEX minus the amount of Contributions necessary to complete the investment alternative if the alternative is specified to be a Enhancement project.
	Net Total CAPEX O (CA)	Measures the total CAPEX and Dismantlement costs minus the amount of Contributions necessary to complete the investment alternative.



Strategic Priorities	Value Measure	Description
	Net Total CAPEX O (US)	Measures the total CAPEX and Dismantlement costs minus the amount of Contributions necessary to complete the investment alternative.
	Net Total CAPEX O Growth (CA)	Measures the total CAPEX and Dismantlement costs minus the amount of Contributions necessary to complete the investment alternative if the alternative is specified to be a Growth project.
	Net Total CAPEX O Growth (US)	Measures the total CAPEX and Dismantlement costs minus the amount of Contributions necessary to complete the investment alternative if the alternative is specified to be a Growth project.
	Net Total CAPEX O Maintenance (CA)	Measures the total CAPEX and Dismantlement costs minus the amount of Contributions necessary to complete the investment alternative if the alternative is specified to be a Maintenance project.
	Net Total CAPEX O Maintenance (US)	Measures the total CAPEX and Dismantlement costs minus the amount of Contributions necessary to complete the investment alternative if the alternative is specified to be a Maintenance project.
	Net Total CAPEX O Enhancement (CA)	Measures the total CAPEX and Dismantlement costs minus the amount of Contributions necessary to complete the investment alternative if the alternative is specified to be a Enhancement project.
	Net Total CAPEX O Enhancement (US)	Measures the total CAPEX and Dismantlement costs minus the amount of Contributions necessary to complete the investment alternative if the alternative is specified to be a Enhancement project.
	Base CAPEX O (CA)	Measures the total CAPEX necessary to complete the investment alternative.
	Base CAPEX O (US)	Measures the total CAPEX necessary to complete the investment alternative.
Move to Pure Pipeline	Additional Barrels/Day	Measures the amount of additional throughput that can be achieved by an asset system.
& Utility Model	Throughput Impacted	Measures the amount of throughput affected by the failure of an asset.
	Financial Risk	Measures the mitigation of potential financial risks such as financial losses due to damage of equipment/company assets, if the investment is not completed.
Financial Performance	Cost Avoidance OPEX (CA)	Any action that avoids having to incur OPEX costs in the future (these costs would be unbudgeted/not planned). Cost avoidance measures are never reflected in financial statements or the annual budget. They are only reflected in instances where a proposed action is not implemented, thus resulting in a cost increase.



Strategic Priorities	Value Measure	Description
	Cost Avoidance OPEX (US)	Any action that avoids having to incur OPEX costs in the future (these costs would be unbudgeted/not planned). Cost avoidance measures are never reflected in financial statements or the annual budget. They are only reflected in instances where a proposed action is not implemented, thus resulting in a cost increase.
	Revenue Impact (CA)	Measures the impacts to the total amount of gross income generated by Enbridge's primary operations. Revenue represents the total income earned before expenses are deducted.
	Revenue Impact (US)	Measures the impacts to the total amount of gross income generated by Enbridge's primary operations. Revenue represents the total income earned before expenses are deducted.
	Budget Savings OPEX (CA)	Values the OPEX Budget Savings of the investment.
	Budget Savings OPEX (US)	Values the OPEX Budget Savings of the investment.
	Installation Gross Margin Impact (CA)	Measures the lost revenue less power costs experienced during the necessary downtime to replace an asset.
	Installation Gross Margin Impact (US)	Measures the lost revenue less power costs experienced during the necessary downtime to replace an asset.
	Budget Savings CAPEX (CA)	Budget savings is the net benefit between the anticipated cost increases to the CAPEX budget as well as cost savings to current planned spending. This is not the Investment Cost.
	Budget Savings CAPEX (US)	Budget savings is the net benefit between the anticipated cost increases to the CAPEX budget as well as cost savings to current planned spending. This is not the Investment Cost.
	Cost Avoidance CAPEX (CA)	Any action that avoids having to incur CAPEX costs in the future (these costs would be unbudgeted/not planned). Cost avoidance measures are never reflected in financial statements or the annual budget. They are only reflected in instances where a proposed action is not implemented, thus resulting in a cost increase.
	Cost Avoidance CAPEX (US)	Any action that avoids having to incur CAPEX costs in the future (these costs would be unbudgeted/not planned). Cost avoidance measures are never reflected in financial statements or the annual budget. They are only reflected in instances where a proposed action is not implemented, thus resulting in a cost increase.
	Energy Efficiency (CA)	Measures the financial benefits in the form of annual power savings and reduced CO_2 emissions.
	Energy Efficiency (US)	Measures the financial benefits in the form of annual power savings and reduced CO_2 emissions.
	Employee Productivity (CA)	Measures the impact on working conditions and employee productivity.



Strategic Priorities	Value Measure	Description
	Employee Productivity (US)	Measures the impact on working conditions and employee productivity.
	Total Investment Cost (CA)	Measures the total cost necessary to complete the investment alternative.
	Total Investment Cost (US)	Measures the total cost necessary to complete the investment alternative.
	Total OPEX Cost (CA)	The total monthly spend for the Investment Alternative under the Account Type OPEX.
	Total OPEX Cost (US)	The total monthly spend for the Investment Alternative under the Account Type OPEX.
	US Projects Cost (US)	The total US\$ monthly spend for the Investment Alternative for US projects (UnitsSelection = US\$ (Imperial))
	CA Projects Cost (CA)	The total CA\$ monthly spend for the Investment Alternative for Canadian projects (UnitsSelection = CA\$ (Metric))

Table 5: Value Measure Definitions and Owners

4.1 Value Measure and Value Model Types

4.1.1 Value Measures and Units

Value Measures may be calculated in any unit. For Value Measures to be included in a Value Function, a conversion is made between the units used for the Value Measure and the standard Value Units that are used in the Risk Matrix and in all value calculations.

At Enbridge Inc., all Value Measures used in a Value Function are calculated either directly in Value Units (Risk Matrix based Value Models) or in Canadian Dollars (CA\$). Any models that are computed in CA\$ have a conversion factor of 0.001 applied to normalize it to the Value Measure scale.

As Enbridge Inc. operates in both Canada and the United States, a matching US Value Measure is provided for each of the CA Value Measures. The US Value Measures are for reporting purposes. To prevent double counting, only the CA Value Measures are allowed in the Value Function.

4.1.2 Baselines and Outcomes

Value Measures may be configured either to measure a change in value created by an Investment or the absolute value that exists after the Investment has been completed.

For example, Risk Mitigation is typically measured as the delta between the risk without the Investment (baseline risk) and the outcome or residual risk after the Investment is completed. For Value Measures such as Investment Cost, only the outcome after Investment completion is relevant as there is no baseline to be considered.

4.1.3 Use of Value Models

As described in the table above, Value Models can be designated as either "mandatory" or "optional" for Investments. This allows the system to automatically add certain Value Models such as Investment Cost to all Investments.



4.1.4 Risk Light, Risk Medium, and Risk Heavy Value Models

There are three different approaches for performing risk analysis. These are the Risk Light, Risk Medium, and Risk Heavy processes.

- Risk Light: Value Models that use the risk matrix. Users select the risk consequence and frequency for both the baseline and outcome scenario to determine the risk mitigation. While consequence and frequency can be overwritten with real world values where known, the Risk Light approach is used when the user can only approximately estimate the risk or appropriate Risk Medium/Heavy value models aren't available.
- Risk Medium: The Risk Medium Value Models use questionnaires to prompt the user to approximate real world numbers that feeds the baseline and outcome risk calculation. The risk calculation for Risk Medium Value Models is more robust than the Risk Light approach and the output is more precise.
- Risk Heavy: Quantitative Risk Analysis performed using an external system and imported into C55. When available, this process will provide the most accurate answers.

4.1.5 Time Varying Values

All Value Measures are calculated as streams of value over time. The system and questionnaire inputs used in calculation may be defined as either fixed or varying over time. For example, the Asset Type of an Asset is a value that does not change over time, while the Frequency of Failure of that same Asset may be specified to increase over time as the Asset ages.

The figure below shows how a Risk Matrix Model calculates time varying value. From Nov 2017 to October 2022 (5 years) the Risk Consequence level is significant, and the Risk Frequency is low. From Nov 2022 to the end of the analysis period new Risk Consequence and Risk Frequency values are chosen. There is no limit to the number of time periods a user can input in a time-varying questionnaire. Time periods can be specified for all years up to the end of the Planning Horizon. The Planning Horizon is a configurable system setting and has been initially set to 50 years for Enbridge.

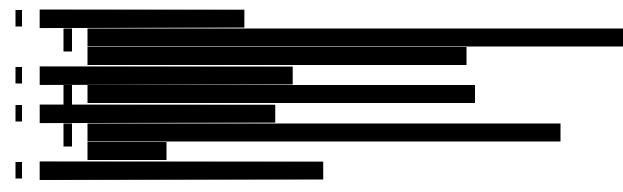
Nov 2017 to 5 Years V Oct 2022 to 10 Strains V Oct 2022 to 10 Significant V		ionnaire Manual Risk 🔻 🕞 Save 📩 Revert	
1. Risk Consequence Significant	_		nd Date
Significant	Nov	2017 to 5 Years V Oct 2022	
	1.	Risk Consequence	
2. Risk Probability		Significant	•
	2.	Risk Probability	
Low 👻		Low	•

Figure 9: Time Varying Risk Matrix Model



4.1.6 Value Measure Calculations

Calculations for all Value Measure Outputs for all Value Models will follow the below format:



4.2 User Selected (Optional) Models

The Value Models discussed in this section are not mandatory for Investments. The project evaluator is required to determine which Value Models are required for evaluating a project. A User may add any of the Value Models in this section to an Investment.

4.2.1 Avoided Reactive Replacement

Avoided Reactive Replacement measures the potential benefits of financial savings by performing proactive replacement (e.g. replacement) projects that avoid reactive project costs particularly when the asset has a probable end of life. (Any on-going OPEX impacts are to be captured in the Financial Benefits and Costs Value Model. In addition, asset sustainment models are typically used to model the risks present in the system that are mitigated by doing the sustainment project. This model is meant to be used when an asset has few associated risk drivers.)

4.2.1.1 Value Model Inputs



User Questionnaires

Outcome – All Time

Questionnaire Prompt (Description)		Variable Name	Required?	Description / Selection Options
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)
2.	What is the estimated age of the asset?	AssetAge	NO	Number
3.	From today's date, what is the minimum number of years before failure given the current asset condition?	AssetMinLife	YES	Number



Questionnaire Prompt (Description)		Variable Name	Required?	Description / Selection Options
4.	If available, from today's date, what is the most likely number of years until failure given the current asset condition?	AssetModeLife	NO	Number
5.	From today's date, what is the maximum number of years until failure given the current asset condition?	AssetMaxLife	YES	Number
6.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)

Table 6: Avoided Reactive Replacement Questionnaire – Outcome All Time

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 7: Avoided Reactive Replacement System Parameters





4.2.1.2 Value Measure Outputs

The Avoided Reactive Replacement Value Model outputs the following Value Measures:



Figure 10: Avoided Reactive Replacement Value Model

4.2.1.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the Avoided Reactive Replacement Model.

Intermediate Calculations

FrequencyOfFailure

The calculation of annual frequency of failure uses the Heuristic Failure Frequency Estimation Tool. The methodology and calculations behind this tool are described in Section 6: Heuristic Failure Frequency Estimation Tool.

Final Outputs

Avoided Reactive Replacement

Avoided Reactive Replacement measures the financial benefit of completing a proactive replacement project rather than waiting for the assets to fail and repairing reactively. This value measure is calculated as follows:



This Value Measure is calculated in Value Units. It is intended for use in a Value Function.

4.2.2 Customer Retention

Customer Retention measures the avoided OPEX costs that would be required to maintain customer satisfaction and retain their business when there is a potential for customer dissatisfaction if the project is not completed (e.g. adding a connection to a competitor's service line to keep a customer happy). This Value Model excludes contract penalty and direct revenue impact.

4.2.2.1 Value Model Inputs

Takes Inputs from: User Questionnaire System Parameters Investme	nt Fields
--	-----------



Outcome – All Time

Questionnaire Prompt (Description)		Variable Name	Required?	Description / Selection Options
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)
2.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)

Table 8: Customer Retention Questionnaire – Outcome All Time

Outcome – Time Varying

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
1.	What is the annual value to Enbridge of the impacted customer? (Investment Currency)	CustomerAnnualValue	YES	Number	\$
2.	Who is the key customer impacted by this investment?	KeyCustomer	NO	Text	
3.	What is the magnitude of impact to the customer if corrective action is not taken?	CustomerImpact	YES		



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
4. What is the probability of the event occurring if corrective action is not taken? (%)	CustomerImpactProbability	YES	Number	%

Table 9: Customer Retention Questionnaire – Outcome Time Varying

Investment Configurable Fields

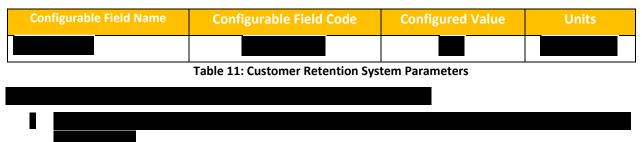
The following values are investment configurable fields. The investment configurable field applies to all value models within the investment.

Configurable Field Name	Configurable Field Code	Configured Value	Units
	UnitSelection	Dropdown List:	
Unit Selection		1. CA\$ (Metric)	
		2. US\$ (Imperial)	

 Table 10: Customer Retention Investment Configurable Fields

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.





4.2.2.2 Value Measure Outputs

The Customer Retention Value Model outputs multiple Value Measures as shown below.

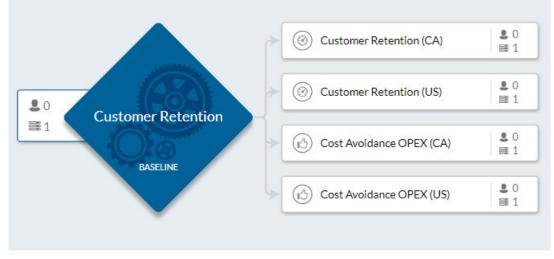


Figure 11: Customer Retention Value Model

4.2.2.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the **Customer Retention** Model.

Intermediate Calculations

Final Outputs

Customer Retention (CA)

Values the Customer Retention change due to the investment.



Customer Retention is a service measure used for reporting and constraining. It is not intended for use in the value function.

Customer Retention (US)

Values the Customer Retention change due to the investment.



Customer Retention is a service measure used for reporting and constraining. It is not intended for use in the value function.

Cost Avoidance OPEX (CA)

Values the impact to the OPEX budget due to the investment.



This Value Measure is calculated in CA\$. It is intended for use in a Value Function and is converted to Value Units as described in Section 4.1.1 - Value Measures and Units.

Cost Avoidance OPEX (US)

Values the impact to the OPEX budget due to the investment.

This Value Measure is calculated in US\$. It is not intended for use in a Value Function.

4.2.3 EGI Gas Commodity Loss

EGI Gas Commodity Loss captures the financial and GHG impact of lost gas commodity due to current leaks or ruptures.

4.2.3.1 Value Model Inputs

Takes Inputs from:User QuestionnaireSystem Parameters

User Questionnaires

The user is prompted to answer the following questionnaires for the EGI Gas Commodity Loss Value Model.

Outcome – All Time

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
1. Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)	
2. What is the geographic region this investment is located in?	AvoidedGHGRegionEGI	YES	Dropdown List:	



3.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)	

Table 12: EGI Gas Commodity Loss Questionnaire – Outcome All Time

Outcome – Time Varying

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
1. What is the current leak severity?	LeakSeverity	YES	Dropdown List:	scm



2.	Override: If available, what is the precise volume of commodity lost per leak? (scm)	LeakSeverityOverride	NO	Number	scm
3.	How many leaks per year of this severity are currently experienced?	CurrentLeakFrequency	YES	Number	Leaks / year
4.	How many leaks per year of this severity are expected after the investment?	ExpectedLeakFrequency	YES	Number	Leaks / year

Table 13: EGI Gas Commodity Loss Questionnaire – Outcome Time Varying

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 14: EGI Gas Commodity Loss System Parameters



4.2.3.2 Value Measure Outputs

The EGI Gas Commodity Loss Value Model outputs multiple Value Measures as shown below.



Figure 12: EGI Gas Commodity Loss Value Model

4.2.3.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the EGI Gas Commodity Loss Value Model.

Intermediate Calculations

CO2Value



Tonnes of GHG avoided. Used for reporting and constraining purposes.

This Value Measure is not intended for use in the Value Function.

Avoided GHG Emissions (CA)

Monetary value of reducing CO₂ greenhouse gas emissions.



This Value Measure is calculated in CA\$. It is intended for use in a Value Function and is converted to Value Units as described in Section 4.1.1 - Value Measures and Units.

Budget Savings OPEX (CA)

Budget savings resulting from reducing the loss of commodity.

This Value Measure is calculated in CA\$. It is intended for use in a Value Function and is converted to Value Units as described in Section 4.1.1 - Value Measures and Units.

4.2.4 EGI Operational Disruption Risk

EGI Operational Disruption Risk measures the mitigation of financial and societal (customer minutes of interruption) risks associated with service disruption to customers as result of asset failure. The public safety risks of customer outages are also considered.

4.2.4.1 Value Model Inputs

Takes Inputs from: User Questionnaire

re System Parameters

User Questionnaires

The user is prompted to answer the following questionnaires for the EGI Operational Disruption Risk Value Model.

Baseline – All Time

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)	
2.	What is the Asset Type? (For station, answer the time varying questions 9 and 10)	AssetType	YES	Dropdown:	
3.	Which region is the asset in?	Region	YES	Dropdown:	
4.	How long does it take to fix the issue excluding re-light? (days)	AverageOutageDuration	YES	Number	days



	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
5.	Is this a multi-feed system?	MultiFeed	YES	Checkbox:	
6.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)	

Table 15: EGI Operational Disruption Risk – Baseline All Time

Baseline – Time Varying

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
1.	How frequent an asset failure would lead to an onset of service disruption?	AssetFailureFrequency	YES	Dropdown List:)	
2.	If available, what is the annual frequency of asset failure leading to onset of service disruption?	AssetFailureFrequencyOverride	NO	Number	Events / Year
3.	Are customer types fed from the asset known? If yes, answer questions 4 to 7.	KnownCustomerType	YES	Dropdown List:	
4.	What is the percentage of Residential Customer fed from the asset?	PercentResidentialCustomer	NO	Number	%
5.	What is the percentage of Commercial Customer fed from the asset?	PercentCommercialCustomer	NO	Number	%
6.	What is the percentage of Apartment Customer fed from the asset?	PercentApartmentCustomer	NO	Number	%



	estionnaire Prompt scription)	Variable Name	Required?	Description / Selection Options	Units
7.	What is the percentage of Industrial Customer fed from the asset?	PercentIndustrialCustomer	NO	Number	%
8.	What is the peak load served by this asset? (Thousands of scm/ hour)	AssetPeakLoad	YES	Number	Thousands of scm / hour
9.	For station only, what is the ratio (in percentage) between the yearly average load and the peak load (e.g. 50% means yearly average load is half of the peak load)?	PercentStationPeakLoadReduction	NO	Number	%
10.	For station only, what's the maximum percentage backfed for the station that can be provided by the system?	MaxPercentageBackfed	NO	Number	%

Table 16: EGI Operational Disruption Risk – Baseline Time Varying

Outcome – All Time

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)	
2.	How long does it take to fix the issue excluding re- light? (days)	AverageOutageDuration	YES	Number	days
3.	Is this a multi-feed system?	MultiFeed	YES	Dropdown List: • Yes • No	

Table 17: EGI Operational Disruption Risk – Outcome All Time



Outcome – Time Varying

	estionnaire Prompt scription)	Variable Name	Required?	Description / Selection Options	Units
1.	How frequent an asset failure would lead to an onset of service disruption?	AssetFailureFrequency	YES	Dropdown List:	
2.	If available, what is the annual frequency of asset failure leading to onsite of service disruption?	AssetFailureFrequencyOverride	NO	Number	
3.	Are customer types fed from the asset known? If yes, answer questions 4 to 7.	KnownCustomerType	YES	Dropdown List:	
4.	What is the percentage of Residential Customer fed from the asset?	PercentResidentialCustomer	NO	Number	%
5.	What is the percentage of Commercial Customer fed from the asset?	PercentCommercialCustomer	NO	Number	%
6.	What is the percentage of Apartment Customer fed from the asset?	PercentApartmentCustomer	NO	Number	%
7.	What is the percentage of Industrial Customer fed from the asset?	PercentIndustrialCustomer	NO	Number	%
8.	What is the peak load served by this asset? (Thousands of scm/ hour)	AssetPeakLoad	YES	Number	Thousands of scm/ hour
9.	For station only, what is the Percentage Peak Flow not served in the event of the station failure?	PercentagePeakFlowNotServed	NO	Number	%
10.	For station only, what's the maximum percentage backfed for this station that can be provided by the system?	MaxPrecentageBackfed	NO	Number	%

Table 18: EGI Operational Disruption Risk – Outcome Time Varying

System Parameters



The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units



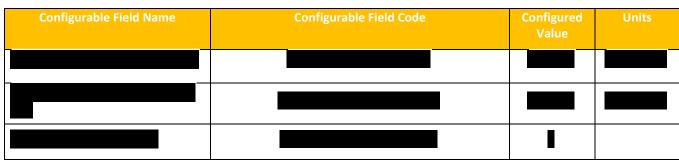


Table 19: EGI Operational Disruption Risk System Parameters

4.2.4.2 Value Measure Outputs

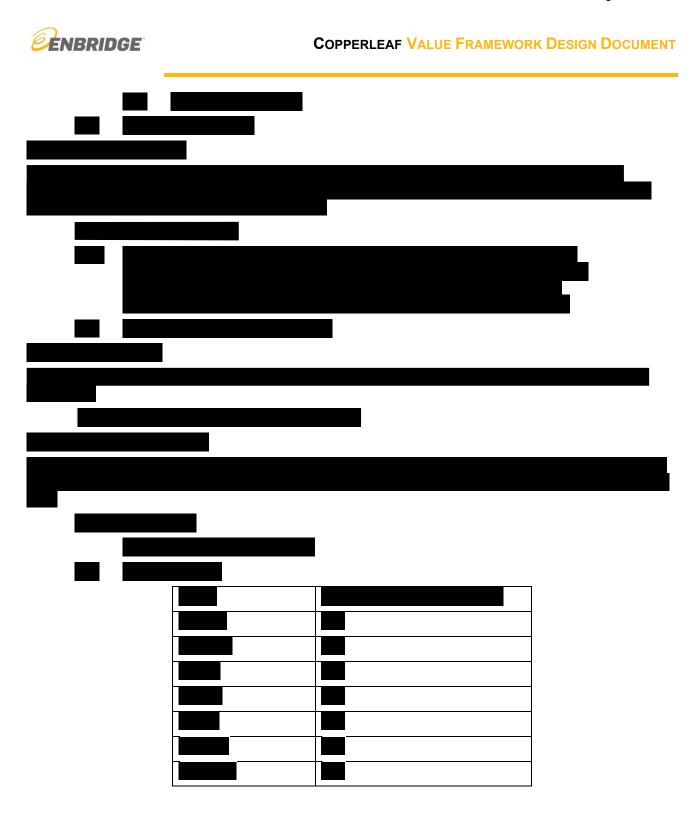
The EGI Operational Disruption Risk Value Model outputs multiple Value Measures as shown below.



Figure 13: EGI Operational Disruption Risk Value Model

4.2.4.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the **EGI Operational Disruption Risk** Value Model.



REDACTED Filed: 2023-04-06, EB-2022-0200, Exhibit JT5.10, Attachment 1, Page 58 of 216

COPPERLEAF VALUE FRAMEWORK DESIGN DOCUMENT	E ENBRIDGE

COPPERLEAF VALUE FRAMEWORK DESIGN DOCUMENT		

Unacceptable Risk

The Unacceptable Risk measure serves as a flag to notify when the Operational Disruption Risk (Gas), Financial Risk, or Public Safety Risk exceeds a level of tolerance defined by Enbridge.





4.2.5 EGI Station Capacity

EGI Station Capacity measures the mitigation of financial and societal risks caused by regulator stations that are currently being used over their target utilization factor. The public safety risks of customer outages are also considered. The Unacceptable Risk measure serves as a flag to notify when the Operational Disruption Risk exceeds a level of tolerance defined by Enbridge.

4.2.5.1 Value Model Inputs

Takes Inputs from:	User Questionnaire	System Parameters
--------------------	--------------------	-------------------

User Questionnaires

The user is prompted to answer the following questionnaires for the EGI Station Capacity Value Model.

Baseline – All Time

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)	
2.	What's the current or previous year flow? (Thousands of scm / hour)	PreviousStationFlow	YES	Number	Thousands of scm / hour
3.	What's the previous year utilization factor? (%)	PreviousYearStationUtilization	YES	Number	%
4.	How long does it take to fix the issue excluding re- light? (days)	AverageOutageDuration	YES	Number	days
5.	Is this a multi-feed system?	MultiFeed	YES	Checkbox:	
6.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)	

Table 20: EGI Station Capacity – Baseline All Time



Baseline – Time Varying

Qu	estionnaire Prompt			Description (
	scription)	Variable Name	Required?	Description / Selection Options	Units
1.	How frequent an asset failure would lead to an onset of service disruption?	AssetFailureFrequency	YES	Dropdown List:	
2.	If available, what is the annual frequency of asset failure leading to onset of service disruption?	Asset Failure Frequency Override	NO	Number	Events / Year
3.	Are customer types fed from the asset known? If yes, answer questions 4 to 7.	KnownCustomerType	YES	Dropdown List:	
4.	What is the percentage of Residential Customer fed from the asset?	PercentResidentialCustomer	NO	Number	%
5.	What is the percentage of Commercial Customer fed from the asset?	PercentCommercialCustomer	NO	Number	%
6.	What is the percentage of Apartment Customer fed from the asset?	PercentApartmentCustomer	NO	Number	%
7.	What is the percentage of Industrial Customer fed from the asset?	PercentIndustrialCustomer	NO	Number	%
8.	What's the target station regulation utilization factor? (%)	TargetStationUtilization	YES	Number	%
9.	What is the peak load served by this asset (Thousands of scm/ hour)?	AssetPeakLoad	YES	Number	Thousands of scm / hour
10.	What is the ratio (in percentage) between the yearly average load and the peak load (e.g. 50% means yearly average load is half of the peak load)?	PercentStationPeakLoadReducti onSC	YES	Number	%



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
11. What's the maximum percentage backfed for the station that can be provided by the system?	MaxPercentageBackfedSC	Yes	Number	%

Table 21: EGI Station Capacity – Baseline Time Varying

Outcome – All Time

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)	
2.	What's the current or previous year flow? (Thousands of scm / hour)	PreviousStationFlow	YES	Thousands of scm / hour	Thousands of scm / hour
3.	What's the previous year utilization factor? (%)	PreviousYearStationUtilization	YES	Number	%
4.	How long does it take to fix the issue excluding re-light? (days)	AverageOutageDuration	YES	Number	days
5.	ls this a multi-feed system?	MultiFeed	YES	Dropdown List:	

Table 22: EGI Station Capacity – Outcome All Time

Outcome – Time Varying

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
1. How frequent an asset failure would lead to an onset of service disruption?	AssetFailureFrequency	YES	Dropdown List:	



	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection	Units
1-0	seriptiony			Options	
2.	If available, what is the annual frequency of asset failure leading to onsite of service disruption?	AssetFailureFrequencyOverride	NO	Number	
3.	Are customer types fed from the asset known? If yes, answer questions 4 to 7.	KnownCustomerType	YES	Dropdown List:	
4.	What is the percentage of Residential Customer fed from the asset?	PercentResidentialCustomer	NO	Number	%
5.	What is the percentage of Commercial Customer fed from the asset?	PercentCommercialCustomer	NO	Number	%
6.	What is the percentage of Apartment Customer fed from the asset?	PercentApartmentCustomer	NO	Number	%
7.	What is the percentage of Industrial Customer fed from the asset?	PercentIndustrialCustomer	NO	Number	%
8.	What's the target station regulation utilization factor? (%)	TargetStationUtilization	YES	Number	%
9.	What is the peak load served by this asset (Thousands of scm / hour)?	AssetPeakLoad	YES	Number	Thousands of scm / hour
10.	What is the ratio (in percentage) between the yearly average load and the peak load (e.g. 50% means yearly average load is half of the peak load)?	PercentStationPeakLoad ReductionSC	YES	Number	%
11.	What's the maximum percentage backfed for this station that can be provided by the system?	MaxPrecentageBackfedSC	YES	Number	%

Table 23: EGI Station Capacity – Outcome Time Varying

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.



Configurable Field Name	Configurable Field Code	Configured Value	Units

COPPERLEAF VALUE FRAMEWORK DESIGN DOCUMENT

Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 24: EGI Station Capacity System Parameters

4.2.5.2 Value Measure Outputs

The EGI Station Capacity Value Model outputs multiple Value Measures as shown below.

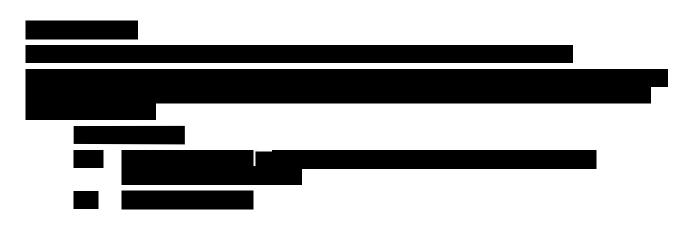


Figure 14: EGI Station Capacity Value Model

4.2.5.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the **EGI Station Capacity** Model.

Intermediate Calculations



COPPERLEAF VALUE FRAMEWORK DESIGN DOCUMENT

4.2.6 EGI System Reinforcement

EGI System Reinforcement measures the risk of failing to provide infrastructure to support current and future demand. The Unacceptable Risk measure serves as a flag to notify when System Reinforcement risk exceeds an unacceptable level defined by Enbridge.

4.2.6.1 Value Model Inputs



User Questionnaires

The user is prompted to answer the following questionnaires for the EGI System Reinforcement Value Model.

Baseline – All Time

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options
1. Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying



Qu	lestionnaire Prompt			Description / Selection
(De	escription)	Variable Name	Required?	Options
				selection of answers (Max 10,000 characters)
2.	What is the pressure classification of the pipe?	PipeClassification	YES	Dropdown List:
3.	Which regional administration number is the reinforcement in?	RegionalAdminNumber	YES	Dropdown List:



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options
4. Please tell us your ideas for			
improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)

Table 25: EGI System Reinforcement Questionnaire – Baseline All Time

Baseline - Time Varying

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options
1. How many customers are at risk of an outage due to low pressure?	CustAtRiskAtLowPress	YES	Number
2. How many customers are impacted outside of planning criteria (drooping regulator feed, etc)?	CustOutOfPlanCriteria	YES	Number
3. What is the minimum pipe pressure experienced by the pipe? (psig)	MinimumPressure	YES	Number

Table 26: EGI System Reinforcement Questionnaire – Baseline Time Varying

Outcome – All Time

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)
2.	What is the pressure classification of the pipe?	PipeClassification	YES	Dropdown List: 1. High Pressure 2. Low Pressure

Table 27: EGI System Reinforcement Questionnaire – Outcome All Time



Outcome – Time Varying

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options
1.	How many customers are at risk of an outage due to low pressure (pressure at or below minimum pipe pressure)?	CustomersAtRiskAtLowPress	YES	Number
2.	How many customers are impacted outside of planning criteria (drooping regulator feed, etc)?	CustOutOfPlanCrit	YES	Number
3.	What is the minimum pressure that will be experienced? (psig)	MinimumPressure	YES	Number
4.	What is the expected incremental growth in demand for residential customers enabled by this investment? (customers /yr)	Expected Growth Residential Cust Per Year	YES	Number
5.	What is the expected incremental growth in demand for commercial customers enabled by this investment? (customers /yr)	ExpectedGrowthCommercialCustPerYear	YES	Number
6.	What is the expected incremental growth in demand for apartment customers enabled by this investment? (customers /yr)	Expected Growth Apartment Cust Per Year	YES	Number
7.	What is the expected incremental growth in demand for industrial customers enabled by this investment? (customers /yr)	ExpectedGrowthIndustrialCustPerYear	YES	Number

Table 28: EGI System Reinforcement Questionnaire – Outcome Time Varying

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units



Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 29: EGI System Reinforcement System Parameters



4.2.6.2 Value Measure Outputs

The EGI System Reinforcement Value Model outputs multiple Value Measures as shown below.



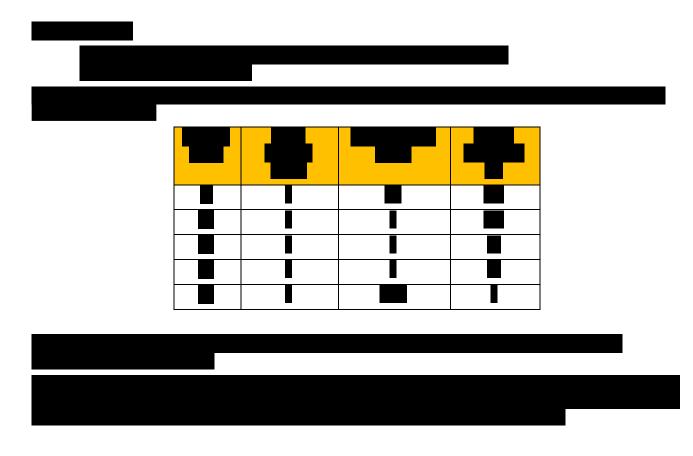
Figure 15: EGI System Reinforcement Value Model

4.2.6.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the **EGI System Reinforcement** Model. Values provided in lookup tables are placeholders subjected to future validation.

Intermediate Calculations

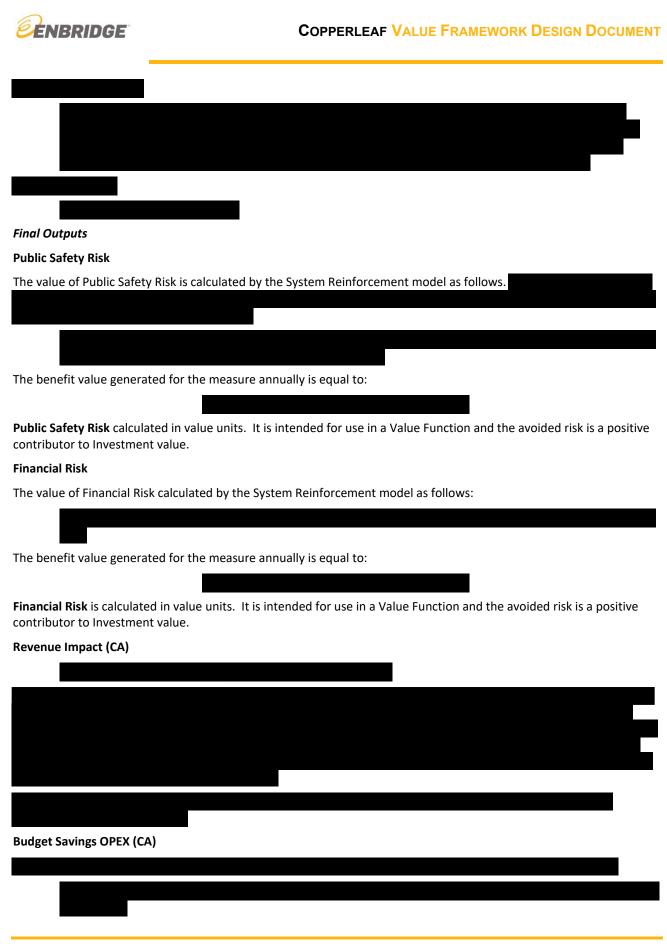






COPPERLEAF VALUE FRAMEWORK DESIGN DOCUMENT	
	_

Value Framework Design Document ■ March 2023 ■ Version# 8.1 ■ Page 76



Value Framework Design Document ■ March 2023 ■ Version# 8.1 ■ Page 77



Growth Per Year

Growth Per Year calculates the expected customer growth per year the system serves. It is calculated as:

Growth Per Year is not intended to be used in the value function and is used for reporting/constraining purposes.

Unacceptable Risk

The Unacceptable Risk measure serves as a flag to notify when any of the risks exceed a level of tolerance defined by Enbridge.

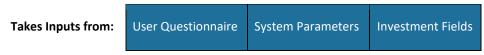
I		

4.2.7 Employee and Contractor Safety Risk

Employee and Contractor Safety Risk measures the risk of employee & contractor safety incidents that will be mitigated by the investment. The Unacceptable Risk measure serves as a flag to notify when the Employee and Contractor Safety Risk exceeds a level of tolerance defined by Enbridge.

This is a risk matrix-based model. See Section 3 Risk Matrix for more details.

4.2.7.1 Value Model Inputs



User Questionnaires

The user is prompted to answer the following questionnaires for the **Employee and Contractor Safety Risk** Value Model.

Baseline and Outcome – All Time

Questionnaire Prompt (Description)		Variable Name	Required?	Description / Selection Options
1. Provide any rationale or assumptions for all the numbers provided.		Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)
2.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)

Table 30: Employee and Contractor Safety Risk Questionnaire – Baseline and Outcome All Time



Baseline and Outcome – Time Varying

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options
1.	What is the risk consequence?	RiskConsequence	YES	Dropdown List:
3.	What is the frequency of the risk?	RiskFrequency	YES	Dropdown List: (
4.	Override: if available, what is the annual frequency of this risk occurring? (Events/Year)	RiskFrequencyOverride	NO	Number

Table 31: Employee and Contractor Safety Risk Questionnaire – Baseline and Outcome Time Varying

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 32: Employee and Contractor Safety Risk System Parameters



4.2.7.2 Value Measure Outputs

The Employee and Contractor Safety Risk Value Model outputs multiple Value Measures as shown below.



Figure 16: Employee and Contractor Safety Risk Value Model

4.2.7.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the **Employee and Contractor Safety Risk** Model.

Intermediate Calculations

Employee and Contractor Safety Risk_{Outcome}

Value of Employee and Contractor Safety Risks after the investment.





4.2.8 Employee Productivity

Employee Productivity measures the financial benefits from increasing employee efficiency, whether overall or for a given task. (If additional labour hours are required after the investment, this should be captured as additional costs under the Financial Benefits and Costs Value Model.)

4.2.8.1 Value Model Inputs

Takes Inputs from:	User Questionnaire	System Parameters	Investment Fields

User Questionnaires

The user is prompted to answer the following questionnaires for the **Employee Productivity** Value Model.

Outcome – All Time

Questionnaire Prompt (Description)		Variable Name	Required?	Description / Selection Options
1. Provide any rationale or assumptions for all the numbers provided.		Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)
2.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)

Table 33: Employee Productivity Questionnaire – Outcome All Time

Outcome - Time Varying

Questionnaire Prompt (Description)		Variable Name	Required? Description / Selection Options		Units
1.	How many employees will be impacted, following this investment?	NumberEmployees	YES	Number	
2.	For each employee, how many hours will be saved per year?	HoursSaved	YES	Number	hours / (employee * year)



	uestionnaire Prompt Description)	Variable Name	Required?	Description / Selection Options	Units
3.	What is the probability of this benefit being achieved? (%)	BenefitProbability	YES	Percentage	%

Table 34: Employee Productivity Questionnaire – Outcome Time Varying

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units
)

Table 35: Employee Productivity System Parameters

Probability of Repurposing captures the degree to which a person who no longer must perform certain tasks will be able to repurpose that time to perform other work that would otherwise have had to be staffed by someone else. This assumes that productivity improvements result in a much smaller bottom-line benefit, and this factor is an assumption to reflect that.

4.2.8.2 Value Measure Outputs

The Employee Productivity Value Model outputs two Value Measures:



Figure 17: Employee Productivity Value Model



4.2.8.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the Employee Productivity Model.

Final Outputs

Employee Productivity (CA)

The benefit value for Employee Productivity is calculated as follows:

This Value Measure is calculated in CA\$. It is intended for use in a Value Function and is converted to Value Units as described in Section 4.1.1 - Value Measures and Units.

Employee Productivity (US)

The benefit value for Employee Productivity is calculated as follows:

This Value Measure is calculated in US\$. It is not intended for use in the Value Function.

4.2.9 Energy Efficiency

Energy Efficiency evaluates investments that bring measurable financial benefits in the form of annual power savings and reduced CO2 emissions. The Energy Efficiency (CA) value measure calculates the financial benefit of the energy saved. Avoided Tonnes of GHG and Energy Savings Total are not used in the value function but are used for reporting and/or constraining.

4.2.9.1 Value Model Inputs



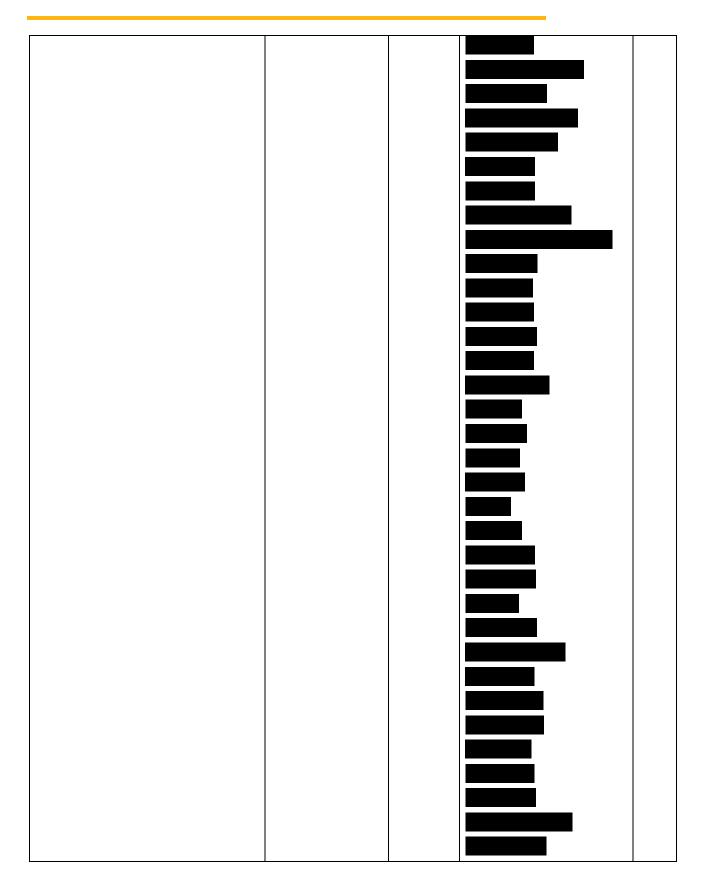
User Questionnaires

The user is prompted to answer the following questionnaires for the **Energy Efficiency** Value Model.

Outcome – All Time

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)	
2.	What geographic region is this investment located in?	AvoidedGHGRegion	YES	Dropdown List:	







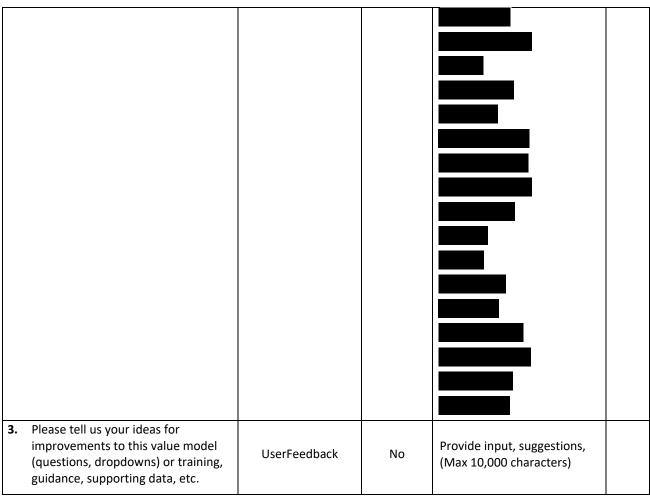


Table 36: Energy Efficiency Questionnaire – Outcome All Time

Outcome – Time Varying

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
1.	What is the expected annual fuel gas power savings from this investment? Use negative numbers for additional consumption. (CA: GJ or US: MMBtu)	PowerSavingsFuelGas	YES	Number	GJ or MMBtu
2.	What is the expected annual electric power savings from this investment? Use negative numbers for additional consumption. (MWh)	PowerSavingsElectric	YES	Number	MWh
3.	What is the probability of this benefit being achieved? (%)	BenefitProbability	YES	Percentage	%

Table 37: Energy Efficiency Questionnaire – Outcome Time Varying



Investment Configurable Fields

The following values are investment configurable fields. The investment configurable field applies to all value models within the investment.

Configurable Field Name	Configurable Field Code	Configured Value	Units
		Dropdown List:	
Unit Selection	UnitSelection	1. CA\$ (Metric)	
		2. US\$ (Imperial)	

Table 38: Energy Efficiency Investment Configurable Fields

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 39: Energy Efficiency System Parameters



4.2.9.2 Value Measure Outputs

The Energy Efficiency Value Model outputs multiple Value Measures as shown below.



Figure 18: Energy Efficiency Value Model

4.2.9.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the Energy Efficiency Model.





Final Outputs

Avoided Tonnes of GHG

Tonnes of GHG avoided. Used for reporting and constraining purposes.



This Value Measure is not intended for use in the Value Function.

Avoided Tons of GHG

Tons of GHG avoided. Used for reporting and constraining purposes.



This Value Measure is not intended for use in the Value Function.

Energy Efficiency (CA)

Monetary value of power savings.

This Value Measure is calculated in CA\$. It is intended for use in a Value Function and is converted to Value Units as described in Section 4.1.1 - Value Measures and Units.

Energy Efficiency (US)

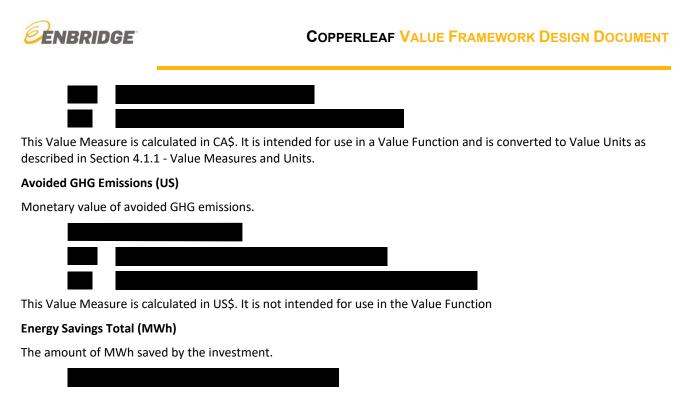
Monetary value of power savings.

This Value Measure is calculated in US\$. It is not intended for use in the Value Function.

Avoided GHG Emissions (CA)

Monetary value of avoided GHG emissions.

Value Framework Design Document ■ March 2023 ■ Version# 8.1 ■ Page 88



This Value Measure is not intended for use in the Value Function.

4.2.10 Enterprise General Risks

Enterprise General Risks measures the mitigation of likely and worst-case risks by the investment.

4.2.10.1 Value Model Inputs

Takes Inputs from:

User Questionnaire System Parameters

User Questionnaires

The user is prompted to answer the following questionnaires for the Enterprise General Risks Value Model.



Baseline – All Time

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
1. Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)	



	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
2.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)	

Table 40: Enterprise General Risks Questionnaire – Baseline All Time

Baseline – Time Varying

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
1.	What is the frequency of the most likely risk?	LikelyRiskFrequency	YES	Dropdown List:	
2.	Override: If available, what is the annual frequency of the most likely risk occurring? (Events/Year)	LikelyRiskFrequencyOverrid e	NO	Number	
3.	What is the consequence level of the most likely financial consequence? (Per Event)	Asset Likely Financial Conseq uence	YES	Dropdown List: (See Table 1: Consequence Scale in Value Units – all Value Measures)	
4.	Override: If available, what is the precise dollar amount of the most likely financial consequence? (Investment Currency/ Event)	AssetLikelyFinancialConseq uenceOverride	NO	Number	\$
5.	What is the consequence level of the most likely public safety consequence? (Per Event)	AssetLikelyPublicSafetyCon sequence	YES	Dropdown List:	
6.	If known that more than 1 member of the public may be harmed in the most likely case, please choose the type of harm above (using only consequence 1-5) and specify the number of people at risk.	AssetLikelyPublicSafetyPeo pleHarmed	No	Number	



Questionnaire Prompt				Description / Selection	
(De	scription)	Variable Name	Required?	Options	Units
7.	What is the consequence level of the most likely employee or contractor safety consequence? (Per Event)	AssetLikelyEmployeeContr actorSafetyConsequence	YES	Dropdown List:	
8.	If known that more than 1 employee or contractor may be harmed in the most likely case, please choose the type of harm above (using only consequence 1-5) and specify the number of people at risk.	AssetLikelyEmployeeContra ctorPeopleHarmed	No	Number	
9.	What is the consequence level of the most likely environmental consequence? (Per Event)	AssetLikelyEnvironmentalC onsequence	YES	Dropdown List:	
10.	Override: If available, what is the precise dollar amount of the most likely environmental consequence? (Investment Currency/Event)	AssetLikelyEnvironmentalC onsequenceOverride	NO	Number	\$
11.	What is the consequence level of the most likely reputational consequence? (Per Event)	AssetLikelyReputationalCo nsequence	YES	Dropdown List:	
12.	Override: If available, what is the precise dollar amount of the most likely reputational consequence? (Investment Currency/Event)	AssetLikelyReputationalCon sequenceOverride	NO	Number	\$
13.	What is the frequency of the worst-case risk?	WorstRiskFrequency	YES	Dropdown List:	
14.	Override: If available, what is the annual frequency of the worst-case risk occurring? (Events/Year)	WorstRiskFrequencyOverrid e	NO	Number	



	estionnaire Prompt	Variable Name	Required?	Description / Selection	Units
(De	scription)	Valiable Name	Required.	Options	Offics
15.	What is the consequence level of the worst-case financial consequence? (Per Event)	AssetWorstFinancialConse quence	YES	Dropdown List:	
16.	Override: If available, what is the precise dollar amount of the worst-case financial consequence? (Investment Currency/Event)	Asset Worst Financial Conseq uence Override	NO	Number	\$
17.	What is the consequence level of the worst-case public safety consequence? (Per Event)	AssetWorstPublicSafetyCo nsequence	YES	Dropdown List:	
18.	If known that more than 1 member of the public may be harmed in the worst- case, please choose the type of harm above (using only consequence 1-5) and specify the number of people at risk.	AssetWorstPublicSafetyPeo pleHarmed	No	Number	
19.	What is the consequence level of the worst-case employee or contractor safety consequence? (Per Event)	Asset Worst Employee Contr actor Safety Consequence	YES	Dropdown List:	
20.	If known that more than 1 employee or contractor may be harmed in the worst- case, please choose the type of harm above (using only consequence 1-5) and specify the number of people at risk.	AssetWorstEmployeeContr actorPeopleHarmed	No	Number	
21.	What is the consequence level of the worst-case environmental consequence? (Per Event)	AssetWorstEnvironmental Consequence	YES	Dropdown List:	



	estionnaire Prompt scription)	Variable Name	Required?	Description / Selection Options	Units
22.	Override: If available, what is the precise dollar amount of the worst-case environmental consequence? (Investment Currency/Event)	AssetWorstEnvironmentalC onsequenceOverride	NO	Number	\$
23.	What is the consequence level of the worst-case reputational consequence? (Per Event)	Asset Worst Reputational Co nsequence	YES	Dropdown List:	
24.	Override: If available, what is the precise dollar amount of the worst-case reputational consequence? (Investment Currency/Event)	Asset Worst Reputational Co nsequence Override	NO	Number	\$

Table 41: Enterprise General Risks Questionnaire – Baseline Time Varying

Fully Mitigated Risk Outcome – All Time

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options
1. Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)
2. What is the geographic region this investment is located in?	AvoidedGHGRegionEG I	YES	Dropdown List:

Value Framework Design Document ■ March 2023 ■ Version# 8.1 ■ Page 93



Full	Table 42: Enterprise General Risk y Mitigated Risk Outcome – Time Varying	s Questionnaire – Fully Mi	itigated Risk (Dutcome All Time
	uestionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options
1.	What is the annual CAPEX cost avoidance amount anticipated from this investment (Investment Currency)?	CAPEXCostAvoidance	NO	Number
2.	What is the annual OPEX cost avoidance amount anticipated from this investment (Investment Currency)?	OPEXCostAvoidance	NO	Number
3.	What is the current leak severity?	CurrentLeakSeverity	NO	Dropdown List:



4.	Override: If available, what is the precise volume of commodity lost per leak? (scm)	LeakSeverityOverride	NO	Number
5.	How many leaks per year of this severity are currently experienced?	CurrentLeakFrequency	NO	Number
6.	How many leaks per year of this severity are expected after the investment?	ExpectedLeakFrequency	NO	Number

Table 43: Enterprise General Risks Questionnaire – Fully Mitigated Risk Outcome Time Varying

Partially Mitigated Risk Outcome – All Time

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options
1. Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)
2. What is the geographic region this investment is located in?	AvoidedGHGRegionEGI	NO	Dropdown List:

Table 44: Enterprise General Risks Questionnaire – Outcome Override All Time

Partially Mitigated Risk Outcome – Time Varying

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
1.	What is the annual CAPEX cost avoidance amount anticipated from this	CAPEXCostAvoidance	NO	Number	



Qu	estionnaire Prompt				
(De	escription)	Variable Name	Required?	Description / Selection Options	Units
	investment (Investment Currency)?				
2.	What is the annual OPEX cost avoidance amount anticipated from this investment (Investment Currency)?	OPEXCostAvoidance	NO	Number	
3.	What is the current leak severity?	CurrentLeakSeverity	NO	Dropdown List:	
4.	Override: If available, what is the precise volume of commodity lost per leak? (scm)	LeakSeverityOverride	NO	Number	scm



Que	estionnaire Prompt				
(De	scription)	Variable Name	Required?	Description / Selection Options	Units
5.	How many leaks per year of this severity are currently experienced?	CurrentLeakFrequency	NO	Number	
6.	How many leaks per year of this severity are expected after the investment?	ExpectedLeakFrequency	NO	Number	
7.	What is the frequency of the most likely risk?	LikelyRiskFrequency	YES	Dropdown List:)	
8.	Override: If available, what is the annual frequency of the most likely risk occurring? (Events/Year)	LikelyRiskFrequencyOverri de	NO	Number	
9.	What is the consequence level of the most likely financial consequence? (Per Event)	AssetLikelyFinancialConse quence	NO	Dropdown List:	
10.	Override: If available, what is the precise dollar amount of the most likely financial consequence? (Investment Currency/Event)	AssetLikelyFinancialConseq uenceOverride	NO	Number	\$
11.	What is the consequence level of the most likely public safety event? (Per Event)	Asset Likely Public Safety Co nsequence	YES	Dropdown List:	
12.	If known that more than 1 member of the public may be harmed in the most likely case, please choose the type of harm above (using only consequence 1-5) and specify the number of people at risk.	Asset Public Safety People Ha rmed	No	Number	
13.	What is the consequence level of the most likely employee or contractor	Asset Likely Employee Contr actor Safety Consequence	YES	Dropdown List:	



Que	estionnaire Prompt				
(De	scription)	Variable Name	Required?	Description / Selection Options	Units
	safety consequence? (Per Event)				
14.	If known that more than 1 employee or contractor may be harmed in the most likely case, please choose the type of harm above (using only consequence 1-5) and specify the number of people at risk.	AssetLikelyEmployeeContr actorPeopleHarmed	No	Number	
15.	What is the consequence level of the most likely environmental consequence? (Per Event)	AssetLikelyEnvironmental Consequence	YES	Dropdown List:	
16.	Override: If available, what is the precise dollar amount of the most likely environmental consequence? (Investment Currency/Event)	AssetLikelyEnvironmentalC onsequenceOverride	NO	Number	\$
17.	What is the consequence level of the most likely reputational consequence? (Per Event)	AssetLikelyReputationalCo nsequence	YES	Dropdown List:	
18.	Override: If available, what is the precise dollar amount of the reputational consequence? (Investment Currency/Event)	AssetLikelyReputationalCo nsequenceOverride	NO	Number	\$
19.	What is the frequency of the worst-case risk?	WorstRiskFrequency	NO	Dropdown List:	
20.	Override: If available, what is the annual frequency of the worst- case risk occurring? (Events/Year)	WorstRiskFrequencyOverri de	NO	Number	
21.	What is the consequence level of the worst-case	AssetWorstFinancialConse quence	YES	Dropdown List:	



Qu	estionnaire Prompt				
(De	scription)	Variable Name	Required?	Description / Selection Options	Units
	financial consequence? (Per Event)				
22.	Override: If available, what is the precise dollar amount of the worst-case financial consequence? (Investment Currency/Event)	AssetWorstFinancialConse quenceOverride	NO	Number	\$
23.	What is the consequence level of the worst-case public safety consequence? (Per Event)	AssetWorstPublicSafetyCo nsequence	YES	Dropdown List:	
24.	If known that more than 1 member of the public may be harmed in the worst- case, please choose the type of harm above (using only consequence 1-5) and specify the number of people at risk.	Asset Worst Public Safety Pe ople Harmed	No	Number	
25.	What is the consequence level of the worst-case employee or contractor safety consequence? (Per Event)	Asset Worst Employee Cont ractor Safety Consequence	YES	Dropdown List:	
26.	If known that more than 1 employee or contractor may be harmed in the worst-case, please choose the type of harm above (using only consequence 1-5) and specify the number of people at risk.	Asset Worst Employee Contr actor People Harmed	No	Number	
27.	What is the consequence level of the worst-case environmental consequence? (Per Event)	AssetWorstEnvironmental Consequence	YES	Dropdown List:	
28.	Override: If available, what is the precise dollar amount of the worst-case environmental	AssetWorstEnvironmental ConsequenceOverride	NO	Number	\$



	estionnaire Prompt scription)	Variable Name	Required?	Description / Selection Options	Units
	consequence? (Investment Currency/Event)				
29.	What is the consequence level of the worst-case reputational consequence? (Per Event)	AssetWorstReputationalC onsequence	YES	Dropdown List:	
30.	Override: If available, what is the precise dollar amount of the worst-case reputational consequence? (Investment Currency/Event)	Asset Worst Reputational Co nsequence Override	NO	Number	\$

Table 45: Enterprise General Risks Questionnaire – Partially Mitigated Risk Outcome Time Varying

Investment Configurable Fields

The following values are investment configurable fields. The investment configurable field applies to all value models within the investment.

Configurable Field Name	Configurable Field Code	Configured Value	Units
		Dropdown List:	
Unit Selection	UnitSelection	1. CA\$ (Metric)	
		2. US\$ (Imperial)	

Table 46: Enterprise General Risks Investment Configurable Fields

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units
Tonnes of CO2 equivalent per scm			



Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 47: Enterprise General Risks System Parameters



4.2.10.2 Value Measure Outputs

The Enterprise General Risks Value Model outputs the following value measures:



Figure 19: Enterprise General Risks Loss Value Model

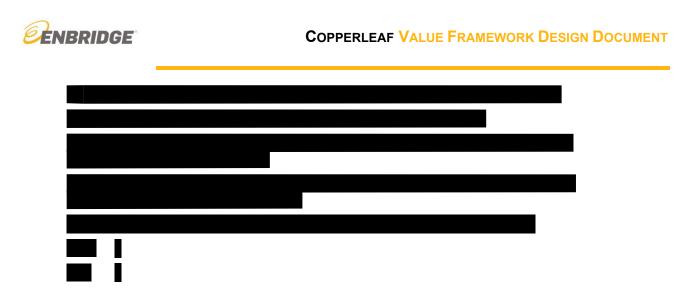
4.2.10.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the Enterprise General Risks Value Model.



COPPERLEAF VALUE FRAMEWORK DESIGN DOCUMENT





4.2.11 4.2.11 Environmental Risk and Remediation

Environmental Risk and Remediation measures the risks of environmental incidents requiring remediation that are mitigated by the investment. The Unacceptable Risk measure serves as a flag to notify when the Environmental Risk and Remediation exceeds a level of tolerance defined by Enbridge.

This is a risk matrix-based model. See Section 3 Risk Matrix for more details.

4.2.11.1 Value Model Inputs

Takes Inputs from:	User Questionnaire	System Parameters	Investment Fields
Takes Inputs from:	User Questionnaire	System Parameters	Investment Fields

User Questionnaires

The user is prompted to answer the following questionnaires for the **Environmental Risk and Remediation** Value Model.

Baseline and Outcome – All Time

Questionnaire Prompt (Description)		Required?		Description / Selection Options
1	. Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)
2	 Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc. 	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)

Table 48: Environmental Risk and Remediation Questionnaire – Baseline and Outcome All Time



Baseline and Outcome – Time Varying

	Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options
1.	What is the risk consequence?	EnvironmentalRiskConsequence	YES	Dropdown List:)
2.	Override: if available, what is the dollar value of the risk consequence? (Investment Currency)	RiskConsequenceOverride	NO	\$
3.	What is the frequency of the risk?	RiskFrequency	YES	Dropdown List: (
4.	Override: if available, what is the annual frequency of this risk occurring? (Events/Year)	RiskFrequencyOverride	NO	Number

Table 49: Environmental Risk and Remediation Questionnaire – Baseline and Outcome

Investment Configurable Fields

The following values are investment configurable fields. The investment configurable field applies to all value models within the investment.

Configurable Field Name	Configurable Field Code	Configured Value	Units
		Dropdown List:	
Unit Selection	UnitSelection	1. CA\$ (Metric)	
		2. US\$ (Imperial)	

Table 50: Environmental Risk and Remediation Investment Configurable Fields

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 51: Environmental Risk and Remediation System Parameters



4.2.11.2 Value Measure Outputs

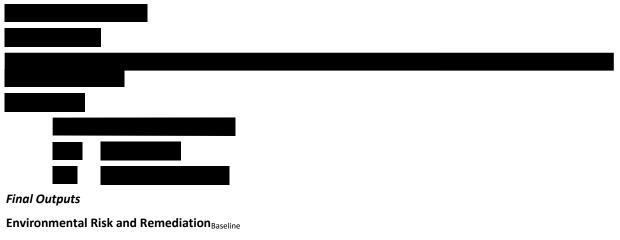
The Environmental Risk and Remediation Value Model outputs multiple Value Measures as shown below.



Figure 20: Environmental Risk and Remediation Value Model

4.2.11.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the **Environmental Risk and Remediation** Model.



Value of Environmental Risk and Remediations before the investment.

Environmental Risk and Remediation_{Outcome}

Value of Environmental Risk and Remediations after the investment.

Unacceptable Risk

The Unacceptable Risk measure serves as a flag to notify when the Environmental Risk and Remediation exceeds a level of tolerance defined by Enbridge.





4.2.12 External Risks Investment

External Risks Investment uses quantitative risk outputs (business case outputs) from

The Unacceptable Risk measure serves as a flag to notify when the External Risks Investments exceeds a level of tolerance defined by Enbridge.

4.2.12.1 Value Model Inputs

The model will use IBM SPSS and Excel investment information to import a time series of risk values. This value model also uses system parameters that define Enbridge's risk tolerances.

Baseline and Outcome – All Time

Questionnaire Prompt (Description)		Variable Name	Required?	Description / Selection Options
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)
2.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)

Table 52: External Risks – Investment Questionnaire – Baseline and Outcome All Time

Baseline – Time Varying

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options
1.	What is the annual Risk Frequency? (Events/Year)	ERRiskFrequency	YES	Number
2.	What is the Employee and Contractor Safety Risk? (Investment Currency/Event)	EREmployeeContractorSafetyRisk	NO	Number
3.	What is the Environmental Risk and Remediation? (Investment Currency/Event)	EREnvironmentalRisk	NO	Number
4.	What is the Financial Risk? (Investment Currency/Event)	ERFinancialRisk	NO	Number
5.	What is the Operational Risk? (Investment Currency/Event)	EROperationalRisk	NO	Number
6.	What is the Public Safety Risk? (Investment Currency/Event)	ERPublicSafetyRisk	NO	Number



Questionnaire Prompt (Description)		Variable Name	Required?	Description / Selection Options
7.	What is the Reputational Risk? (Investment Currency/Event)	ERReputationalRisk	NO	Number
8.	What is the Operational Disruption Risk (Gas)? (Investment Currency/Event)	EROperationalDisruptionRiskGas	NO	Number
9.				
10.	What is the Gas Storage Reliability risk? (Investment Currency/Event)	ERGasStorageReliability	NO	Number
11.	What is the Societal Risk? (Investment Currency/Event)	ERSocietalRisk	NO	Number
12.	What is the Individual Risk? (Investment Currency/Event)	ERIndividualRisk	NO	Number

Table 53: External Risks – Investment Questionnaire – Baseline Time Varying

Outcome – Time Varying

Questionnaire Prompt (Description)		Variable Name		Description / Selection Options
1.	What is the annual Risk Frequency? (Events/Year)	ERRiskFrequency	YES	Number
2.	What is the Employee and Contractor Safety Risk? (Investment Currency/Event)	EREmployeeContractorRisk	NO	Number
3.	What is the Environmental Risk and Remediation? (Investment Currency/Event)	EREnvironmentalRisk	NO	Number
4.	What is the Financial Risk? (Investment Currency/Event)	ERFinancialRisk	NO	Number
5.	What is the Operational Risk? (Investment Currency/Event)	EROperationalRisk	NO	Number
6.	What is the Public Safety Risk? (Investment Currency/Event)	ERPublicSafetyRisk	NO	Number
7.	What is the Reputational Risk? (Investment Currency/Event)	ERReputationalRisk	NO	Number
8.	What is the Operational Disruption Risk (Gas)? (Investment Currency/Event)	EROperational Disruption Risk Gas	NO	Number



Questionnaire Prompt (Description)		Variable Name	Required?	Description / Selection Options
9.				
10.	What is the Gas Storage Reliability risk? (Investment Currency/Event)	ERGasStorageReliability	NO	Number
11.	What is the Societal Risk? (Investment Currency/Event)	ERSocietalRisk	NO	Number
12.	What is the Individual Risk? (Investment Currency/Event)	ERIndividual Risk	NO	Number
13.	What is the CAPEX Budget Savings of the investment? (Investment Currency/Event)	ERBudgetSavingsCAPEX	NO	Number
14.	What is the OPEX Budget Savings of the investment? (Investment Currency/Event)	ERBudgetSavingsOPEX	NO	Number
15.	What is the CAPEX Cost Avoidance of the investment? (Investment Currency/Event)	ERCostAvoidanceCAPEX	NO	Number
16.	What is the OPEX Cost Avoidance of the investment? (Investment Currency/Event)	ERCostAvoidanceOPEX	NO	Number
17.	What is the Revenue Impact of the investment? (Investment Currency/Event)	ERRevenueImpact	NO	Number
18.	What is the Energy Efficiency of the investment? (Investment Currency/Event)	EREnergyEfficiency	NO	Number
19.	What are the Avoided GHG Emissions savings of the investment? (Investment Currency/Event)	ERAvoidedGHGEmissions	NO	Number

Table 54: External Risks – Investment Questionnaire – Outcome Time Varying

Investment Configurable Fields

The following values are investment configurable fields. The investment configurable field applies to all value models within the investment.

Configurable Field Name	Configurable Field Code	Configured Value	Units
		Dropdown List:	
Unit Selection	UnitSelection	1. CA\$ (Metric)	
		2. US\$ (Imperial)	

Table 55: External Risks – Investment - Investment Configurable Fields



System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 56: External Risks - Investment System Parameters



4.2.12.2 Value Measure Outputs

The External Risks Investment Value Model outputs multiple Value Measures as shown below.

	Environmental Risk and Remediation	±0 ≡1
	-	10
	Public Safety Risk	≣1
	Employee and Contractor Safety Risk	±0 ≡1
	Operational Disruption Risk (Gas) (CA)	±0 ⊯1
	Operational Disruption	±0 Ⅲ1
	Kisk(das)(das)	10 1
*	Avoided GHG	±0 ≡1
	Emissions (CA)	
	Avoided GHG Emissions (US)	±0 ≡1
	Financial Risk	≗ 0 ≡ 1
	🛞 Budget Savings OPEX (CA)	±0 ≡1
	Budget Savings OPEX (US)	≛0 ≣1
	Budget Savings CAPEX (CA)	≗ 0 ≡1
	Budget Savings CAPEX (US)	≗ 0 ≡1
	🙆 Revenue Impact (CA)	±0 ≡1
	0	10
	(🖒) Revenue Impact (US)	111
		 Employee and Contractor Safety Risk Operational Disruption Risk (Gas) (CA) Operational Disruption Risk (Gas) (US) Operational Disruption Risk (Gas) (US) Avoided GHG Emissions (US) Avoided GHG Emissions (US) Financial Risk Budget Savings OPEX (CA) Budget Savings OPEX (US) Budget Savings CAPEX (CA) Budget Savings CAPEX (US)



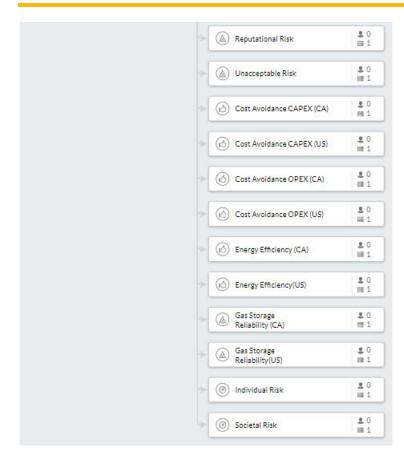


Figure 21: External Risks Investment - Value Model

4.2.12.3 Value Measure Calculation Details

Calculations will be performed through an external software and loaded into C55 through spreadsheet loaders.



ENBRIDGE COPPERLEAF VALUE FRAMEWORK DESIGN DOCUMENT **Operational Risk** Public Safety Risk **Reputational Risk** Individual Risk Societal Risk Operational Disruption Risk (Gas) (CA) **Operational Disruption Risk (Gas) (US)**





Cost Avoidance OPEX (CA)
Cost Avoidance OPEX (US)
Revenue Impact (CA)
Revenue Impact (US)
Energy Efficiency (CA)
Energy Efficiency (US)
Avoided GHG Emissions (CA)
Avoided GHG Emissions (US)



Unacceptable Risk

The Unacceptable Risk measure serves as a flag to notify when any of the risks exceed a level of tolerance defined by Enbridge.



4.2.13 Financial Benefits and Costs

Financial Benefits and Costs measures the measurable financial benefits or costs to the organization in the form of annual CAPEX and OPEX cost savings/increases, cost avoidances or revenue impacts (i.e. would result in a budget decrease/increase).

The Value Measures for the Financial Benefits & Cost model have the following definitions:

Cost Avoidance:

Any action that avoids having to incur costs in the future (these costs are unbudgeted/not planned) and can include both avoidance of CAPEX and OPEX. Cost avoidance measures are never reflected in financial statements or the annual budget. They are only reflected in instances where a proposed action is not implemented, thus resulting in a cost increase.

Budget Savings:

Budget Savings measures the net savings from budget impacts i.e. (Cost savings – Cost increases). This is not the Investment Cost. Budget impacts need to change the bottom line and are reflected in financial statements and the annual budget:



- Cost Increases: Any action that results in a tangible financial cost that increases current spending, investment, or debt levels.
- Cost Savings: Any action that results in a tangible financial benefit that lowers current spending, investment, or debt levels.

Revenue Impact:

Impacts (increases or decreases) to the total amount of gross income generated by Enbridge's primary operations. Revenue represents the total income earned before expenses are deducted.

If the investment does not impact one of the above value measures, enter 0 for the corresponding question in the questionnaire.

4.2.13.1 Value Model Inputs



User Questionnaires

The user is prompted to answer the following questionnaires for the Financial Benefits and Costs Value Model.

Outcome – All Time

Questionnaire Prompt (Description)		Variable Name Required?		Description / Selection Options	
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)	
2.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)	

Table 57: Financial Benefits and Costs Questionnaire – Outcome All Time

Outcome – Time Varying

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options
1.	What are the annual CAPEX budget savings anticipated from this investment (Investment Currency)?	CAPEXBudgetSavings	YES	Number
2.	What is the annual CAPEX budget increase anticipated from this investment (Investment Currency)?	CAPEXBudgetIncrease	YES	Number
3.	What are the annual OPEX budget savings anticipated from this investment (Investment Currency)?	OPEXBudgetSavings	YES	Number



4.	What is the annual OPEX budget increase anticipated from this investment (Investment Currency)?	OPEXBudgetIncrease	YES	Number
5.	What is the annual CAPEX cost avoidance amount anticipated from this investment (Investment Currency)?	CAPEXCostAvoidance	YES	Number
6.	What is the annual OPEX cost avoidance amount anticipated from this investment (Investment Currency)?	OPEXCostAvoidance	YES	Number
7.	What is the annual revenue increase anticipated from this project (Investment Currency)?	RevenueIncrease	YES	Number
8.	What is the annual revenue decrease anticipated from this project (Investment Currency)?	RevenueDecrease	YES	Number
9.	What is the probability of this benefit being achieved? (%)	BenefitProbability	YES	Number

Table 58: Financial Benefits and Costs Questionnaire – Outcome Time Varying

Investment Configurable Fields

The following values are investment configurable fields. The investment configurable field applies to all value models within the investment.

		Dropdown List:	
Unit Selection	UnitSelection	1. CA\$ (Metric)	
		2. US\$ (Imperial)	

Table 59: Financial Benefits and Costs Investment Configurable Fields

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Co	onfigurable Field	Name	Confi	gurable Field	Code	Config	ured	Value	Units	
										ļ

Table 60: Financial Benefits and Costs System Parameters



4.2.13.2 Value Measure Outputs

The Financial Benefits and Costs Value Model outputs multiple Value Measures as shown below.

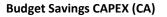


Figure 22: Financial Benefits and Costs Value Model

4.2.13.3 Value Measure Calculation Details

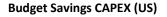
This section details the calculation of each of the Value Measure Output for the Financial Benefits and Costs Model.

Final Outputs





This Value Measure is calculated in CA\$. It is intended for use in a Value Function and is converted to Value Units as described in Section 4.1.1 - Value Measures and Units.





This Value Measure is calculated in US\$. It is not intended for use in the Value Function.

Budget Savings OPEX (CA)



This Value Measure is calculated in CA\$. It is intended for use in a Value Function and is converted to Value Units as described in Section 4.1.1 - Value Measures and Units.

Budget Savings OPEX (US)



This Value Measure is calculated in US\$. It is not intended for use in the Value Function.

Cost Avoidance CAPEX (CA)



This Value Measure is calculated in CA\$. It is intended for use in a Value Function and is converted to Value Units as described in Section 4.1.1 - Value Measures and Units.

Cost Avoidance CAPEX (US)



This Value Measure is calculated in US\$. It is not intended for use in the Value Function.

Cost Avoidance OPEX (CA)



This Value Measure is calculated in CA\$. It is intended for use in a Value Function and is converted to Value Units as described in Section 4.1.1 - Value Measures and Units.

Cost Avoidance OPEX (US)



This Value Measure is calculated in US\$. It is not intended for use in the Value Function.



Revenue Impact (CA)



This Value Measure is calculated in CA\$. It is intended for use in a Value Function and is converted to Value Units as described in Section 4.1.1 - Value Measures and Units.

Revenue Impact (US)



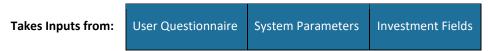
This Value Measure is calculated in US\$. It is not intended for use in the Value Function.

4.2.14 Financial Risk

Financial Risk measures the mitigation of any potential financial risks such as financial losses due to damage of company or public assets (i.e. office equipment, pressure control valves, vehicles, public property), including emergency costs to quickly bring an asset back in to service (e.g.: an emergency install of a generator to restore power, installation of small parts, contractor time to hot-shot parts to site, etc.) if the investment is not completed. For example, if the failure of a pressure relief valve causes the destruction of a pipeline or vessel, there would be a financial risk associated with that failure whose consequence is valued at the cost of repair or replacement. The Unacceptable Risk measure serves as a flag to notify when the Financial Risk exceeds a level of tolerance defined by Enbridge.

This is a risk matrix-based model. See Section 3 Risk Matrix for more details.

4.2.14.1 Value Model Inputs



User Questionnaires

The user is prompted to answer the following questionnaires for the **Financial Risk** Value Model.

Baseline and Outcome – All Time

Questionnaire Prompt (Description)		Variable Name Required?		Description / Selection Options	
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)	
2.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)	



Table 61: Financial Risk Questionnaire – Baseline and Outcome All Time

Baseline and Outcome – Time Varying

1.	What is the risk consequence?	FinancialRiskConsequence	YES	Dropdown List:
2.	Override: if available, what is the dollar value of the risk consequence? (Investment Currency)	RiskConsequenceOverride	NO	\$
3.	What is the frequency of the risk?	RiskFrequency	YES	Dropdown List:
4.	Override: if available, what is the annual frequency of this risk occurring? (Events/Year)	RiskFrequencyOverride	NO	Number

Table 62: Financial Risk Questionnaire – Baseline and Outcome Time Varying

Investment Configurable Fields

The following values are investment configurable fields. The investment configurable field applies to all value models within the investment.

		Dropdown List:	
Unit Selection	UnitSelection	1. CA\$ (Metric)	
		2. US\$ (Imperial)	

Table 63: Financial Risk Investment Configurable Fields

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 64: Financial Risk System Parameters



4.2.14.2 Value Measure Outputs

The Financial Risk Value Model outputs multiple Value Measures as shown below.



Figure 23: Financial Risk Value Model

4.2.14.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the Financial Risk Model.

Intermediate Calculations

RiskConsequence



Value of Financial Risks after the investment.

Unacceptable Risk

The Unacceptable Risk measure serves as a flag to notify when the Financial Risk exceeds a level of tolerance defined by Enbridge.



4.2.15 Gas Storage Reliability

Gas Storage Reliability measures the financial benefits of investments that increase the reliability of gas storage assets to prevent supply interruptions. The benefit achieved by the investment is dependent on the usage of the gas storage assets and failure duration. The Unacceptable Risk measure serves as a flag to notify when the Gas Storage Reliability exceeds a level of tolerance defined by Enbridge.

4.2.15.1 Value Model Inputs

Takes Inputs from: User Questionnaire System Parameters Investment Fields	Takes Inputs from:	User Questionnaire	System Parameters	Investment Fields
---	--------------------	--------------------	-------------------	-------------------

User Questionnaires

The user is prompted to answer the following questionnaires for the Gas Storage Reliability Value Model.

Baseline and Outcome – All Time

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)	
2.	If known, what is the average Spot Market Price? If unanswered, the calculation will use the system default value. (Investment Currency/GJ)	AvgSpotMarketPriceOverride	NO	Number	\$/GJ
3.	If known, what is the average Price Escalator Factor? If unanswered, the calculation will use the system default value. (CA: CA\$/GJ/scm US: US\$/GJ/MMscf)	PriceEscalatorFactorOverride	NO	Number	CA\$/GJ/scm or US\$/GJ/MMscf



	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
4.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)	

Table 65: Gas Storage Reliability Questionnaire – Baseline and Outcome All Time

Baseline and Outcome – Time Varying

Questionnaire Prompt (Description)		Variable Name		Description / Selection Options	Units
1.	What is the frequency of this asset failing?	RiskFrequency	YES	Dropdown List:	
2.	If available, what is the annual frequency of this asset failing? (Events/Year)	RiskFrequencyOverride	NO	Number	
3.	What is the expected gas short fall if the failure occurs during injection? (CA: scm or US: MMscf)	Expected GasShort Fall Injection	YES	Number	scm or MMscf
4.	What is the expected gas short fall if the failure occurs during withdrawal? (CA: scm or US: MMscf)	ExpectedGasShortFallWithdrawl	YES	Number	scm or MMscf
5.	What are the chances the failure would occur during withdrawl? (%)	ProbabilityDuringWithdrawl	YES	Number	%
6.	What is Nominal daily shortfall? (CA: scm or US: MMscf)	NominalDailyLoss	YES	Number	scm / day or MMscf / day

Table 66: Gas Storage Reliability Questionnaire – Baseline & Outcome Time Varying



Investment Configurable Fields

The following values are investment configurable fields. The investment configurable field applies to all value models within the investment.

Configurable Field Name	Configurable Field Code	Configured Value	Units
		Dropdown List:	
Unit Selection	UnitSelection	1. CA\$ (Metric)	
		2. US\$ (Imperial)	

Table 67: Gas Storage Reliability Investment Configurable Fields

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 68: Gas Storage Reliability System Parameters

4.2.15.2 Value Measure Outputs

The Gas Storage Reliability Value Model outputs multiple Value Measures as shown below.



Figure 24: Gas Storage Reliability Value Model



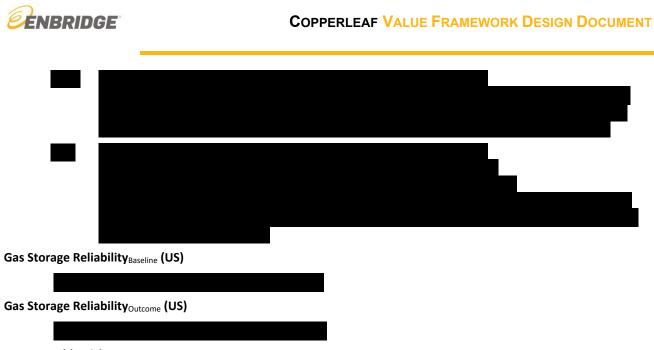
4.2.15.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the Gas Storage Reliability Model.



Gas Storage Reliability_{Baseline} (CA)

Gas Storage Reliability _{Outcome} (CA)		



Unacceptable Risk

The Unacceptable Risk measure serves as a flag to notify when the Gas Storage Reliability exceeds a level of tolerance defined by Enbridge.

I		

4.2.16 GHG Emissions

GHG Emissions captures the environmental benefit of the reduction of GHG Emissions. The GHG Emissions Value Model outputs two Value Measures: Avoided GHG Emissions and Avoided Tonnes of GHG. Avoided Tonnes of GHG is a service measure used for constraining and reporting, it is not included in the value function.

4.2.16.1 Value Model Inputs

 Takes Inputs from:
 User Questionnaire
 System Parameters
 Investment Fields

User Questionnaires

The user is prompted to answer the following questionnaires for the **GHG Emissions** Value Model.

Outcome – All Time

Questionnaire Prompt		Description (D	Description (Colection Online
(Description)	Variable Name	Required?	Description / Selection Options
1. Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection



Questionnaire Prompt			
(Description)	Variable Name	Required?	Description / Selection Options
			of answers (Max 10,000 characters)
2. What is the geographic region this investment is located in?	AvoidedGHGRegion	YES	Dropdown List: Image: State of the state of



Variable Name	Required?	Description / Selection Options
UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)
	UserFeedback	

Table 69: GHG Emissions Questionnaire – Outcome All Time



Outcome – Time Varying

1.	What is the quantity of CO2 emissions that will be reduced each year from fuel gas savings? Added emissions should be entered as a negative value. (CA: Tonnes, US: Tons)	CO2ReductionFuelGas	YES	Number	Tonnes or Tons
2.	What is the quantity of CO2 emissions that will be reduced each year from electricity savings? Added emissions should be entered as a negative value. (CA: Tonnes, US: Tons)	CO2ReductionElectricity	YES	Number	Tonnes or Tons
3.	What is the probability of this benefit being achieved? (%)	BenefitProbability	YES	Number	%

Table 70: GHG Emissions Questionnaire – Outcome Time Varying

Investment Configurable Fields

The following values are investment configurable fields. The investment configurable field applies to all value models within the investment.

		Dropdown List:	
Unit Selection	UnitSelection	1. CA\$ (Metric)	
		2. US\$ (Imperial)	

Table 71: GHG Emissions Investment Configurable Fields

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units
)

Table 72: GHG Emissions System Parameters



4.2.16.2 Value Measure Outputs

The **GHG Emissions** Value Model outputs multiple Value Measures as shown below.



Figure 25: GHG Emissions Value Model

4.2.16.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the GHG Emissions Model.

	-		
Final Outputs			

Avoided Tonnes of GHG

Intermediate Calculations

Tonnes of GHG avoided. Used for reporting and constraining purposes.



This Value Measure is not intended for use in the Value Function.

Avoided Tons of GHG

Tons of GHG avoided. Used for reporting and constraining purposes.



This Value Measure is not intended for use in the Value Function.



Avoided GHG Emissions (CA)

Monetary value of reducing CO₂ greenhouse gas emissions. The CO2 Value of Region is dependent on the user's selection of geographic region that the investment is targeting.



This Value Measure is calculated in CA\$. It is intended for use in a Value Function and is converted to Value Units as described in Section 4.1.1 - Value Measures and Units.

Avoided GHG Emissions (US)

Monetary value of reducing CO₂ greenhouse gas emissions. The CO2 Value of Region is dependent on the user's selection of geographic region that the investment is targeting.



This Value Measure is calculated in US\$. It is not intended for use in the Value Function.

4.2.17 GTM Asset Sustainment



4.2.17.1 Value Model Inputs





Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units

Table 73: GTM Asset Sustainment Questionnaire – Baseline All Time

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units



Questionnaire Prompt	Variable Name	Domino d D	Description / Selection	Units
(Description)	Variable Name	Required?	Options	Units
				I



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
				I
				I

Table 74: GTM Asset Sustainment Questionnaire – Baseline Time Varying



COPPERLEAF VALUE FRAMEWORK DESIGN DOCUMENT

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units

Table 75: GTM Asset Sustainment Questionnaire – Fully Mitigated Risk Outcome All Time

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units

Table 76: GTM Asset Sustainment Questionnaire – Fully Mitigated Risk Outcome Time Varying

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units

Table 77: GTM Asset Sustainment Questionnaire – Partially Mitigated Risk Outcome All Time



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
				I
				I



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
				I



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
				I

Table 78: GTM Asset Sustainment Questionnaire – Partially Mitigated Risk Outcome Time Varying

Configurable Field Name Configurable Field Code Configured Value Units				
	Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 79: GTM Asset Sustainment Investment Configurable Fields

Configurable Field Name	Configurable Field Code	Configured Value	Units



Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 80: GTM Asset Sustainment System Parameters

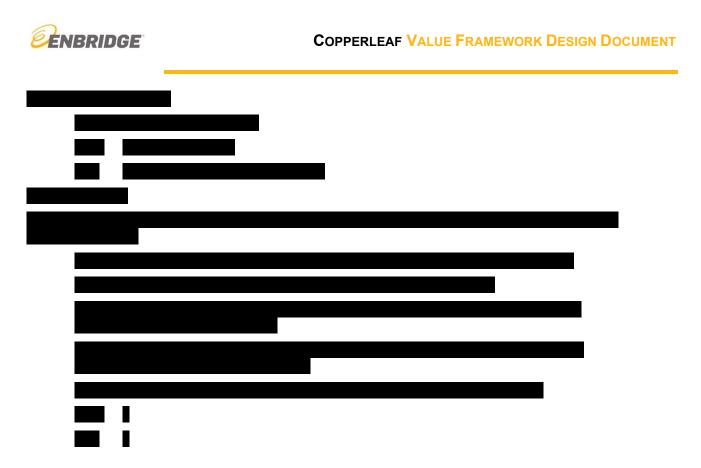
4.2.17.2 Value Measure Outputs



Figure 26: GTM Asset Sustainment Value Model



4.2.17.3 Value Measure Calculation Details



4.2.18 IT and Facilities Capacity Risk

IT and Facilities Capacity Risk measures the mitigation of risk that the organization would not be capable of continued delivery of services at acceptable levels following a disruptive incident. The IT and Facilities Capacity Risk Value Model captures the IT and Facilities Capacity Risk that is mitigated by the investment.

The Unacceptable Risk measure serves as a flag to notify when the IT and Facilities Capacity Risk exceeds a level of tolerance defined by Enbridge.

4.2.18.1 Value Model Inputs

Takes Inputs from:	User Questionnaire	System Parameters	Investment Fields

User Questionnaires

The user is prompted to answer the following questionnaires for the **IT and Facilities Capacity Risk** Value Model.

Baseline and Outcome – All Time

	Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)



	Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options
2	 Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc. 	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)

Table 81: IT and Facilities Capacity Risk Questionnaire – Baseline and Outcome All Time

Baseline and Outcome – Time Varying

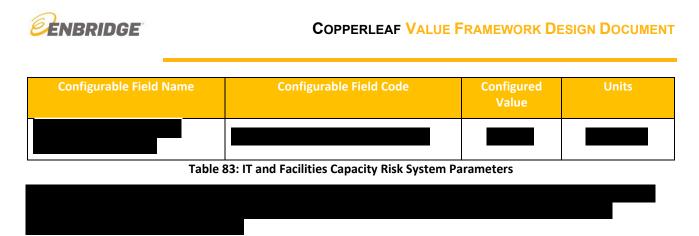
	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options	Units
1.	How many employees would be affected by the event that this project is designed to avoid?	EmployeesAffected	YES	Number	
2.	What would be the impact on each employee?	EmployeeImpactLevel	YES	Dropdown List:	
3.	What is the probability that the event will occur? (%)	EmployeeImpactProbability	YES	Number	%
4.	What is the amount of time it would take the business to recover from the event? (hours)	TimeToRecover	YES	Number	hours

Table 82: IT and Facilities Capacity Risk Questionnaire – Baseline and Outcome Time Varying

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units
Employee Productivity Value	EmployeeProductivityValue	293,400	CA\$ /year



4.2.18.2 Value Measure Outputs

The IT and Facilities Capacity Risk Value Model outputs one Value Measure as shown below.



Figure 27: IT and Facilities Capacity Risk Value Model

4.2.18.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the IT and Facilities Capacity Risk Model.

Intermediate Calculations



Final Outputs

IT and Facilities Capacity Risk

Monetary value (negative) of the potential unintended disruption to employees during the execution of the investment.



This Value Measure is calculated in Value Units. It is intended for use in a Value Function.

Unacceptable Risk

The Unacceptable Risk measure serves as a flag to notify when the IT and Facilities Capacity Risk exceeds a level of tolerance defined by Enbridge.





4.2.19 LP Asset Sustainment



4.2.19.1 Value Model Inputs





Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options



(Description) Variable Name Require	red? Description / Selection Options



Questionnaire Prompt		D 1	
(Description)	Variable Name	Required?	Description / Selection Options



Questionnaire Prompt	Variable Name	Required?	Description / Selection Options
(Description)			



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options

Table 84: LP Asset Sustainment Questionnaire – Baseline All Time

Questionnaire Prompt (Description)	Variable Name	Required ?	Description / Selection Options	Units



Questionnaire Prompt (Description)	Variable Name	Required ?	Description / Selection Options	Units



Questionnaire Prompt (Description)	Variable Name	Required ?	Description / Selection Options	Units



Questionnaire Prompt (Description)	Variable Name	Required ?	Description / Selection Options	Units
				I

Table 85: LP Asset Sustainment Questionnaire – Baseline Time Varying



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units

Table 86: LP Asset Sustainment Questionnaire – Fully Mitigated Risk Outcome All Time



Questionnaire Prompt	Variable Name	Required?	Description / Selection Options	Units
(Description)				
				H

Table 87: LP Asset Sustainment Questionnaire – Partially Mitigated Risk Outcome All Time

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units



Questionnaire Prompt	Variable Name	Required?	Description / Selection	Units
(Description)			Options	



Questionnaire Prompt			Description / Selection	
(Description)	Variable Name	Required?	Options	Units
				•
				I



Questionnaire Prompt	Variable Name	Required?	Description / Selection	Units
(Description)		nequireu.	Options	
				ı
				I

Table 88: LP Asset Sustainment Questionnaire – Partially Mitigated Risk Outcome Time Varying



Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 89: LP Asset Sustainment Investment Configurable Fields

Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 90: LP Asset Sustainment System Parameters



4.2.19.2 Value Measure Outputs

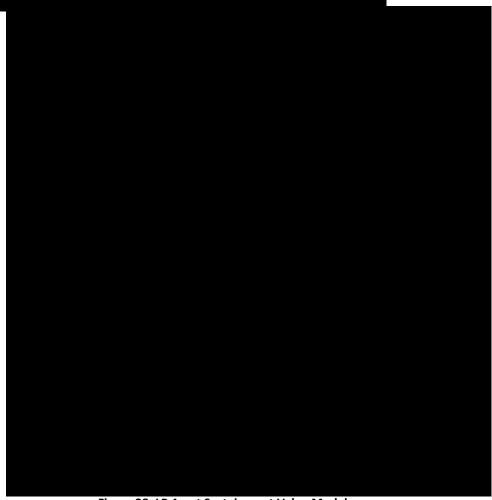
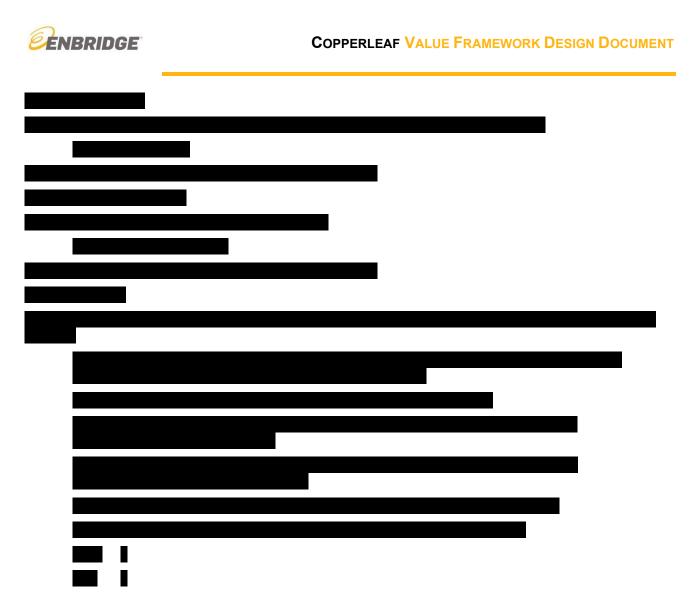


Figure 28: LP Asset Sustainment Value Model

4.2.19.3 Value Measure Calculation Details



-



4.2.20 LP System Optimization



4.2.20.1 Value Model Inputs





Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units

Table 91: LP System Optimization Questionnaire – Outcome All Time

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
				I
				I

Table 92: LP System Optimization Questionnaire – Outcome Time Varying

·			
Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 93: LP System Optimization System Parameters



4.2.20.2 Value Measure Outputs

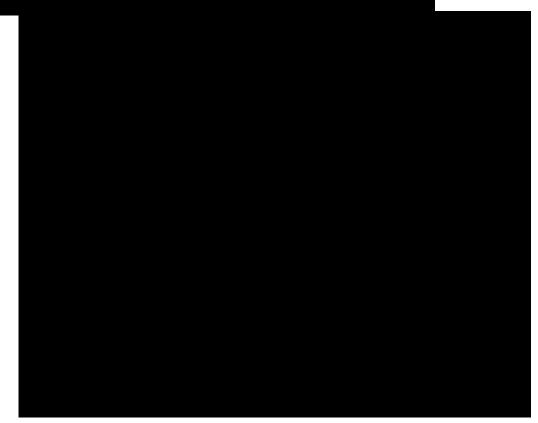


Figure 29: LP System Optimization Value Model

4.2.20.3 Value Measure Calculation Details



I

COPPERLEAF VALUE FRAMEWORK DESIGN DOCUMENT

4.2.21 LP Throughput Impact Risk

		-

4.2.21.1 Value Model Inputs

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options

Value Framework Design Document ■ March 2023 ■ Version# 8.1 ■ Page 171



Questionnaire Prompt	Variable Name	Required?	Description / Selection Options
(Description)		Required:	



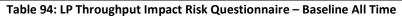
Questionnaire Prompt	Variable Name	Poguirod?	Description / Selection Ontions
(Description)	vanable Name	Required?	Description / Selection Options
		I	



Questionnaire Prompt	Variable Name	Required?	Description / Selection Options
(Description)			



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options



Questionnaire Prompt (Description)	Variable Name	Require d?	Description / Selection Options	Units



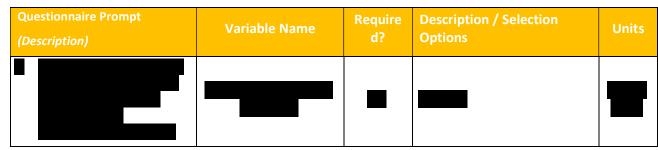


Table 95: LP Throughput Impact Risk Questionnaire – Baseline Time Varying



Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units

Table 96: LP Throughput Impact Risk Questionnaire – Fully Mitigated Risk Outcome All Time

Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
				I

Table 97: LP Throughput Impact Risk Questionnaire – Partially Mitigated Risk Outcome All Time



Questionnaire Promet				
Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options	Units
				ear

Table 98: LP Throughput Impact Risk Questionnaire – Partially Mitigated Risk Outcome Time Varying



Configurable Field Name	Configurable Field Code	Configured Value	Units
Table 99: LP T	hroughput Impact Risk Investment C	Configurable Fields	1

Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 100: LP Throughput Impact Risk System Parameters



4.2.21.2 Value Measure Outputs

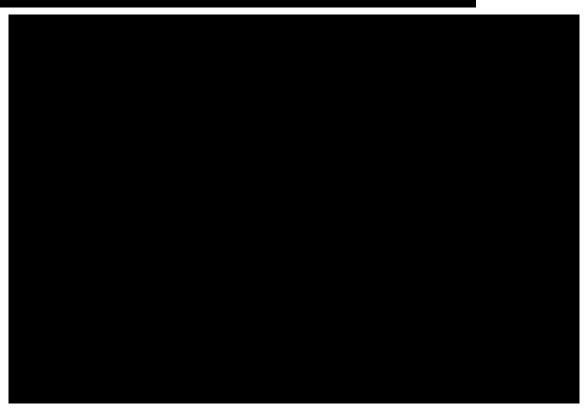
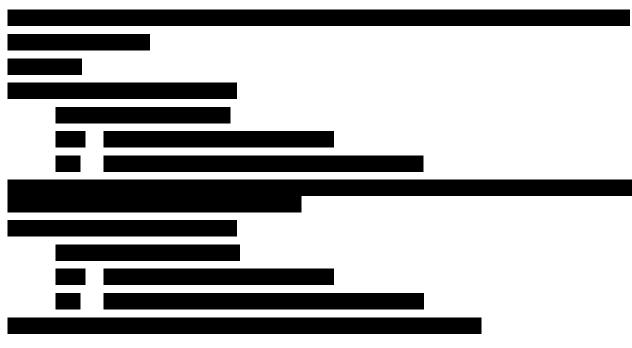


Figure 30: LP Throughput Impact Risk Value Model



4.2.21.3 Value Measure Calculation Details



	_	

4.2.22 Obsolescence Risk

Obsolescence Risk evaluates investments that mitigate the risk of Software/Application, Hardware, and Asset performance/operability/reliability shortfalls, as well as reduced employee productivity due to obsolescence and lack



of support (e.g. Expiring Support Agreements, high cost contract parts supply, retrofits and partial upgrades, costs to reverse engineer obsolete parts, sourcing spare parts from within, and sourcing spare parts from industry). The Unacceptable Risk measure serves as a flag to notify when the Obsolescence Risk exceeds a level of tolerance defined by Enbridge.

System Parameters

4.2.22.1 Value Model Inputs

Takes Inputs from:

User Questionnaire

User Questionnaires

The user is prompted to answer the following questionnaires for the **Obsolescence Risk** Value Model.

Baseline – All Time

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)
2.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)

Table 101: Obsolescence Risk Questionnaire – Baseline All Time

Baseline – Time Varying

	Questionnaire Prompt (Description)	Variable Name	Required?	Description / Selection Options
1.	What are the additional annual costs required to maintain or sustain the Asset or Software because it is obsolete? (Investment Currency/Year)	AdditionalMaintainSustain Cost	YES	Number
2.	How many additional employee hours are required per year for this Asset or Software during normal operation because it is obsolete? (Hours/Year)	AdditionalEmployeeHours	YES	Number



3.	What are the additional annual operating costs to Enbridge due to reduced performance of the Asset or Software because it is obsolete (e.g. a pump only supplying 80% of possible throughput)? (Investment Currency/Year)	OperationalDegradationCos t	NO	Number
4.	What is the frequency of a regulatory or compliance fine because the Asset or Software is obsolete? Leave blank for one-time fines. (Fines/Year)	ComplianceFrequency	NO	Number
5.	If applicable, what is the cost of the regulatory or compliance fine? (Investment Currency/Fine)	ComplianceCost	NO	Number
6.	What is the failure frequency of the Asset or Software if it is not replaced?	of the Asset or AssetSoftwareFailureFrequ		Dropdown List:
7.	 Override: If available, what is the annual failure frequency of the Asset or Software if it is not replaced? (Events/Year) AssetSoftwareFailureFrequ encyOverride 			
	is the annual failure frequency of the Asset or Software if it is not	-	NO	Number



9.	After a failure, how many additional employee hours are required to fix the Asset or Software because it is obsolete? (Hours/Event)	EmployeeHoursToFix	NO	Number
10.	After a failure, how many additional employee productivity hours are lost during the downtime of the Asset or Software because it is obsolete? (Hours/Event)	AdditionalEmployeeProduct ivityHours	NO	Number

 Table 102: Obsolescence Risk Questionnaire – Baseline Time Varying

Investment Configurable Fields

The following values are investment configurable fields. The investment configurable field applies to all value models within the investment.

Configurable Field Name	Configurable Field Code	Configured Value	Units
		Dropdown List:	
Unit Selection	UnitSelection	1. CA\$ (Metric)	
		2. US\$ (Imperial)	

Table 103: Obsolescence Risk Investment Configurable Fields

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units
	Table 104 Obselver Disk Custom D		

Table 104: Obsolescence Risk System Parameters



4.2.22.2 Value Measure Outputs

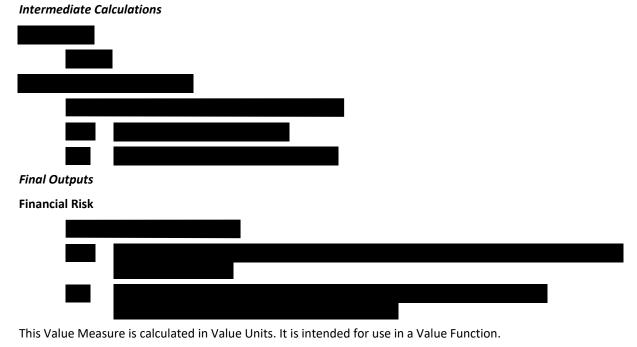
The **Obsolescence Risk** Value Model outputs multiple Value Measures:



Figure 31: Obsolescence Risk Value Model

4.2.22.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the **Obsolescence Risk** Model.



Operational Risk



This Value Measure is calculated in Value Units. It is intended for use in a Value Function.

Reputational Risk



This Value Measure is calculated in Value Units. It is intended for use in a Value Function.

Unacceptable Risk

The Unacceptable Risk measure serves as a flag to notify when the Obsolescence Risk exceeds a level of tolerance defined by Enbridge.



4.2.23 Operational Risk

Operational Risk measures the mitigation of the risk of disruptive incidents preventing Enbridge to operate or serve its customers. If a Risk Medium model is already being used by the investment to calculate operational disruption risk, this model should not be used. The Unacceptable Risk measure serves as a flag to notify when the Operational Risk exceeds a level of tolerance defined by Enbridge.

This is a risk matrix-based model. See Section 3 Risk Matrix for more details.

4.2.23.1 Value Model Inputs

Takes Inputs from: User Question	naire System Parameters Investment Fields
----------------------------------	---

Value Framework Design Document ■ March 2023 ■ Version# 8.1 ■ Page 185



User Questionnaires

The user is prompted to answer the following questionnaires for the **Operational Risk** Value Model.

Baseline and Outcome – All Time

Questionnaire Prompt (Description)		Prompt Variable Requination Name		Description / Selection Options
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)
2.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)

Table 105: Operational Risk Questionnaire – Baseline and Outcome All Time

Baseline and Outcome – Time Varying

Questionnaire Prompt (Description)		Variable Name	Required?	Description / Selection Options
1.	What is the risk consequence?	RiskConsequence YES		Dropdown List:
2.	If available, what is the dollar value of the risk consequence? (Investment Currency)	RiskConsequenceOverride	NO	\$
3.	What is the frequency of the risk?	RiskFrequency	YES	Dropdown List:
4.	If available, what is the annual frequency of this risk occurring? (Events/Year)	RiskFrequencyOverride	NO	Number

Table 106: Operational Risk Questionnaire – Baseline and Outcome Time Varying

Investment Configurable Fields

The following values are investment configurable fields. The investment configurable field applies to all value models within the investment.

Configurable Field Name	Configurable Field Code	Configured Value	Units
		Dropdown List:	
Unit Selection	UnitSelection	1. CA\$ (Metric)	
		2. US\$ (Imperial)	





System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

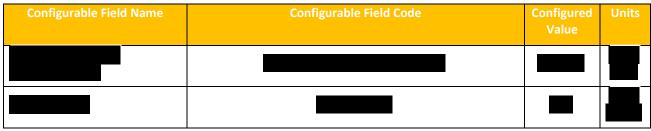


Table 108: Operational Risk System Parameters

4.2.23.2 Value Measure Outputs

The **Operational Risk** Value Model outputs multiple Value Measures:



Figure 32: Operational Risk Value Model

4.2.23.3 Value Measure Calculation Details

Intermediate Calculations

This section details the calculation of each of the Value Measure Output for the **Operational Risk** Model.

Final Outputs Operational Risk_{Baseline}

Value Framework Design Document ■ March 2023 ■ Version# 8.1 ■ Page 187



Operational Risk_{Outcome}

Unacceptable Risk

The Unacceptable Risk measure serves as a flag to notify when the Operational Risk exceeds a level of tolerance defined by Enbridge.

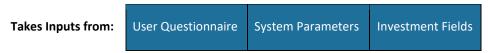


4.2.24 Public Safety Risk

Public Safety Risk measures the mitigation of the risk of public safety incidents by the investment. The Unacceptable Risk measure serves as a flag to notify when the Public Safety Risk exceeds a level of tolerance defined by Enbridge.

This is a risk matrix-based model. See Section 3 Risk Matrix for more details.

4.2.24.1 Value Model Inputs



User Questionnaires

The user is prompted to answer the following questionnaires for the **Public Safety Risk** Value Model.

Baseline and Outcome – All Time

Questionnaire Prompt (Description)		ompt Variable R Name R		Description / Selection Options	
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)	
2.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)	

Table 109: Public Safety Risk Questionnaire – Baseline and Outcome All Time

Baseline and Outcome – Time Varying



1.	What is the risk consequence?	RiskConsequence	YES	Dropdown List:
2.	If known that more than 1 member of the public may be harmed, please choose the type of harm above (using only consequence 1-5) and specify the number of people at risk of that harm.	PeopleHarmed	No	Number
3.	What is the frequency of the risk?	RiskFrequency	YES	Dropdown List: (
4.	If available, what is the annual frequency of this risk occurring? (Events/Year)	RiskFrequencyOverride	NO	Number

Table 110: Public Safety Risk Questionnaire – Baseline and Outcome Time Varying

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units

Table 111: Public Safety Risk System Parameters

4.2.24.2 Value Measure Outputs

The Public Safety Risk Value Model outputs multiple Value Measures as shown below.



Figure 33: Public Safety Risk Value Model



4.2.24.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the Public Safety Risk Model.

Intermediate Calculations



Public Safety Risk_{Outcome}

Value of Public Safety Risks after the investment.

Unacceptable Risk

The Unacceptable Risk measure serves as a flag to notify when the Public Safety Risk exceeds a level of tolerance defined by Enbridge.

4.2.25 Reputational Risk

Reputational Risk measures the mitigation of the risk of incidents that would be perceived poorly by customers, the media, and stakeholders. The risk of receiving compliance or regulatory fines is also captured by Reputational Risk. The Unacceptable Risk measure serves as a flag to notify when the Reputational Risk exceeds a level of tolerance defined by Enbridge.

This is a risk matrix-based model. See Section 3 Risk Matrix for more details.

4.2.25.1 Value Model Inputs

Takes Inputs from:	User Questionnaire	System Parameters	Investment Fields



User Questionnaires

The user is prompted to answer the following questionnaires for the **Reputational Risk** Value Model.

Baseline and Outcome – All Time

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options
1.	Provide any rationale or assumptions for all the numbers provided.	Rationale	YES	Provide background information justifying selection of answers (Max 10,000 characters)
2.	Please tell us your ideas for improvements to this value model (questions, dropdowns) or training, guidance, supporting data, etc.	UserFeedback	No	Provide input, suggestions, (Max 10,000 characters)

Table 112: Reputational Risk Questionnaire – Baseline and Outcome All Time

Baseline and Outcome – Time Varying

	estionnaire Prompt escription)	Variable Name	Required?	Description / Selection Options
1.	What is the risk consequence?	RiskConsequence	YES	Dropdown List:
2.	If available, what is the dollar value of the risk consequence? (Investment Currency)	RiskConsequenceOverride	NO	\$
3.	What is the frequency of the risk?	RiskFrequency	YES	Dropdown List:
4.	If available, what is the annual frequency of this risk occurring? (Events/Year)	RiskFrequencyOverride	NO	Number

Table 113: Reputational Risk Questionnaire – Baseline and Outcome Time Varying

Investment Configurable Fields

The following values are investment configurable fields. The investment configurable field applies to all value models within the investment.

Configurable Field Name	Configurable Field Code	Configured Value	Units
		Dropdown List:	
Unit Selection	UnitSelection	1. CA\$ (Metric)	
		2. US\$ (Imperial)	



Table 114: Reputational Risk Investment Configurable Fields

System Parameters

The following values are stored as system parameters and are applied to all Investments. These values may be updated by an administrator.

Configurable Field Name	Configurable Field Code	Configured Value	Units

 Table 115: Reputational Risk System Parameters

4.2.25.2 Value Measure Outputs

The Reputational Risk Value Model outputs multiple Value Measures:



Figure 34: Reputational Risk Value Model

4.2.25.3 Value Measure Calculation Details

This section details the calculation of each of the Value Measure Output for the Reputational Risk Model.

Intermediate Calculations

Risk Consequence

The Risk Consequence is calculated using the methodology for all risk value measures described in <u>3.4 Risk Value</u> <u>Measure Calculations</u>.

RiskFrequency

IF RiskFrequencyOverride = NULL

- THEN RiskFrequency
- ELSE RiskFrequencyOverride



Final Outputs

Reputational Risk_{Baseline}

Value of Reputational Risks before the investment.

Reputational Risk_{Outcome}

Value of Reputational Risks after the investment.

Unacceptable Risk

The Unacceptable Risk measure serves as a flag to notify when the Reputational Risk exceeds a level of tolerance defined by Enbridge.



4.3 Investment Cost (Prescribed)

The **Investment Cost** Value Model is a prescribed model used to calculate the total costs of an investment as well as the budget impacts to the Maintenance CAPEX, Enhancement CAPEX, and Growth CAPEX. If the Investment configurable field, Unit Selection, is set to CA\$ (Metric) the forecast should only be entered in Canadian dollars. If Unit Selection is set to US\$ (Imperial), the forecast should only be entered in American dollars as a resource.

4.3.1 Value Model Inputs

The inputs to the Investment Cost are the forecast cost of each Investment/Project Alternative and the investment configurable fields Capital Type and Units Selection. The Investment Cost Value Model does not use any user questionnaire inputs.

Investment Configurable Fields

The following values are investment configurable fields. The investment configurable field applies to all value models within the investment. The investment configurable fields can be defaulted by investment type. EGI investment templates will only have Investment Cost Subtracts Contributions selected by default.

Configurable Field Name	Configurable Field Code	Configured Value	Units
		Dropdown List:	
Unit Selection	UnitSelection	1. CA\$ (Metric)	
		2. US\$ (Imperial)	
		Checkbox:	
Investment Cost Includes Dismantlement	InvestmentCostIncludesDismantlement	1. Yes	
		2. No	



Configurable Field Name	Configurable Field Code	Configured Value	Units
		Checkbox:	
Investment Cost Includes Contributions	InvestmentCostIncludesContributions	1. Yes	
		2. No	

Table 116: Investment Cost Investment Configurable Fields

4.3.2 Value Measure Outputs

The Investment Cost Value Model outputs multiple value measures as shown below.

Base CAPEX O (CA)
Base CAPEX O (US)
Contributions (CA)
Contributions (US)
Total OPEX Cost (CA)
> (a) Total OPEX Cost (US)
Total CAPEX O Maintenance (CA)
Total CAPEX O Maintenance (US)
Total CAPEX O Enhancement (CA)
Total CAPEX O Enhancement (US)
> Total CAPEX O Growth (CA)
> G Total CAPEX O Growth (US)
> (a) Dismantlement (CA)
> (B) Dismantlement (US)
Gi US Projects Cost (US)
Gi CA Projects Cost (CA)
Total Investment Cost (CA)
Total Investment Cost (US)
Cost (US) Net Total CAPEX O (US)
Sa Net Total CAPEX O (CA)



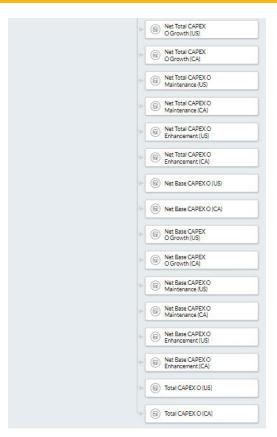
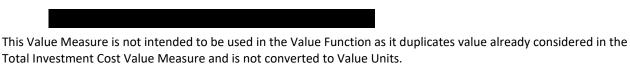


Figure 35: Investment Cost Value Model

4.3.3 Value Measure Calculation Details

Base CAPEX O (CA)

The **Base CAPEX O (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Base CAPEX O. The Base CAPEX O monthly spend is summed regardless of the alternative capital type (Enhancement, Maintenance, or Growth).



This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Base CAPEX O (US)

The **Base CAPEX O (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Base CAPEX O. The Base CAPEX O monthly spend is summed regardless of the alternative capital type (Enhancement, Maintenance, or Growth).

This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.



Net Total CAPEX O (CA)

The **Net Total CAPEX O (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement. The total monthly spend for the Investment Alternative under the account type Contributions is subtracted from this amount.

This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Total CAPEX O (US)

The **Net Total CAPEX O (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement. The total monthly spend for the Investment Alternative under the account type Contributions is subtracted from this amount.

This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Total CAPEX O Growth (CA)

The **Net Total CAPEX O Growth (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement. The total monthly spend for the Investment Alternative under the account type Contributions is subtracted from this amount. This value measure is only calculated when the alternative capital type is set to Growth.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Total CAPEX O Growth (US)

The **Net Total CAPEX O Growth (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement. The total monthly spend for the Investment Alternative under the account type Contributions is subtracted from this amount. This value measure is only calculated when the alternative capital type is set to Growth.





This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Total CAPEX O Maintenance (CA)

The **Net Total CAPEX O Maintenance (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement. The total monthly spend for the Investment Alternative under the account type Contributions is subtracted from this amount. This value measure is only calculated when the alternative capital type is set to Maintenance.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Total CAPEX O Maintenance (US)

The **Net Total CAPEX O Maintenance (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement. The total monthly spend for the Investment Alternative under the account type Contributions is subtracted from this amount. This value measure is only calculated when the alternative capital type is set to Maintenance.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Total CAPEX O Enhancement (CA)

The **Net Total CAPEX O Enhancement (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement. The total monthly spend for the Investment Alternative under the account type Contributions is subtracted from this amount. This value measure is only calculated when the alternative capital type is set to Enhancement.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.



Net Total CAPEX O Enhancement (US)

The **Net Total CAPEX O Enhancement (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement. The total monthly spend for the Investment Alternative under the account type Contributions is subtracted from this amount. This value measure is only calculated when the alternative capital type is set to Enhancement.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Base CAPEX O (CA)

The **Net Base CAPEX O (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Base CAPEX O. The total monthly spend for the Investment Alternative under the account type Contributions is subtracted from this amount.

This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Base CAPEX O (US)

The **Net Base CAPEX O (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Base CAPEX O. The total monthly spend for the Investment Alternative under the account type Contributions is subtracted from this amount.



Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Base CAPEX O Growth (CA)

The **Net Base CAPEX O Growth (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Base CAPEX O minus the total monthly spend under the account type Contributions for alternatives with the capital type Growth.





This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Base CAPEX O Growth (US)

The **Net Base CAPEX O Growth (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Base CAPEX O minus the total monthly spend under the account type Contributions for alternatives with the capital type Growth.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Base CAPEX O Maintenance (CA)

The **Net Base CAPEX O Maintenance (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Base CAPEX O minus the total monthly spend under the account type Contributions for alternatives with the capital type Maintenance.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Base CAPEX O Maintenance (US)

The **Net Base CAPEX O Maintenance (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Base CAPEX O minus the total monthly spend under the account type Contributions for alternatives with the capital type Maintenance.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Base CAPEX O Enhancement (CA)



The **Net Base CAPEX O Enhancement (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Base CAPEX O minus the total monthly spend under the account type Contributions for alternatives with the capital type Enhancement.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Net Base CAPEX O Enhancement (US)

The **Net Base CAPEX O Enhancement (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Base CAPEX O minus the total monthly spend under the account type Contributions for alternatives with the capital type Enhancement.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Total CAPEX O (CA)

The **Total CAPEX O (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement. The Base CAPEX O and Dismantlement monthly spend is summed regardless of the alternative capital type (Enhancement, Maintenance, or Growth).



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

Total CAPEX O (US)

The **Total CAPEX O (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement. The Base CAPEX O and Dismantlement monthly spend is summed regardless of the alternative capital type (Enhancement, Maintenance, or Growth).



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.



Total CAPEX O Growth (CA)

The **Total CAPEX O Growth (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement and whose investment alternative capital type has been defined as Growth.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Total CAPEX O Growth (US)

The **Total CAPEX O Growth (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement and whose investment alternative capital type has been defined as Growth.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Total CAPEX O Maintenance (CA)

The **Total CAPEX O Maintenance (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement and whose investment alternative capital type has been defined as Maintenance.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Total CAPEX O Maintenance (US)

The **Total CAPEX O Maintenance (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement and whose investment alternative capital type has been defined as Maintenance.







This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Total CAPEX O Enhancement (CA)

The **Total CAPEX O Enhancement (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement and whose investment alternative capital type has been defined as Enhancement.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

Total CAPEX O Enhancement (US)

The **Total CAPEX O Enhancement (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account types Base CAPEX O or Dismantlement and whose investment alternative capital type has been defined as Enhancement.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

Contributions (CA)

The **Contributions (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Contributions. Since Contributions is entered negatively into the forecast, the yearly outputs displayed by this value measure will also be negative.

This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Contributions (US)

The **Contributions (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Contributions. Since Contributions is entered negatively into the forecast, the yearly outputs displayed by this value measure will also be negative.



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Dismantlement (CA)

The **Dismantlement (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Dismantlement.

This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Dismantlement (US)

The **Dismantlement (US)** Value Measure is equal to the total monthly spend for the Investment Alternative under the account type Dismantlement.

This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Total Investment Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Total OPEX Cost (CA)

The **Total OPEX Cost (CA)** Value Measure is equal to the total monthly spend for the Investment/Project Alternative under the account type OPEX.

This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Investment/Project Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

Total OPEX Cost (US)

The **Total OPEX Cost (US)** Value Measure is equal to the total monthly spend for the Investment/Project Alternative under the account type OPEX.

This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Investment/Project Cost Value Measure and is not converted to Value Units.

This Value Measure is intended for use as a portfolio optimization constraint and for reporting purposes.

CA Projects Cost (CA)

The **CA Projects Cost (CA)** Value Measure measures all CA-based investment spend (i.e. Unit Selection = CA\$ (Metric)) and equals the total monthly spend for the Investment Alternative under the account types Base CAPEX O, Dismantlement, or OPEX if the investment has been selected as a CA investment in the investment details (i.e. Unit Selection = CA\$ (Metric)).

Value Framework Design Document ■ March 2023 ■ Version# 8.1 ■ Page 203



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Investment/Project Cost Value Measure and is not converted to Value Units.

All Investment spend regardless of Account Code, Account Type, Resource Code or Supplier is included in the calculation of the Investment/Project Cost Value Measure.

US Projects Cost (US)

The **US Projects Cost (US)** Value Measure measures all US-based investment spend (i.e. Unit Selection = US\$ (Imperial)) and equals the total monthly spend for the Investment Alternative under the account types Base CAPEX O, Dismantlement, or OPEX if the investment has been selected as a US investment in the investment details (i.e. Unit Selection = US\$ (Imperial)).



This Value Measure is not intended to be used in the Value Function as it duplicates value already considered in the Investment/Project Cost Value Measure and is not converted to Value Units.

All Investment spend regardless of Account Code, Account Type, Resource Code or Supplier is included in the calculation of the Investment/Project Cost Value Measure.

Total Investment Cost (CA)

The **Total Investment Cost (CA)** Value Measure is equal to the total monthly spend for the Investment Alternative in CA\$. Investment Cost contributes negatively to the value of the Investment. **Intended for use in a Value Function and is converted to Value Units.**

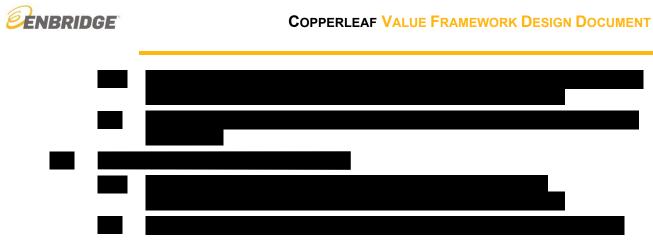


The Account Types used in the Total Investment Cost value measure is dependent on if the checkboxes for including the Dismantlement and Contributions Account Types are selected or not. The spend under the OPEX and Base CAPEX O Account Types are used in the Total Investment Cost calculation every time.

Total Investment Cost (US)

The **Total Investment Cost (US)** Value Measure is equal to the total monthly spend for the Investment Alternative in dollars. Investment Cost contributes negatively to the value of the Investment. **Not intended for use in a Value Function as the investment cost is already used in the value function under Total Investment Cost (CA).**





The Account Types used in the Total Investment Cost value measure is dependent on if the checkboxes for including the Dismantlement and Contributions Account Types are selected or not. The spend under the OPEX and Base CAPEX O Account Types are used in the Total Investment Cost calculation every time.



5 FINANCIAL PARAMETERS & KEY ASSUMPTIONS

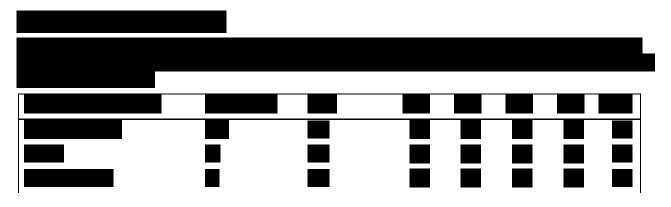
Many parameters used in the evaluation and optimization of investments are constant; however, some may change over the planning horizon. The following section captures background information and key assumptions regarding the considerations that were made in the optimization of investments and actual numbers used to evaluate investments, where appropriate.

5.1 Risk Consequence Multipliers

Value Measures	1	2	3	4	5	6	7
Financial Risk	I	I		I	I	I	I
Public Safety Risk		I					
Employee and Contractor Safety Risk	I						
Environmental Risk and Remediation	I						
Operational Risk	I						
Reputational Risk	I						

Table 117: Risk Consequence Multipliers

5.2 Environmental Benefits







Cor	PPERLEAF VALUE	FRAMEWORK DE	SIGN DOCUMENT
Table 118: CO	2e Value by Region		
			•
—			
	i		
	-		





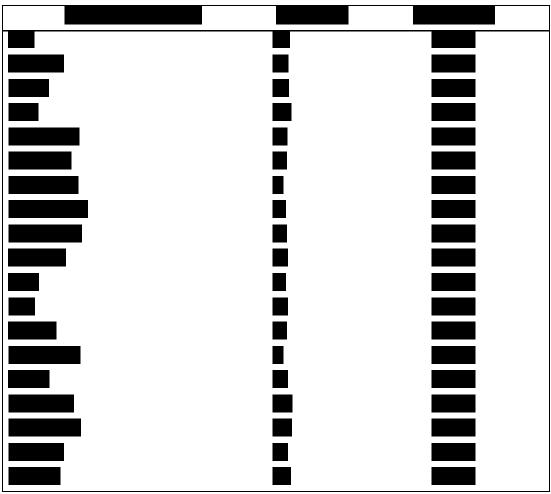


Table 119: eGRID Factors for gCO2e Per MWh Value by Region

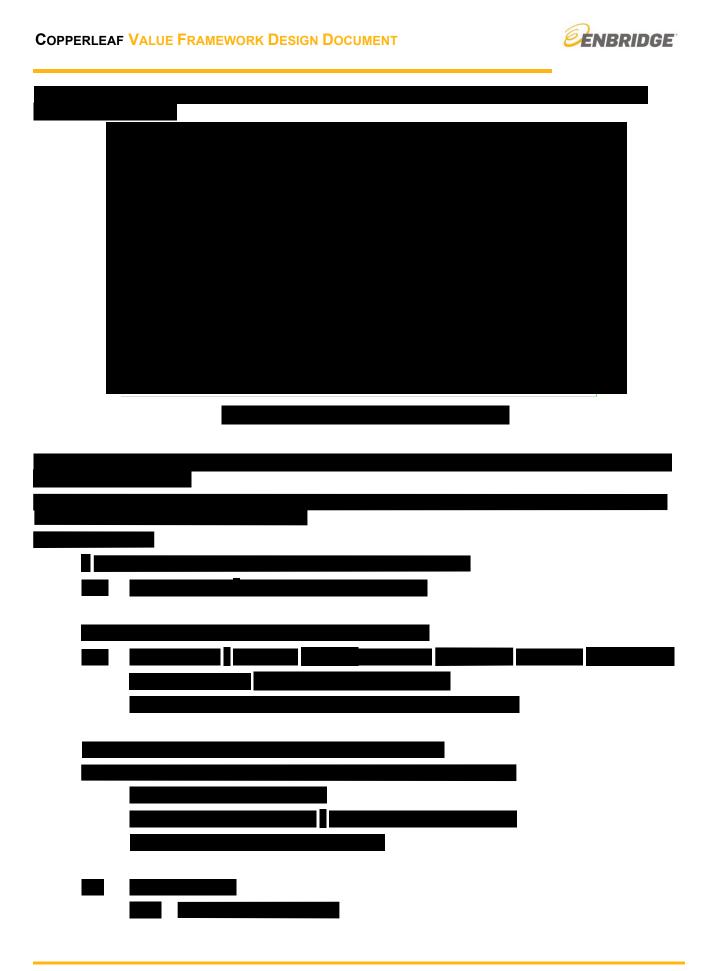


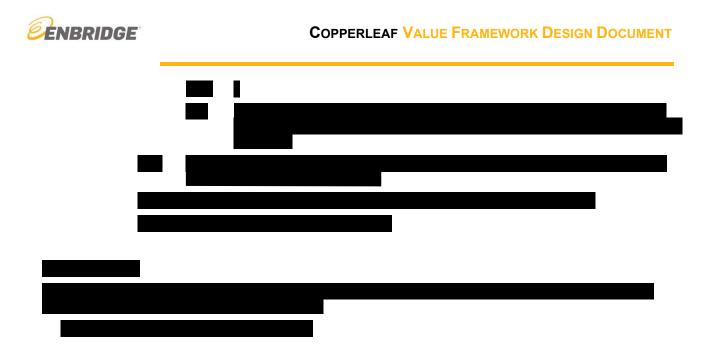
6 HEURISTIC FAILURE FREQUENCY ESTIMATION TOOL













7 **DEFINITIONS**

The terms below are used throughout the Value Framework Definition Document.

Term	Definition
Alternative	Attached to an Investment, an alternative is one of several possible options for undertaking work which will create value for the organization. An Alternative will have an alternative start date, forecast, risk mitigation, milestones and benefits. Each Investment must have at least one Alternative. As part of Optimization, the choice of Alternative is one of the attributes that can be changed for an Investment to maximize value.
Asset Life	The life of the asset. Within the Value Framework interest is around the asset that is impacted by the investment.
Discount Rate	Rate of interest when borrowing money. The Discount Rate is used in C55 to calculate NPV and the value of an investment.
Failure	The failure of an asset which causes Enbridge to experience a financial or societal consequence.
Gross Margin	EGI: Gross margin is defined as Revenue less Gas Costs.
Heuristic Failure Frequency Estimation Tool	
Investment Value Calculation Horizon	C55 system configuration for how far into the future C55 should calculate the value of an Investment for.
Mirror Exponential Distribution	A probability distribution curve that mirrors an exponential distribution.
Normal Distribution	A probability distribution curve that is symmetric about the mean, where years closest to the most likely failure frequency are the most frequent.
Optimization	The process of adjusting a Portfolio's Investments in order to make Investments fit below a Constraint, while maximizing the Value to the organization.
Planning Horizon	The period of time beyond the current fiscal year, looking forward, that is of interest to Organizations for planning and for which investments can be forecasted. Typically, Organizations will not plan beyond the planning horizon given the uncertainty of events so far into the future.
Resource Pricing	The cost per Resource unit. The price can be defined on a monthly basis.
Uniform Distribution	A probability distribution curve where the frequency of failure for each year is the same.
Useful Life	The estimated lifetime of a depreciable asset.
Weibull Distribution	A versatile probability distribution curve commonly used in reliability engineering. Uses a shape and scale factor to determine the failure

Table 120: Terminology Definitions

Gap analysis for the following 18 elements



FACTBASE	ELEMENTS	DESCRIPTION
	Org structure	 The structure of the organization in terms of its ability to deliver organizational & AM objectives; includes roles & responsibilities and information flows between functions & management levels
Onerating	Ops & maintenance decision making	Management activities & processes involved in determining Ops & maintenance requirements in support of AM
Operating Model	Lifecycle value decision making	• The decisions & activities undertaken to balance the costs & benefits of renewal, maintenance, overhaul & disposal interventions for an asset
medel	Capital investment decision making	• Processes & decisions to evaluate decisions related to capital investment. Includes new asset (e.g. greenfield) and replacement of an asset at the end of asset life (e.g. CAPEX sustaining programs)
	Org culture	Includes process of defining and then developing a culture conducive to AM and organizational objectives
	Competence management	The process used to develop & maintain an adequate supply of competent & motivated people to fulfill AM goals
	Asset management leadership	• The leadership of an organization required to promote a whole lifecycle AM approach to deliver organizational & AM objectives
	 Strategic planning (Includes environmental sust. development) 	 Processes for determining long-term renewal, enhancement & maintenance work volumes, associated risks / costs. Typically involves the development of a strategic planning framework that incorporates demand analysis and required levels of service
Strategy &	AM planning	• Specific activities required to develop the AM plan (e.g. review precious plans ,costs associated with plans, outcomes, resources, integrating other plans, approval and monitoring, etc.)
Planning	AM Policies	 The principles, mandate requirements and goals for the management of assets that will provide a framework to achieve the organizational/ corporate objectives
	AM Strategy & Objectives	 Long-term approach to the management of the physical assets. Includes strategic statements describing current/ future service levels and required capabilities to deliver these outcomes
	 Technical Stds. & Legislation 	Processes used to ensure AM activities are compliant with the relevant technical standards & legislation
	Asset information strategy	 The strategic approach to the definition, collection, management, reporting & governance of asset information necessary to support AM strategy & objectives
Data/ Information	Asset information standards	 The specification of a consistent structure and format for collecting and storing asset information and for reporting on the quality & accuracy of asset information
	 Data & info. mgmt. (includes systems, mgmt. review audit & assurance) 	• The data & information held within an organization's asset information system and processes for its management & governance
	Risk assessment & management	Policies & processes for identifying, quantifying and mitigating risks, and capturing opportunities
Risk	Asset performance & health monitoring	• Processes and measures used by an organization to assess the performance & health of its assets using performance indicators
	Asset costing & valuation	 The process for defining & capturing 'as built' maintenance & renewal unit costs & methods used by an organization for the valuation & depreciation of assets

Starting point: LP & GTM



	MODULES	ELEMENTS	Rating vs. Standard				
	MODULES		1 2 3 4				
		Org structure	\bullet \bullet				
		Ops & maintenance decision making					
		Lifecycle value decision making					
	Operating Model	Capital investment decision making					
		Org culture					
		Competence management					
		Asset management leadership					
	1	Strategic planning					
		AM planning	• •				
	Strategy & Planning	AM Policies					
		AM Strategy & Objectives					
		Technical Stds. & Legislation					
		Asset information strategy					
	Data/ Info	Asset information standards					
T		Data & info. mgmt.					
		Risk assessment and management					
	Risk	Asset performance & health monitoring					
		Asset costing & valuation					



Definitions 0 – Need not recognized **1** – Intent to develop **2** – Limited consistency **3** – Standards met

Rating

4 – Standards surpassed

Preliminary ratings for prioritized elements - EGD



MODULES	ELEMENTS	Rating vs. Standard				
WODULES	ELEMENTS	1	2	3	4	
	Org structure		\rightarrow	0—		
	Ops & maintenance decision making		\rightarrow	0—		
	Lifecycle value decision making		\diamond	0-	1	
Operating Model	Capital investment decision making		\rightarrow \bigcirc)		
	Org culture		\diamond	0-	i	
	Competence management	(
	Asset management leadership				þ	
	Strategic planning		\rightarrow	0-	1	
	AM planning		\diamond	0-		
Strategy & Planning	AM Policies			0-		
, iaining	AM Strategy & Objectives		\rightarrow		Ó	
	Technical Stds. & Legislation		\diamond	0-		
	Asset information strategy)	1	
Data/ Information	Asset information standards		· •	0-	1	
	Data & info. mgmt.		0			
	Risk assessment and management		\rightarrow	0—	1	
Risk	Asset performance & health monitoring		\rightarrow ()	1	
	Asset costing & valuation		\diamond)		
A						

Legend EGD Element avg. Range of other BUs

Rating Definitions 0 – Need not recognized 1 – Intent to develop

- 2 Limited consistency
- 3 Standards met
- 4 Standards surpassed

Rationale for scores – Operating Model (1 of 2)



	ELEMENTS	LP	GTM	EGD	UG
	Org structure			 AM role in place, accountabilities internalized, plans used in practice 2.5 Roles defined for asset class manager and directors (rather than positions) 	 Clear understanding of AM, accountabilities & plans formalized Early stages for AM
Operating Model	Ops & maintenance decision making			 Processes formalized & regularly leveraged Consistency varies due to early stages of AM 	 High level use of formalized decision making processes; quality & effort is evident Decision making process/ documentation in early stages; need more time to see AM plan in practice; consistency varies
	Lifecycle value decision making			 Processes documented in 10 year plan & broadly internalized across the BU Consistency of application varies 	 High level application & documentation of processes Further work required to define decision making processes
	Capital investment decision making			 High level processes defined Further work needed on detailed processes, documentation & consistency 	 High level processes defined Further work needed to refine processes and consistency Regulatory approval & constrained capital results in project deferral (wait for EGD to make the case or wait to build up the business case required to obtain approval)

Rationale for scores – Operating Model (2 of 2)



	ELEMENTS				
		LP	GTM	EGD	UG
	Org culture			 Culture conducive to AM Management promotes a culture of safety & continuous improvement, formalized processes and long term planning horizon, e.g. 10-year AMP Change management leveraged through the AM journey 	 Culture conducive to AM Culture has evolved towards supporting AM, and is in line with org values and AM objectives; strong culture of safety & continuous improvement
Operating Model	Competence management (ratings to be updated)		t	 High level competence management of current employees (at times ad hoc) Unclear if specific competencies have been identified for AM Additional capabilities required for ongoing AM implementation 	 Succession planning & training is a high priority; emphasis on competency requirements unclear Additional dedicated Asset Management resources required
	Asset management leadership			 Demonstrated leadership focus & commitment to AM improvement/ implementation; significant support from leadership 	 Leadership highly focused & committed to AM improvement/ implementation Earlier stages for AM implementation

Rationale for scores – Strategy & Planning



	ELEMENTS				
	ELEMENIS	LP	GTM	EGD	UG
	Strategic planning			 Formalized strategic planning process implemented & broadly communicated Informal process to combine top-down & bottom-up input 	 Strategic plan. process documented, still some process refinement underway; tactical components evolving Regulatory approval & constrained capital results in project deferral Strategy prioritizes compliance over performance
ß	AM planning			 Implemented detailed & formalized AM plan Some aspects of plan are still being refined 	 Early stages of AM plan implementation Plan is not public & still under refinement
Strategy & Planning	AM Policies			 Formalized AM policy implemented with clear objectives Policy was required by audits/ regulatory bodies so focus on policy development and implementation Further communication required across lower levels 	 Poundation & process to develop the policy in place but still evolving Early stages of asset management, additional formalization required
	AM Strategy & Objectives			 Formalized strategy & objectives communicated across the BU Barly stages of implementation Initiative underway to report progress vs. AM objectives 	 Formalized strategy & objectives communicated across the BU Early stages of implementation (year 1 of AM journey)
	Technical Stds. & Legislation			 Working with legislation boards to develop the required standards across the industry 2.5 Takes risk tolerance into account Haven't been able to implement every required standard since focus has been on creating the standards 	 Significant focus is on meeting the technical & legislation standards Some gaps in having the required documentation to prove compliance

Rationale for scores – Data / Information



			Rating &	Rationale			
	ELEMENTS	LP	GTM		EGD		UG
	Asset information strategy			2 '	Currently working on improving data reporting and KPIs Significant data quality improvement & rationalization initiative recently completed; included Cash register, work asset & GIS	1.5	 No formal asset information Strategy, although there are some pockets with guidelines/ data governance in place Asset Management Team is focusing on improving data quality and strategy
Data/ Information	Asset information standards			2.5	to delivery of accurate information	2	 No formal asset information standards, although there are some pockets with guidelines/ data governance in place Field information only gets updated once a month (vs. 24 -36 hours for EGD)
Data/ Infe	Data & info. mgmt.			• 2 '	Significant effort to improve data management & info quality Recently completed large data cleaning initiative; monitors are in- place to obtain real time information Data governance processes & data analytics tools are in progress or being refined; information gaps are being addressed Significant push to outsource data collection and incentives are tied to data quality	1.5	 Foundation in place, some data mgmt. initiatives underway Focus for the BU but additional resources required to execute

Rationale for scores - Risk



			Rating &	Rationale	
	ELEMENTS	LP	GTM	EGD	UG
Risk	Risk assessment and management			 Risk management program in place & broadly internalized across the BU Recently adopted a new system for risk optimization (more customized, and configured to specific requirements) System optimizes project portfolio based on risk, time and capital (rather than prioritizing and creating a cut off) Still some room for overall risk assessment improvement 	 Risk mgmt. program in place; understanding & adoption of risk tools varies Further communication & adherence required Quantitative approach varies across assets Storage: qualitative & quantitative Transmission: some quantitative (based on criticality) + frequent qualitative Distribution: qualitative
	Asset performance & health monitoring			 Asset Performance report generated and distributed as an FYI rather than incorporated into decision making Limited asset heath analysis beyond report Effort underway to improve reporting& analysis 	 AP & health monitoring improvement effort underway
	Asset costing & valuation			 High level implementation complete Continue to work on reporting and detailed asset costing analyiss 	 Initiative underway to improve reporting Early stages of AM

Org Structure ratings

Requirements to meet Level 3 rating

- The organization clearly understands its purpose and gives consideration to multiple factors (e.g. sector, product, service, location, scale, customers and stakeholders) and whether assets and Asset Management are central to its purpose or enablers.
- 2. The organization considers both external and internal factors when designing an appropriate structure (e.g. social, cultural, political, legal, regulatory, financial, technological, economic, environmental, internal governance, capability, policies, strategies, objectives etc.)
- 3. The organization designs and implements an appropriate organizational structure that clearly and unambiguously identifies roles, authorities and responsibilities.
- 4. Roles & responsibilities are sufficiently understood by everybody, communicated, maintained & updated
- 5. Top management assigns responsibility and authority for ensuring the adequacy, ongoing suitability and effectiveness of the Asset Management System and ensuring that the Asset Management System supports delivery of the Strategic Asset Management Plan.

- Top management assigns responsibility & authority for the establishment & update of the Strategic Asset Management Plan, Asset Management Objectives & Asset Management Plans
- 7. Decision-making processes are clearly defined across the cross-functional organizational structure & management is best placed to be a leader in taking key performance & reliability decisions.
- 8. The organizational structure is resourced consistent with its roles, responsibilities & workload to enable effective performance of the organization & delivery of Asset Management Objectives, statutory & stakeholder requirements.
- 9. Competency requirements & training are aligned & consistent with the organizational structure.
- 10. Individuals challenge the way of working to continuously improve the Asset Management System.
- 11. Top management assigns the responsibility & authority for reporting the performance of the Asset Management System back up to top management.

LP Score	GTM Score		E	EGD Score	9		UG Score				
		0	1	2	3	4	0	1	2	2	4
									-0-		
		 Meets standards: 1-3, 5-8, 10, 11; AM role in place, accountabilities internalized, plans used in practice; org is lean and effective Org structure is organized around the Asset Classes; Asset Class Managers and Asset Class Directors are responsible for an asset class; accountabilities and ownership are clear Asset Management team roles and responsibilities are well defined, documented and communicated Cross functional decisions have been identified; Asset Class Managers and Asset Class Directors have ownership over asset specific decisions and are ultimately the 'throat to choke' Asset Plan is designed to be updated and to evolve as needed, integrating feedback from the field AM project governance is in place and project team roles and responsibilities are defined Does not meet standards: 4,9; early stages AM initiative is still young and process is ongoing Roles & responsibilities defined/ internalized for ACMs & ACDs; but not yet understood by all employees outside of AM Competencies for AM are being developed; additional AM capabilities are required 					unders formal - O pl ar - O w v - A in - A in - A for AM - R M of m du - C bu re - A	standing of lized org structure is lan; all UG ass ccountabilities org structure is rell defined As nnual mgmt.r nprovements a sset Managen nd individuals nprovement not meet st not meet st not meet st f some decisic nanagers are r eprioritize AM competence m ut not yet fully equired for AM sset ownershi	built around a set Classes eview ensures are integrated nent culture is actively strive andards: 3, Class Manage tified; Formaliz ons has not be not fully dedica activities due gmt. is current developed; ac	ntabilities & implementatic ged with clear asset definition is that updates into the OMS young, but ha towards conti 4,7,9; early ers and Asset ration and corr en fully interna- ted and some to other respo- thy at an advar dditional resou	plans on of AM as within & potential Manual as a high bar nuous stages Category munication alized; asset stimes nusibilities need phase, arces

Operations & Maint. Decision Making ratings

- 1. Operations & Maintenance (O&M) strategies are determined using the organization's criteria for asset management decision-making.
- 2. The methods and processes for determining O&M strategies are documented, where necessary, and are aligned with the asset management policy, asset management objectives and SAMP.
- 3. The processes and methods are consistently applied across all assets and operations and consider asset criticality, remaining life of assets, required service levels, planned capital interventions and the balance between preventive and corrective maintenance. Records are available to demonstrate conformance.
- 4. Risk is included in the evaluation of O&M strategies, including consideration of how risk changes with time.
- 5. Asset performance, condition, costs and maintenance history is analysed regularly to verify the effectiveness of O&M strategies and identify the need for any changes.
- 6. Review processes ensure that, where appropriate, capital interventions will be initiated at the appropriate time and considered through the capital investment decision making process.

LP Score	GTM Score	-		EGD Scol	re		UG Score					
		& regu - F s tu - F p c - F m J c - F m J c - F m J c - F m J c - F m J c - F m J c - F m s - F - F - F - F - F - F - F - F	ularly levera Roles & respon single point of a heir Asset Clas Risk is the main processes have consistently Review process neetings for sh lanuary, June a clear hierarchy not meet st poearly stage Processes & m applied; AM wa Jecisions Scope of AM w	aged asibilities for C accountability ss n criteria by w e been formal ses consist of nort term decis and October f exists to esca tandards: 3 es of AM aethods are stil as recently exp ous developming AM govern	3 processes f D&M are clear: for decisions r hich decisions ized and are a structured we sions and mee for long term de alate issues if r ; consistence ill new and incompanded to inclu- ment of docume nance; conform	ACDs are related to are made; pplied ekly tings every ecisions; necessary cy varies onsistently ude O&M lude Ops & entation is	forma - W id • Does stage: consis - S a - P in	lized decisi Vithin the AM to dentified for fun- lecisions not meet st s; need mon stency varie dignificant effor dditional time Processes for co nplementation	on making framework, rol- nctions; key gr andards: 3, re time to se es rt in improving required to ge decision makir n resulting in at	3 level use of processes es and respons roups are involv 5,6; AM in ea ee AMP in pr quality of O&M t more review ro ng are still in ear t times, inconsis ords unavailable	ibilities are ved in AM arly ractice ; I decisions; eps rly stage of stent	

Lifecycle Value Decision Making rating REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit JT5.15, Attachment 1, Page 11 of 28

- 1. Criteria for 'lifecycle value' are determined and documented using the organization's criteria for asset management decision-making agreed with its stakeholders
- 2. The methods and processes for lifecycle value realisation are documented, where necessary, and are aligned with the asset management policy, asset management objectives, Strategic Asset Management Plan, and methods and criteria used for capital investment decision-making and operations and maintenance decision-making.
- 3. The processes and methods for lifecycle value realisation are consistently applied across all assets and operations in determining the best combination of asset acquisition/creation, utilization, maintenance, improvement, renewal and disposal activities over the lifecycle of assets (i.e. lifecycle strategies). Records are available to demonstrate conformance.
- 4. Risk is included in determining the lifecycle strategies, including consideration of how risk changes with time.
- 5. The organisation continually improves its approach to quantifying, modelling, forecasting, measuring and improving lifecycle value.

LP Score	GTM Score			EGD	Score)		UG Score						
LP Score	GTM Score	i E	0 1 Meets standard in 10 year plan BU - Asset Class to make lifec - Goal is to ma the total lifec - Focus is on t Asset Plan) & determine if ultimate crite compared - Consistent pi ensures that - Strong focus outlined to im Does not meet application vari	ds: 1,2,4 & broad Directors ycle decis aximize th ycle both longe & short tel plan adjus ria by whi rocesses lifecycle v on contin prove va standar	2 4,5; pro- dly inter use inpu sions; im ne availat er term h erm (week stments a ich proje and a sin value is v nuous im alue decis	3 cesses do rnalized ad at from Asset plementation bility of the as norizon, (e.g. kly meetings are required) are required) cts/initiatives ngle methode viewed object provement & sion making p	Managers ongoing sset over 10-year to ; risk is the s are ology tively & processes process	docu - - - - - - - - - - - - - - - - - - -	1 ts standards imentation o A track team is AM lifecycle de Goal is to maxi the total lifecycle Focus is on lor Maint. Capital related to these Stakeholders h continuous imp The overall stra assets over a l s not meet si ired to define Lifecycle value development a Lifecycle decis	2 c: 2,5; high k of processes a directly accou- ecision making imize the avail cle nger term horiz Projects (2018 e; decisions ar nave set a high provement ategy is to max- long period tandards: 1, e decision n e processes are and have not for	3 evel applica untable for imp ability of the as ton, e.g. priorit -2027) and ga re viewed holis to bar and strive ximize the avail , 3,4; further making proc e currently und prmalized or inf	e towards ilability of r work esses ler temalized		
			 Effective dec level can be strategic item Processes fo consistent; re unavailable 	ision mak improved 1s. or lifecycle	l to ensur e value re	re focus is or ealization are	n complex, e not yet	-	progress; furth Processes for l acquisition or c available	er clarification lifecycle realiza	is necessary ation are not ye	et applied to		

Capital investment decision making ratings Updated: 2023-07-27, EB-2022-0200, Exhibit JT5.15, Attachment 1, Page 12 of 28

- 1. Capital investment decision-making follows the organization's criteria for asset management decision-making agreed with its stakeholders
- 2. The processes and methods for capital investment decision-making are documented, where necessary, and are aligned with the asset management policy, asset management objectives and SAMP.
- 3. Credible alternatives are considered, including non-capital interventions, at an individual asset, groupings of assets and asset systems level.
- 4. Options are evaluated considering the agreed decision criteria, constraints and mandatory compliance requirements, and consider the impact of decisions over all lifecycle stages and the organization's long term need for the asset.

- 5. Records are maintained of the decision.
- 6. Risk is included in the evaluation, including consideration of how risk changes with time.
- 7. The processes and methods are consistently applied across all capital investments, including new build, replacement and refurbishment (where this extends asset life). Records are available to demonstrate compliance. Processes consider the nature and criticality of the assets, and are commensurate to the risk and opportunity.
- 8. The methods and processes are reviewed for their effectiveness in achieving asset management objectives and are updated as required.

LP Score	GTM Score	EGD Score UG Score
		 0 1 2 3 4

Org Culture ratings

- 1. The organization identifies internal and external issues relevant to its purpose and considers these in designing its Asset Management System.
- 2. Every individual in the organisation perceives Asset Management as a good investment with positive long term benefits.
- 3. There is consistent self-discipline at all levels in the organisation as an observable habit.
- 4. Top management proactively shapes organisational culture to ensure observed behaviours align with organizational values, the Asset Management Policy, and achievement of Asset Management Objectives.
- 5. The organization ensures roles and responsibilities are assigned and conducive to collaborative and crossfunctional Asset Management thinking.
- 6. The organization has an embedded culture of risk management and all persons working under the organization's control are trained and made aware of the activities they are responsible for, the associated risks and required controls, and opportunities are systematically captured and where appropriate progressed.

- 7. The organization considers and plans for the long term and values processes as well as outputs.
- 8. Top management promotes collaborative and participative consultation to understand and address the cultural challenges that the organisation faces.
- 9. A clear chain of command and communication processes exist in the organization and everybody understands how to escalate issues.
- 10. The organization identifies and determines the aspects of culture that need to change and the pathway between current and desired culture.
- 11. The organisation actively identifies barriers and constraints for culture change and proactively plans to remove or mitigate. The organization establishes effective processes for culture change and identifies the mechanisms of change that are most effective.
- 12. The organization is a 'learning organization' with consistency in understanding, behaviour and good practice.

 0 1 2 3 4
- Barriers to culture change have been identified, but processes and mechanisms for change have not yet been established; biggest challenge is change management of org culture

Competence Management ratings

- 1. The organisation establishes a Competence Management System which aligns all required asset management competences to the roles and responsibilities identified within the organisation's Asset Management System.
- 2. The Competence Management System incorporates processes for identifying competency requirements for asset management activities and assessing competence of resources both internal and external.
- 3. The organization takes necessary actions to acquire competent persons and evaluates the effectiveness of such actions.
- 4. The Competence Management System is utilised to support the recruitment, development and training of all staff within the Asset Management System.

- 5. The organization ensures persons are competent on the basis of education, training and/or experience.
- 6. The organization identifies appropriate activities to address any gaps in competence.
- 7. The organisation retains appropriate documented information as evidence of competence, for both internal and outsourced resources.
- 8. The organization periodically reviews current and future competency requirements.
- 9. The organization proactively forecasts competence requirements to support the development of the Asset Management System and the delivery of the Strategic Asset Management Plan.

Asset Management Leadership ratings REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit JT5.15, Attachment 1, Page 15 of 28

- Top management demonstrate leadership and commitment to Asset Management by ensuring Asset Management Policy, Strategic Asset Management Plan and Asset Management Objectives are established and are aligned to the organisational objectives.
- Top management ensures the Asset Management System requirements are integrated into business processes and that the Asset Management System achieves intended outcomes.
- 3. Top management ensures resources for the Asset Management System are available and actively directs and supports people to contribute to effective Asset Management.
- 4. Leaders support and influence staff to deliver the Asset Management Strategy and objectives of the organization.
- Leaders communicate the importance of asset management and Asset Management System requirements in a clear and concise manner.

- 6. Top Management actively promotes cross-functional working and supports leadership in Asset Management.
- 7. Leaders demonstrate, by their behaviour, commitment to values and principles of Asset Management set out in the Asset Management Policy, Objectives and Strategic Asset Management Plan.
- 8. Top management ensures alignment and integration of asset risk into the organisational risk management system.
- 9. Leaders promote continual improvement.
- 10. Leaders are responsible for ensuring that Asset Management decisions are taken by the relevant role.
- 11. Top management provides stakeholder confidence of the direction being taken and benefits that will be achieved.
- 12. Top management and leaders endorse all key Asset Management System documentation.
- 13. Top Management and leaders identify the interfaces between Asset Management activities and other organizational activities.

LP Score	GTM Score		E	EGD Scor	e		UG Score						
LP Score	GTM Score	focu impl lead - -	ts standards: us & commitm lementation; s dership Leadership is fu ensuring that Al Leaders are pas initiative and err Leadership com	2 1-12; Dem ent to AM in significant s Illy dedicated i M is integrated ssionate/ enth hphasize the in municates AM	3 constrated le mprovemen upport from to implementin d into business usiastic about mportance M objectives ef	nt/ ng AM and s processes the ifectively	comm AM in - L - In o - A s - L	nitted to AM early days eadership is f ntegration of A ongoing Asset risk is inf ystem eadership is f	2 : 1-12; Leac improveme ully dedicated M System into tegrated into the focused on cor	3 dership focu ent/ implem to implementi o business pro- ne org risk ma	entation; ing AM ocesses is nagement		
		• Doe poin	down the chain well informed Asset risk is lea projects and rea Leaders promot recognize shortd attached to pre- es not meet sta not meet sta Interfaces with o not been formal	dership's mai aching decisio e continuous comings (e.g. AM habits) andards: 13 other org activ	n focus when e ns improvement a some individua 3; informal to	evaluating and als ouch	 Does points II 	6	tandards: 13 other org activ				

Strategic Planning ratings

- 1. The strategic planning process to achieve asset management objectives integrates with other organizational planning activities, including financial, human resources and other support functions.
- 2. The strategic planning process is aligned with and supports the organization's overall business planning
- 3. The strategic planning process incorporates the results of supply and demand forecasting

- 4. The strategic planning process provides a structured approach and framework for developing Asset Management Plans for asset systems and asset types.
- 5. The strategic planning process and the asset management planning processes are undertaken in an iterative way combining top-down direction with bottom-up asset needs.

 0 1 2 3 4 0 1 2 3 4 • Meets standards: 1,2,3,4; Formalized strategic planning process implemented & broadly communicated • Long term strategy is well defined, e.g. 10-year Asset Plan outlining policies, roles, accountabilities, processes and tools to make decisions and deliver safe, reliable and cost effective AM that maximizes asset value • Short term strategy is adjusted as needed through weekly meetings • Structured framework for developing AM Plan has been implemented • Does not meet standards: 5; Informal process to combine top-down & bottom-up input • T. teaming by doing "approach combines top-down direction with bottom-up assot needs but key elements around asset strategies are not yet complete
 AM strategies vary somewhat between asset categories Capital constraints has resulted in the deferral of some

Asset Management Planning ratings

- 1. Documented Asset Management (AM) plans exist for asset systems and critical assets in alignment with the SAMP for the achievement of the asset management objectives.
- 2. The AM Plans take account of the risks and opportunities, including how these can change with time.
- The AM plans take account of requirements from outside the AM system and consider the financial and non-financial implications of the plans.
- 4. The AM plans take account of the results of demand analysis the AM plans seek to address continual improvement opportunities
- 5. AM Planning activity is integrated with other planning activities such as IT, human resources and financial planning

- 6. The AM plans detail the processes and methods for managing the assets over their lifecycles.
- 7. AM plans include activities and their timescales, the resources to be utilized, the roles and responsibilities, risks/opportunities and the expected outputs/outcomes from the delivery of the plans.
- 8. Activities within the AM plan are prioritized based on the organization's agreed method and decision criteria documented in the SAMP.
- 9. The AM plans are reviewed and updated regularly, in accordance with specified review periods, to account for the dynamic nature of risks and opportunities.

0 1 2 3 4 0 1 2 3 4 • Meets standards: 1-5,7,8; implemented detailed & formalized AM plan • Meets standards: 1-5,6,7; early stages of AM plan implementation • Asset Plan takes into account risks, opportunities, financial and non-financial implications over lifecycles, or assets • Meets standards: 1-5,6,7; early stages of AM plan implementation • Asset Plan takes into account risks, opportunities, financial and non-financial implications over lifecycles, taking into account risks and opportunities • Meets standards: 1-5,6,7; early stages of AM plan implementation • Am Plan describes processes for managing assets over their lifecycles, taking into account risks and opportunities • Meets standards: 8,9; plan is not public • Dees not meet standards: 6,9; some aspects of plan are still being refined • Masteglies vary somewhat between asset calceding refined • Asset Plan does not yet include risk management over asset lifecycle, plan is focused on asset replacement strategy •

Asset Management Policy ratings

- 1. The AM Policy has been authorized by the top management
- 2. AM Policy is appropriate to the purpose, scale and nature of the organization
- 3. AM Policy provides a set of principles, intentions, organization's mandated requirements and commitments.
- 4. AM Policy provides a framework for development and implementation of the Strategic Asset Management Plan.
- 5. AM Policy is consistent with Organisational Plan, organizational objectives, stakeholder requirements, constraints and other relevant policies within the organization
- 6. The policy sets out the organization's commitment to satisfy applicable (e.g. legal, regulatory, etc) requirements and to continual improvement
- 7. The policy is effectively communicated to employees and stakeholders as appropriate
- 8. The AM Policy is regularly reviewed and updated to support continual improvement.

LP Score	GTM Score	EGD Score UG Score									
		0	1	2	3	4	0	1	2	3	4
		imp - - -	eets standards olemented with Policies are cle improvement, o budget transpa balancing safe performance a Compliance wi internal policie continuous imp Top managem consistent with delivering value es not meet s mmunication r Communication further commu AM Policy coul through formal	h clear obje early defined; in compliance, su arency, improve ty, holistic eval nd cost th all applicabl s is top priority provement ent has author organization of e to customers tandards: 7; equired acro n is most effect nication is required be communi	ctives nclude AM cor ustainability, in ed risk method luation of risk, e laws, regular ; org strives for ized AM polici objectives of sis and stakehol ; Further oss lower le tive at upper la uired between	ntinuous creased lology and tions and r es that are afely ders evels evels of org; all levels	proce evolv - / - F s t • Does asset requin - / i i	ess to devel ing AM Policy com understanding Framework for SAMP in place o framework a not meet s managemered AM implement mprovement a	s: 1,2,3,4, 6; op the policy municated to the across levels at development & and consistency tandards: 5, ent, addition ation is too rec- and regular revi- volving and und a AM journey	y in place b he organizatio and at the fror & implementa mers defined; y across the E 6,8; early s al formaliza ent to assess iews	out still on, broad ntline ation of adherence 3U unclear stages of ation

Asset Management Strategy & Dbjectives REDACTED Updated: 2023-07-18, EB-2022-0200, Exhibit JT5.15, Attachment 1, Page 19 of 28

1. AM objectives have been established at relevant levels and functions of the organization

- 2. AM objectives consider stakeholder and other relevant requirements
- 3. The AM objectives are Specific. Measurable, Achievable, Realistic and Time bound.
- 4. The AM objectives are documented and included within the Strategic Asset Management Plan (SAMP).
- 5. The SAMP sets out the organization's strategic approach to the management of its assets and the achievement of AM objectives.
- 6. The AM objectives and SAMP are aligned with the organization's objectives, the AM Policy and relevant requirements

- 7. The SAMP is consistent with the risk tolerability criteria and the organization's decision making criteria.
- 8. The SAMP is consistent with the methodology for determining asset criticality
- 9. The SAMP outlines the role of the asset management system in achieving the AM objectives and plans for developing asset management capability.
- 10. The SAMP and AM objectives take into account existing and future needs in relation to assets and AM capabilities.
- 11. The SAMP & AM objectives have been communicated to relevant internal and external parties.
- 12. The SAMP and AM objectives are reviewed and updated.

LP Score	GTM Score	EGD Score								UG Score				
		0	1	2	3	4	0	1	2	3	4			
		objec - / - / - / - - / - - - - - - - - - - -	s standards ctives comm AM objectives Asset Plan; the Risk is the mos Asset Plan The Asset Plan all relevant par Asset Plan is re advances a not meet st cmentation Formal metrics effectively mea Opportunities t evaluate for all O&M options	are well define ey are aligned st important cri n has been effo ties egularly review tandards: 12 s tracking how asure shortcom to improve stra	eross the BU d and docume with EGD objecteria considere ectively comment ved as AM imp 2; Early stag objectives are nings tegy exist, e.g	J ented in ectives ed in the unicated to olementation ges of met could u. directly	object - A a - F A - A a • Does implet - F e e - C	tives comm M objectives and documente Risk is the most Asset Plan Asset Plan is r dvances not meet s mentation (Formal metrics affectively mea Communicatio	s: 1-10; form nunicated ac align with UG ed in Asset Pla st important cri regularly review tandards: 1 (year 1 of Al s tracking how asure shortcorr in of Asset Plan cess for updatio	cross the BL goals and are an iteria considered wed as AM imp 1,12; Early s M journey) objectives are nings n could improv	well defined ed in the olementation stages of met could			

Technical Stds. & Legislation ratings

- 1. The organization determines the full extent of financial, non-financial and technical information required to enable it to meet its obligations.
- 2. The organization has all relevant documented information required by applicable standards and legal and regulatory requirements to support the Asset Management System.
- The organization has a process to ensure that any documents required by the Asset Management System and any standards and applicable legal and regulatory requirements are available and suitable for use when required and are adequately protected.
- 4. The organization has a process to create and regularly review and update the documented information.

- 5. The organization has a process to control the documented information, including the distribution and access, storage and preservation, version control and retention and/or disposal.
- 6. The organization has a process to identify and control documented information from sources outside the organization that is required by the Asset Management System.
- 7. Technical documents are aligned to and support the Asset Management System.
- 8. The organization is able to demonstrate how any changes to technical and legislative documentation are appropriately communicated.
- 9. The organization has a process in place to ensure that there is consistency and traceability between organizational data in compliance with any legal and regulatory requirements.

LP Score	GTM Score	EGD Score UG Score									
LP Score	GIM Score	requir • Takes • Have	1 ing with legi red standard s risk tolerar n't been able	2 slation boar ds across the nce into acco e to impleme	3 ds to devel e industry ount ent every re	equired	legisla • Some	1 cant focus tion standa	2 is on meetir ards ving the req	3 ng the techr	
		 standard since focus has been on creating the standards Most Technical and legislation standards in place and internalized in AM activities across the organization. Processes centered around technical & legislation requirements and ensuring compliance. 									

Asset Information Strategy ratings

- 1. The organisation determines what asset management information is required to support its assets, management of assets, the AM System and organizational objectives.
- 2. The organization has a documented Asset Information Strategy that is consistent and aligned with the SAMP.
- 3. Development of the strategy considers:
 - The significance of identified risks on information requirements.
 - Information required to support key decisions required within asset management processes, procedures and activities.
 - The exchange of information with stakeholders, including service providers.
 - How and when information is to be collected, analysed and evaluated.
 - Impact of quality, availability and management of informa ion on its' organizational decision-making.
- 4. The strategy defines the quality required of asset information.
- 5. The strategy is designed to ensure there is appropriate traceability and consistency between financial and nonfinancial information relevant to asset management to the extent required to meet its legal, regulatory and stakeholder requirements and organisational objectives.

- 6. The strategy contains objectives relating to proposed improvements in asset information that are SMART including the identification of gaps between the currently available information (including its quality and accuracy) and that which is required.
- 7. The strategy identifies the processes that are required to manage asset information and assure its quality, along with their governance, including responsibilities and accountabilities, and any programmes to improve these processes.
- 8. The strategy contains information system business requirements necessary to support the organization's business processes and information needs.
- 9. The strategy includes processes to ensure asset information retains alignment to needs as the organization's requirements evolve including migration of data and users from existing systems to new systems.
- 10. The requirements are determined for aligning terminology (financial and non-financial) relevant to asset management across the organization.

LP Score	GTM Score	EGD Score UG Score
LP Score	GTM Score	 EGD Score 0 1 2 3 4 4
		 Currently improving current practices related to asset information; formalization of process improvement ongoing Processes to manage information, or alignment to the organization's evolving needs Data stewardship model is improving data quality, but there remain many isolated data sources with few accuracy controls

Asset Information Standards ratings

- 1. The organization has developed standards and guidelines to ensure a consistent approach to the recording of asset information to meet the asset information needs defined in the Asset Information Strategy.
- 2. The information structure has a hierarchy for assets, and enables the recording of their physical location.
- 3. There are definitions for the attributes required for asset information, including acceptable values and quality criteria.
- 4. The information structure enables collection of data on asset utilization, condition and performance, incidents and non-conformities and describes how these should be recorded in order to support strategic Asset Management planning, improve service and reliability, support long and short term planning activities and help determine overall asset lives and intervals between intervention activities.
- 5. The organization has defined the quality and accuracy that is required for all asset information.
- 6. The organization has defined how the quality and accuracy of all asset information is to be assessed.

LP Score	GTM Score	EGD Score					UG Score						
		stan ensu curre of st - - - - - - - - - - - - - - - - - - -	1 ets standards idards & hier ure data qual ently underw tandards Quality and ac importance; as Invoicing for co accurate inform Ongoing data i improvements, management, es not meet sine variance in Initiative is ong quality and acc leveraging data Formalized ass mechanisms to development	archy in pla ity impleme yay for contin curacy of asse set information ontractors is contation improvement in data governan data profiling tandards: 4, n consistence going to standa curacy, and to a set information	ce and mea nted; initiati nuous impro t information a hierarchy is o onnected to de nitiatives: Data nce, records 5,6; early s 5,6; early s y rdize definition develop strate standards an	asures to ive ovement are of great defined divery of a quality stages, ns of data egies on d feedback	respo - () in - S • Does - F 2 - C r - C t - F	Ansibilities in Quality and ac mportance; do Strategies to le not meet s Field informati 24 -36 hours fo Definitions of c not yet fully im Guidelines are be collected	curacy of asse ocument hierar everage data a standards: 4 ion only gets up or EGD) data requireme	et information a chy is defined are under deve ,5,6; early s pdated once a ents have been nough on how	are of great elopment stages month (vs. n made, but		

Data & Information Management rating REDACTED Updated: 2023-07-27, EB-2022-0200, Exhibit JT5.15, Attachment 1, Page 23 of 28

- 1. There are governance processes to provide assurance that information is consistent with the quality and accuracy requirements defined in the Asset Information Strategy and asset information standards.
- 2. There are data collection and maintenance plans to address any information gaps identified in the Asset Information Strategy.
- 3. There are processes to ensure provision of asset information resulting from asset interventions.
- 4. Suitable controls are incorporated into the business decision making process to ensure data of the required data quality is used to inform the decision.
- 5. Processes and governance for managing asset management information are specified, implemented and maintained.

- 6. There are processes and systems in place for the storage and preservation, distribution, access, retrieval and use of data and information to ensure that required information is available and suitable for use, where and when it is needed.
- 7. Information is adequately protected, including from loss of confidentiality, improper use or loss of integrity.
- 8. There are processes in place for the control of changes to data and information
- 9. There are processes and systems in place for the retention and disposition of data and information.
- 10. Documented information originating from outside the organization and determined to be necessary for asset management activities is identified and controlled.

LP Score	GTM Score			E	EGD Scor	е				UG Score)	
		•	improv - Da in be - Re - Go wo - Inf co - Sig ind Does r initiativ - Op fee ma - Un do sy - Th co rer	1 standards: re data mar ata governanc progress or b ing addressed ecently comple bod systems in ork required formation is pri ntrolling data gnificant push centives are ti- not meet sta res underwa poprtunity exis edback to AM aking nder developm bare remain m introls on accu- medied ome data is no	nagement & ee processes a eing refined; i d eted large dat n place for de rotected and p changes and to outsource ed to data qua andards: 4, ay, early st leadership ar nent: governa control of data any isolated s uracy and curr	A info qualit A info qualit A data analyti Information ga a deaning ini- icision making processes are retention of d data collection ality 5,6,10; mu ages e data in orde and influence d nce processe a, storage & r spreadsheets rency, but this	ty ics tools are aps are itiative g but ongoing e in place for lata on and Itiple data r to provide lecision es, gap etrieval with few s is being	son - - - Doe the	to databases a collection Data governar although OMS handled es not meet s BU but addit cute Process for m governance, a retrieval are s the first step to Opportunity er feedback to A	at. initiatives I and database ds underway to be ata, improve ho and automate n nce processes & Manual discus standards: 4,	underway reviews are us woperations fe nanual pieces of have not been f sses how data s 5,6,8,9,10; fr ces required nformation, dat gaps and stora S Manual guide e data in order in dinfluence de	eed to lata, eeds data of data formalized, should be focus for to ta age & lelines are to provide

Risk Assessment & Management rating Sedacted Updated: 2023-07-27, EB-2022-0200, Exhibit JT5.15, Attachment 1, Page 24 of 28

- 1. Top management ensures that the management of asset management risks is aligned with the organization's risk management approach.
- 2. The organization's approach to risk and opportunity assessment and management ensures compliance with legal, statutory requirements and is consistent with stakeholder requirements and expectations.
- 3. The organization assesses the risks and opportunities associated with outsourcing any activities that can have an impact on the achievement of its asset management objectives
- 4. The organization determines the risks and opportunities to be addressed to:
 - a) Enable the asset management system to achieve its required outcomes
 - b) Prevent or reduce undesired effects on the asset management system
 - c) Continually improve the asset management system
- 5. The organization assesses how these risks and opportunities can change over time.
- 6. The organization creates and carries out action plans to address the risks and opportunities and integrates the actions into its asset management processes.
- 7. The organization evaluates the effectiveness of its actions to address risks and opportunities.

- 8. The organization has documented risk management processes for assets and asset management activities to:
 - a) Identify and assess risks and opportunities;
 - b) Identify the criticality of assets with respect to achievement of asset management objectives;
 - c) Select and implement appropriate treatments for risks and opportunities;
 d) Monitor these treatments and their effectiveness;
- 9. The organization ensures that staff carrying out risk and opportunity assessment are competent to perform the activity.
- 10. The organization documents its risks in a way that supports the identification, recording, evaluation, ranking/ prioritizing, reporting, review, updating and archiving and closure of business risk records.
- 11. The organization manages risks and opportunity arising from the management of change, and assesses risks which can impact on achievement of objectives before the change is implemented.
- 12. The organization includes the treatment and monitoring of risks and opportunities in its processes for operational planning and control.
- 13. The organization evaluates and reports on the effectiveness of its processes for managing risks and opportunities.

LP Score	GTM Score	EGD Score						UG Score							
LP Score	GTM Score	progra the Bl - F - A - K - th th th th th th th th th th th th th t	1 s standards: am in place	2 : 1-12; risk I & broadly in ecision criteria; sk & customer is aligned to e ents y assesses cha gs, and creates e quantified and d by managem proved ent processes eatments sele	3 management nternalized risk is split int r satisfaction ri nsure complia anging risks th s action plans d entered into nent and detern are formalize cted based or	across o safety sk nce with rough to adapt to risk register mines which d and priority	in plac requir - D m - R d - M - R a - Q u s	1 s standards: ce, further c ed Detailed risk ma nonitor risk, wh Risk management ocumented; tru Aanagement of Risk registries a nnual risk worl Quantitative rist	2 : 1-8,10,13; communica atrices were conich is the ma ent processes eatments sele f change risks are completed kshops k approach is sion asses ba storage asset	3 ; Risk mgmt tion & adhe developed in o in decision crit s are formalize ected based or s are considered d and reviewed s very effective issed on critical (s)	rence rder to teria ed and n priority ed d during where it is				
		e - M tr • Does impro - A F	Adved away fro ool in favor of a not meet st vement Adherence to ri orogress achiev eedback loop Disputes regard	isk is now par om proprietary a more flexible tandards: 13 isk processes ved through ris on solution im	t of the lexicor pipeline risk a tool in line wi 3; still some vary across th sk mgmt. form plementation	assessment th needs room for e org, but alization;	o tt - U - S b - R fo	Ider risk mana he BU Inderstanding Some risk mgm y intuition from Risk assessme	and adoption and adoption t. process are n operators ra nt process is	ng; benefits are lices are evide of risk tools is e still informal, ather than cond predominately to incorporate	nt across inconsistent and guided crete metrics qualitative				

Asset Performance & Health Monitoring EDAGTED Updated: 2023-07-27, EB-2022-0200, Exhibit JT5.15, Attachment 1, Page 25 of 28

- 1. The organization determines its requirements to monitor and measure the performance and health of its assets, including:
 - a) What is to be monitored and measured
 - b) Methods of monitoring, measurement, analysis and evaluation to ensure results are valid
 - c) Establishing criteria to understand when there is deviation from the required level of performance, and if appropriate identify as a non-conformance
 - d) The frequency of monitoring, measurement, analysis and evaluation
- 2. The organization reports on asset performance, including asset health, in accordance with stakeholder requirements
- 3. The organization develops a hierarchy of asset performance and asset health reporting through the organization appropriate to the needs and decisions that are being managed

- 4. The organization develops a range of leading and lagging performance measures for its assets
- 5. The organisation establishes monitoring and reporting that allows for the prediction of future asset performance & health
- 6. The organization regularly reviews asset performance and asset health monitoring, measurement, analysis and evaluation to ensure that it supports the achievement of asset management objectives and to identify opportunities for improvement.
- 7. The organization maintains records of asset performance and asset health monitoring, analysis and evaluation

LP Score	GTM Score	-		EGD Scor	e	UG Score						
		repor	1 ts standards: rt generated;	; effort unde	erway to im	prove	impro	1 s standards ovement effo	ort underwa	У		
		• Does repoi decis beyo	Requirements of Data hierarchy Scorecards del assets; these a Asset performa part of AM; this is not meet st rt is an FYI r sion making; ond report; fu Ongoing effort quantify risk an Asset performa Some aspects monitoring to a development; s performance ta should be evalu Opportunity exi with uncertainty typically assum proven otherwise	exist to report in place; perfor ineate metrics are available for ance monitorin is regularly re- tandards: 4- ather than i limited ass in ther optimi to establish co- d standardize ance analysis of of asset health llow prediction some assets durget; effectives uated over ent ists to develop y in asset con- ne that asset is	on asset performance hiera that are used or several year g is viewed 6; Asset He ncorporated et heath an zation requi- onsistent prince evaluations done ad hoc non yet have ness of risk tra- ire asset life a methodolog dition; stakeho	ormance; rchy exists to monitor s an integral ealth d into halysis ired iples to e.g. der a a eatments gy to deal olders	- / ii - L - r • Does - / c t t - li	Asset performa nclude all metri Leadership rec nonitoring, but not yet in place not meet st Asset health m detailed failure completed for o hat n some cases assessments a decisions can b known in advar	ance records e rics used to m cognizes value t this effort is r tandards: 3 nonitoring is sti analyses and compressor st issues still ari are changing th be reached an	exist and score onitor assets of asset perfo lew; data hiera -6; efforts u II in its infancy HAZOPS hav ations, but not se unexpected his so that pro- d asset health	ormance archies are nderway r; some re been thing beyond dly, but risk active	

Asset Costing & Valuation ratings

- 1. The organization determines the financial and technical data and information that is necessary to enable the management of its assets.
- 2. The organization ensures that data and information are aligned to the achievement of the organization's objectives.
- 3. The organization determines that these data and information enable the organization to fulfil its:
 - a) Legal and regulatory obligations
 - b) Stakeholder requirements
 - c) Needs to make informed decisions on asset management issues

- 4. The organisation has an Asset valuation register and a documented valuation methodology
- 5. The organisation has documented processes for capturing 'as-built' capital costs.
- 6. The organization reviews the financial and technical data and information periodically in the light of developments in quantitative and qualitative analytical measures and also the importance and complexity of the decisions being made
- 7. The organization implements changes to the measurement, collection and analysis of financial and technical data and information that support asset costing and valuation where it is beneficial

LP Score	GTM Score	EGD Score	UG Score
LP Score	GTM Score	 EGD Score 0 1 2 3 4 Meets standards: 1,2,3; High level implementation complete Scorecards closely track asset financial and some technical data; focus is on metrics that demonstrate that assets fulfill safety & other stakeholder requirements and legal obligations Initiatives are underway to ensure that data is aligned to achievement of org objectives Focus is on reviewing information periodically to find improvement opportunities Does not meet standards: 4,5,6,7; Early stages of AM implementation Asset valuation register and documented processes to be implemented for capturing capital costs Data is reviewed and applied periodically, but this is in early stages and does not yet pertain specifically to asset costing 	 UG Score 0 1 2 3 4 Meets standards: 1,2,3; Initiative underway to improve reporting Scorecards closely track asset financial and some technical data; focus is on metrics that demonstrate that assets fulfill safety & other stakeholder requirements and legal obligations Initiatives are underway to ensure that data is aligned to achievement of org objectives Management seeks improvement opportunities through data reviews Does not meet standards: 4,5,6,7; Early stages of AM implementation Asset valuation register is not mentioned Initiatives are ongoing to review and apply data to derive useful lessons, but not specifically from a valuation or asset costing perspective Valuation methodology does not yet exist
		g	 Management seeks to conduct data reviews; these are ongoing

Backup: Preliminary GFMAM ratings vs. charter phase survey responses

OFMAN Flowert		Survey Re	esponses*		GFMAM Rating*						
GFMAM Element	LP	GTM	EGD	UP	LP	GTM	EGD	UP			
Ops and mtce decision making			1.8	2.8			2.5	2			
Lifecycle value decision making			2.5	2.3			2.5	1.5			
Capital inv. decision making			2.3	2.3			2	2			
Competence management			1.2	1.8			1	2			
Asset Management Leadership			2.8	2.2			3	2.5			
Strategic planning			2.3	1.9			2.5	2			
Asset Management planning			2.0	2.7			2.5	2			
Asset Management policy			2.2	2.1			2.5	2			
AM strategy & objectives			2.8	2.7			3	2.5			
Asset information strategy			1.3	2.2			2	1.5			
Asset information standards			1.7	1.8			2.5	2			
Data & information mgmt.			1.5	2.4			2	1.5			
Risk assessment and mgmt.			2.7	2.8			2.5	2			
AP & health monitoring			1.5	1.9			2	2			
Average (14 elements)			2.0	2.3			2.3	2.0			
Org structure							2.5	2			
Org culture							2.5	2			
Technical stds. & legislation	Not ma	oped to prioritiz	zed GFMAM E	lements			2.5	2			
Asset costing and valuation							2	1.5			
Average (18 elements)							2.3	1.9			

Note: *GFMAM rating reflects the average rating across 14 of the 18 prioritized GFMAM elements; Survey Respondents' rating reflects the average rating of 14 survey questions that have been mapped to the prioritized GFMAM elements (1-5 scale translated to 0-4); Survey questions and GFMAM elements are not identical, which may drive some of the variation in responses

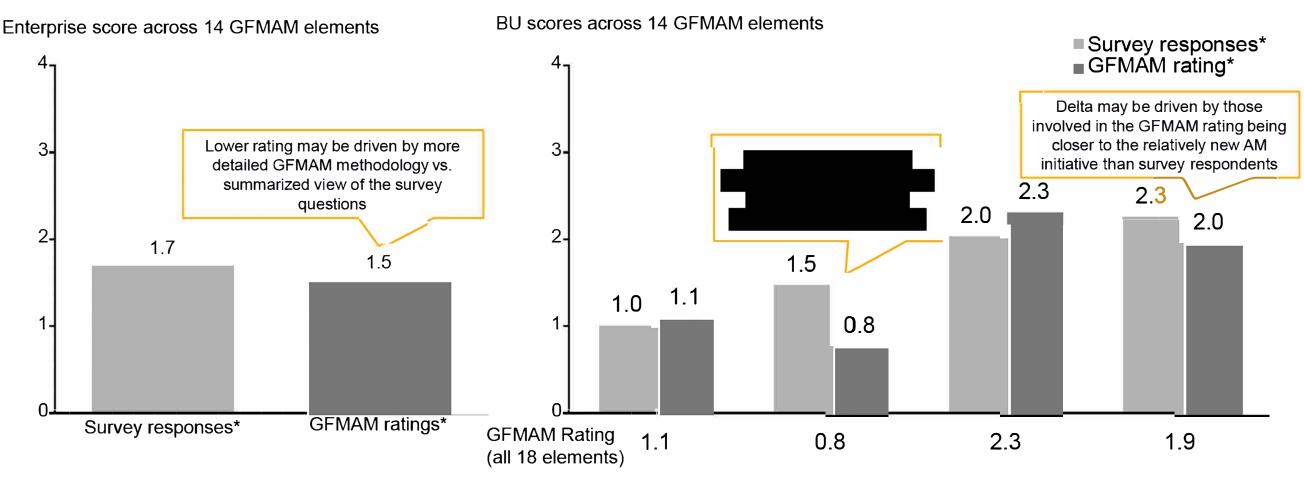
ÉNBRIDGE

ile Takes Energy

GFMAM ratings vs. charter phase survey responses Largely aligned with survey responses

AVERAGE RATINGS LARGELY SIMILAR

ADDITIONAL GRANULARITY USING GFMAM RATINGS



Note: *GFMAM rating reflects the average rating across 14 of the 18 prioritized GFMAM elements; Survey Respondents' rating reflects the average rating of 14 survey questions that have been mapped to the prioritized GFMAM elements (1-5 scale translated to 0-4); Survey questions and GFMAM elements are not identical, which may drive some of the variation in responses