

ENBRIDGE SUMMARY RESPONSES TO 2016 NATURAL GAS
DEMAND SIDE MANAGEMENT ANNUAL VERIFICATION RECOMMENDATIONS

In its final 2016 Natural Gas Demand Side Management Annual Verification report, dated October 30, 2018, the Evaluation Contractor outlined findings and recommendations for review by the utilities for the purposes of informing future evaluation work.

Findings and recommendations were summarized in the following categories:

1. 2016 annual verification recommendations
 - Overall annual verification
 - Whole home simulation modeling
 - Cost-effectiveness recommendations
2. CPSV recommendations
 - Energy savings and program performance
 - Verification process recommendations
 - Documentation and support recommendations
 - Data management recommendations
3. Measure Life Study Recommendations
 - Updates to Measure Lives
 - Future Research
 - Recommended measure lives

Enbridge has reproduced below the various tables provided in Section 5 of the EC's 2016 Annual Verification Report as well as the details provided regarding the EC's "Findings", "Recommendations", and "Outcomes", from the EC's report. The following is a listing of these items along with Enbridge's responses where such findings were applicable to Enbridge.

1. 2016 Annual Verification Recommendations

Overall Annual Verification – Summary of Recommendations¹

#	Finding	Recommendation	Recommended in 2015	Applies to 2016			Primary Outcome		
				Union	Enbridge	Evaluation	Reduce Costs	Improve Accuracy	Decrease Risk
O1	The Enbridge tracking file does not currently include information that allows the evaluator to identify all the projects installed by a single customer.	A: Consider investing in a relational program tracking database.	✓	✓	✓		✓	✓	✓
		B: Enbridge should include site-level information for all measures installed through the program.	✓		✓			✓	✓
O2	The format of Enbridge's tracking data is not well suited to a combined evaluation with the Union data.	A: Enbridge should deliver tracking data in a single flat file.	✓		✓		✓	✓	✓
		B: Consider investing in a relational program tracking database.	✓	✓	✓		✓	✓	✓
O3	Neither Union nor Enbridge tracking databases currently use prescriptive measure descriptions that map directly to the approved energy savings spreadsheet (TRM).	A: Develop, maintain, and use an electronic summary spreadsheet of the TRM.	✓	✓	✓	✓	✓	✓	✓
		B: Once the electronic TRM spreadsheet is developed, track prescriptive savings using unique measure descriptions that map to electronic TRM.	✓	✓	✓	✓	✓	✓	✓
		C: Once the electronic TRM spreadsheet is developed, utilize the same electronic TRM for both utilities		✓	✓	✓	✓	✓	✓
		D: OEB: develop means for consistent system				✓	✓	✓	✓
O4	Different TRMs were used by utilities for savings calculations.	A: Explicitly agree to the TRM version to utilize for measure-inputs		✓	✓	✓	✓	✓	✓
		B: Use the same TRM version for both utilities for each program year		✓	✓	✓	✓	✓	✓
O5	DNV GL and other EAC members were sometimes confused about appropriate sources and the definition of terms.	A: Evaluation Contractor: distribute to the EAC a list of the anticipated sources at the start of the verification process, possibly within the scope of work, for review and verification.				✓	✓		✓
		B: Evaluation Contractor: distribute to the EAC a glossary of terms at the start of the verification process, possibly within the scope of work, for review and verification.				✓	✓		✓

¹ 2016 Natural Gas DSM Annual Verification Report, October 30, 2018, Table 56, page 32

O6	Explicit documentation was not available for all program stages, specifically for non-savings metrics	A: Document each required element and stage for non-savings metrics.		✓	✓	✓	✓		✓
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O1. Finding: The Enbridge tracking file does not currently include information that allows the evaluator to identify all the projects installed by a single customer.

Recommendation A: Both utilities should strongly consider investing in relational program tracking databases. Relational program tracking databases and customer relationship management (“CRM”) systems allow for multiple measures and projects to be associated with a single customer and/or customer site. The incremental cost of implementation is low if it is part of the initial database design, populated as projects are started, and updated once they are complete.

Outcome: Reduced burden on utility staff and reduced evaluation costs. A relational database would streamline aggregation of program data for scorecards and make providing data simpler for annual savings evaluation and verification.

ENBRIDGE RESPONSE: As detailed in its 2015-2020 Multi-Year Plan, Enbridge outlined the need for a DSM IT system replacement. The Board approved this request in its January 20th, 2016 Decision. As a result, Enbridge DSM is currently undergoing a system upgrade that will include improved tracking & reporting and CRM components. This system upgrade is expected to be rolled out in late 2018.

Recommendation B: Enbridge should include a unique site-level or customer-level identifier for every measure installed in the program to allow the evaluator to identify all projects installed at a single customer, regardless of program.

Outcome: Confirmation that each installation is unique and assessment of interactive effects.

ENBRIDGE RESPONSE: Enbridge's projects are designated with a unique project ID. Although a customer identifier to identify related sites is not utilized for projects, they can be linked on the basis of account billing information, site address, or at the customer name assignment for multiple addresses. There are some exceptions however such as School Boards and property managers with many sites.

O2. Finding: The format of Enbridge's tracking data is not well suited to a combined evaluation with the Union data, meaning that the format requires a significant investment of time to extract the necessary data for verifying each program's savings. In addition to increased time and thus verification cost, the need for manual extraction of data introduces many opportunities for error, which potentially decreases savings accuracy and increases risk.

Recommendation A: Deliver to evaluators a single, flat file of tracking data.² Each record should have measure-level information which includes the information listed below:

- Program identification information, such as scorecard, and program name
- Customer identification information, such as a unique customer ID, rate class, and location
- Measure identification information, such as measure description, unique measure identification, measure group, measure life, free rider rate, and savings per unit for prescriptive measures
- Savings information, such as annual gross and net savings, cumulative gross and net savings, and non-gas savings
- Additional information as needed to allow the evaluator to verify lost revenue and cost-effectiveness
- A "verification ready" flat file would not require summary rows, hidden rows or

² In this context, a flat file is a table with one record per line and no summary information.

columns, links or formulas but would include all necessary variables in a single tab or table for all projects and measures, regardless of type.

Outcome: Reduced burden on program staff, more flexibility for evaluators.

ENBRIDGE RESPONSE: Enbridge's tracking summary has evolved and improved through the review of previous audits to a comprehensive and transparent tool. Prior auditors and Audit Committees expected Enbridge's tracking database to have this level of transparency to fully illustrate the determination of scorecard achievements. Enbridge's tracking reports have historically been found to be comprehensive and accurate. Though Enbridge's tracking information for 2016 was not laid out in a single flat file, as was desired by the current EC, with the exception of this item, the tracking spreadsheet Enbridge provided the EC included the project information details requested in Recommendation A. Based on the EC's recommendations from the 2015 verification, Enbridge made every effort to ensure the 2016 tracking summary clearly provided the information requested.

Recommendation B: See recommendation O1A. The utilities should consider investing in a new database.

Outcome: Reduced burden on utility staff and reduced evaluation costs.

ENBRIDGE RESPONSE: See response to O1A.

O3. Finding: Neither Union nor Enbridge tracking databases currently use prescriptive measure descriptions that map directly to the approved energy savings spreadsheet ("TRM"). The EC does note that Enbridge did provide a tab within the excel Tracking File that provided a summary of their prescriptive offers and the savings values associated with these and that Union provided a mapping of Union names to TRM terms. However, these offer names do not consistently match the values described within the TRMs. The EC often struggled to align tracking measures to the

correct TRM measure, resulting in increased effort and time in identifying intended TRM measures and repeated back-and-forth between evaluation and the utilities for clarification.

Recommendation A: Develop, maintain, and use an electronic summary of the TRM, such as an Excel file. Each measure (identified as a unique savings value) should have an assigned measure ID number, and new ID numbers should be assigned when a measure is updated with a new savings value. This allows for a historical record of the changes in the TRM and allows the evaluation to identify outdated values. Once developed or agreed to, both utilities should utilize this system for simplification and transparency.

Recommendation B: Once the electronic TRM is developed, track prescriptive savings using unique measure descriptions that clearly map to the electronic TRM.

Recommendation C: Once the electronic TRM is developed, utilize the same electronic summary file for both utilities.

Recommendation D: As the entity with primary ownership of the TRM, the OEB should develop the references for parties to directly refer to specific measures in a consistent way which accounts for variations in energy savings due to capacity or other characteristics.

Outcome: Reduced burden on utility staff and reduced evaluation costs. Fewer errors in the tracking data.

ENBRIDGE RESPONSE to Recommendations O3A, O3B, O3C, O3D: As acknowledged by the EC in Recommendation O3D, the OEB now has ownership of the TRM. As such these recommendations should be directed to OEB Staff. In the meantime, as noted in the finding above, Enbridge provided, in its 2016 tracking worksheet, details that provided a summary of prescriptive offers and their

associated savings values per the TRM sub-docs. It should be noted that a direct one-to-one naming of measures based on the current TRM to Enbridge's tracking database is not always possible. For example, a measure offered across two different sectors that have unique incentive structures (e.g., CI Prescriptive and Low-Income Prescriptive) might refer back to the same sub-doc but would require two different "names" within Enbridge's tracking database. Also of note, the EC did not find any errors in Enbridge's tracking database related to incorrect mapping of prescriptive measures to the appropriate sub-doc.

O4. Finding: Mid-way through the evaluation and verification process, it was noted that utilities were using different TRMs for reference for savings values. The general rule for use of the best available information, while generally good, does allow for ambiguity. In this instance, the ambiguity created a need for additional verification processes, with new savings values for Union Gas.

Recommendation A: Explicitly state which TRM version applies to the annual savings calculations for savings calculations for both Scorecard / DSM shareholder incentive calculations as well as lost revenue calculations. This explicit agreement on the appropriate TRM should be made prior to the start of the verification cycle, at the very latest.

Recommendation B: Use the same TRM version for both utilities for each program year.

Outcome: Reduced evaluation costs. Decreased risk to utilities that savings estimates are incorrect due to use of "incorrect" TRM, improved savings accuracy.

ENBRIDGE RESPONSE to O4A and O4B: It is Enbridge's understanding that the expectation was that for the 2016 program year, the Company should use the TRM that had been most recently filed as at December 31, 2015 (the end of the previous

program year). As such Enbridge utilized the TRM that was reflected in EB-2015-0344 New and Updated DSM Measures – Joint Submission from Union Gas Limited and Enbridge Gas Distribution, December 16, 2015. The EC accepted these TRM values as appropriate in the 2016 verification. Enbridge's understanding of the Board's direction for the balance of the 2015 to 2020 Framework is that input assumptions and net-to-gross factors that are the result of the annual evaluation process will be used to determine subsequent targets. Results for gas savings calculations will use the same input assumptions and net-to-gross adjustment factors that were used to determine that year's targets. Results for lost revenue calculations will use the best available information at the time of the audit.

O5. Finding: Throughout the verification process, DNV GL and other EAC members had questions about the appropriate source to use for items such as TRM savings (March or December), program eligibility requirements, and other information necessary to complete the evaluation. The EAC and EC also had a number of discussions about terminology and the meaning of different terms. These conversations often resulted in small delays in the evaluation work.

Recommendation A: The evaluation team should distribute to the EAC a list of the anticipated sources at the start of the verification process, possibly within the scope of work, for review and verification.

Recommendation B: The evaluation team should distribute a glossary of terms to the EAC at the start of the verification process, possibly within the scope of work, for review and verification.

Outcome: Clearly defined and agreed upon sources, definitions and documentation should reduce the risk for confusion and re-analysis of scorecard metrics and reduce costs.

ENBRIDGE RESPONSE to O5A and O5B: These recommendations were not specifically directed to Enbridge but rather for future evaluation consideration however, Enbridge concurs that clear and documented consensus amongst the EAC and EC regarding the sources to be utilized is appropriate.

Enbridge adheres to the glossary of terms developed as part of the Board approved TRM filed in EB-2016-0245 in December 2016 and supports its use in the evaluation effort. Scorecard metrics and their calculation are as defined in the Board's Decision on Enbridge's 2015-2020 DSM Plan in EB-2015-0049.

O6. Finding: Explicit documentation was not available for all program stages for programs such as Enbridge's Market Transformation Run It Right program. In that program, there was no documentation for participants moving to step 4 of the program (see Appendix H), only documentation that the participants had completed step 3 and utility confirmation that this is equivalent to engagement in step 4. Similar recommendations are included in section 5.1.2 for whole home simulation modeling programs.

Recommendation A: Documentation for each required element and stage for non-savings metrics should be recorded. The majority of these elements for future years have been identified in this evaluation, in the scorecard and program-relevant appendix sections.

Outcome: Reduced burden on utility staff and reduced evaluation costs.

ENBRIDGE RESPONSE: Enbridge believes it collects documentation sufficient to support results for non-savings metrics. Ultimately, upon review and with clarification from Enbridge regarding eligibility, the EC concluded no changes to Enbridge's non-savings metrics were warranted.

Whole Home Simulation Modelling - Summary of Recommendations³

#	Finding	Recommendation	Recommended in 2015	Applies to			Primary Outcome		
				Union	Enbridge	Evaluation	Reduce Costs	Improve Accuracy	Decrease Risk
SM1	Both utilities use building simulation modeling to estimate energy savings	A: Provide both simulation file (HSE) and output file (TSV) to the evaluation team for every project.	✓		✓		✓		✓
SM2	Both utilities collect and deliver <i>some</i> photographs to support retrofit site improvements.	A: Provide more explicit support for major measure installations.	✓	✓	✓				✓
SM3	There were some inaccurate savings entries.	A: Consider reviewing and modifying program processes to avoid data entry or outdated simulation result errors.		✓			✓		✓
		B: Provide more explicit support for major measure installations.	✓	✓	✓		✓		✓
SM4	Air sealing as a savings measure is present in a high percentage of single-family home retro-fit projects.	A: Evaluation: distribute before and after equivalent leakage area and energy savings attributable to reduced air leakage (if possible).				✓		✓	✓
SM5	The energy savings from the home retrofit programs rely exclusively on the simulations provided by the delivery agents.	A: Consider funding a study to verify the models produced by the utility agents.	✓			✓		✓	

SM1. Finding: Both utilities use building simulation modeling to estimate energy savings for their home retrofit programs, including Home Energy Conservation, Home Reno Rebate, Winterproofing, and the Home Weatherization Program. HOT2000 is the most common program used for those simulations, which is a program developed and released by NRCAN for certified energy advisors. Because of the restrictions on the program, the evaluator could not consistently run the simulation files and produce the same result reported by the program. While Union provided TSV files for all sampled locations, Enbridge did not.

³ 2016 Natural Gas DSM Annual Verification Report, October 30, 2018, Table 57, page 34

Recommendation A: Provide the building simulation file (HSE), the program output file (“TSV”), and full supporting documentation for all claimed project measures for every sampled project.

Outcome: Reduced burden on utility staff and reduced evaluation costs.

ENBRIDGE RESPONSE: Enbridge believes that the EC has made this finding in error. In the case of the Residential Home Energy Conservation offer, all program output files were provided to the EC along with the HSE building simulation file and full supporting documentation for all requested projects included in the EC’s verification sample. A TSV can only be generated where the EnerGuide mode of NRCAN’s HOT2000 software is used.

As permitted in the Home Weatherization offer, not all projects include building simulation models completed in the EnerGuide Rating application mode of HOT2000. In scenarios where the building simulation model (“HSE”) for the project was completed in “general” mode, the software does not provide for the generation of a TSV program output file. In these cases, to be of assistance, Enbridge proactively provided the EC with a PDF document clearly illustrating the values in the HSE file referenced to support the calculation of the project energy savings. This PDF document provided an explanation on how the building simulation was utilized to confirm the gas savings claimed and included a breakout of the gas savings calculations accompanied with screenshots from the building simulation file to verify the data used in the calculations.

SM2. Finding: Both utilities collect and deliver some photographs to support many of the changes made at a home retrofit site as well as additional documentation for installed equipment and performed measures. However, the evaluator could not consistently confirm the number or type of major measures installed based on the photographs or other documentation provided.

Recommendation A: Consider providing more explicit support for each measure to eliminate uncertainty around project savings and participation. Full project documentation (pre/post photos, documentation of all installations or actions such as invoices and/or photos of each measure, data collection reports, pre-and post blower door tests for all sites) to the evaluation team. By delivering all documentation, the evaluation team would not have to follow up with the utility to obtain output for models that could not be run but could still verify the output for models that can be run.

Outcome: Greater certainty around scorecard achievements.

ENBRIDGE RESPONSE: Enbridge consistently works to provide all available supporting information (e.g., documents/photos/invoices) collected by agents in delivering the offering to the EC upon request. The supporting information gathered for the Whole Home offers is consistent with what Natural Resources Canada (“NRCan”) requires be collected for use of HOT2000 software. Building simulation (“HSE”) files as well as project data output files (“TSV”) are also provided, where available.

Of note, in some projects, confirming measures after they have been installed can be challenging. By way of example, wall insulation once completed is covered up by drywall, making a post-installation photo difficult however, an invoice confirms that work was complete.

Enbridge will continue to strive to provide all available information to facilitate the confirmation of measures installed in a project subject to review.

SM3. Finding: The evaluator identified a number of inaccurate savings entries due to data entry errors or outdated Union home retrofit simulation results. Many of these errors could be avoided through changes in program processes.

Recommendation A: Consider reviewing and modifying program processes to avoid similar errors in the future.

ENBRIDGE RESPONSE: This finding/recommendation was not directed to Enbridge.

Recommendation B: Consider providing more explicit support for each measure to eliminate uncertainty around project savings and participation. Full project documentation (pre/post photos, documentation of all installations or actions such as invoices and/or photos of each measure, data collection reports, pre-and post blower door tests for all sites) to the evaluation team. By delivering all documentation, the evaluation team would not have to follow up with the utility to obtain output for models that could not be run but could still verify the output for models that can be run.

Outcome: Reduced burden on utility staff and reduced evaluation costs.

ENBRIDGE RESPONSE: See response to SM2.

SM4. Finding: Air sealing as a savings measure is present in a high percentage of single-family home retro-fit projects, over 90% of projects in some programs. With such a high percentage of projects relying on a single measure, it is more important to ensure the savings validity of that measure.

Recommendation A: If possible, the evaluation team should evaluate the before and after leakage area and attributable energy savings.

Outcome: Greater certainty around savings estimates.

ENBRIDGE RESPONSE: This recommendation was not directed to Enbridge.

SM5. Finding: The energy savings from the home retrofit programs rely exclusively on the simulations provided by the delivery agents. Those simulations likely rely on a number of assumptions or standard modeling practices which may or may not follow

industry standards. A detailed review of the models was outside the scope of the annual audit.

Recommendation A: Consider funding a study to verify the models produced by the utility agents to ensure they conform to standard industry practice.

Outcome: Greater certainty around savings estimates.

ENBRIDGE RESPONSE: While this recommendation was not directed to Enbridge, it should be clarified that the agents supporting the home retrofit offer are expected to follow NRCan protocols. These agents complete training to achieve their certification from NRCan, and are trained to simulate home energy usage using NRCan's HOT2000 modeling software. This certification requires advisors to use NRCan industry standard inputs and modeling practices. In practice, home energy modelling simulation files are submitted to NRCan and are subject to NRCan's QA procedures.

SM6. Finding: Site-level documentation confirmed that an auditor was involved, it does not signal that the auditor was an approved Certified Energy Evaluator.

Recommendation A: Tracking certifications for all energy evaluators and/or auditors submitting records.

Outcome: Ensuring proper credentials for all auditors decreases risk to program.

ENBRIDGE RESPONSE: This recommendation was not directed to Enbridge.

SM7. Finding: Number of projects for residential retrofit programs was very large.

Recommendation A: Increase sample to include more project files in following verification cycles.

Outcome: Increased sample, along with improved documentation recommended earlier, increases the accuracy of savings estimates for the applicable programs.

ENBRIDGE RESPONSE: This recommendation was not directed to Enbridge.

Cost-Effectiveness - Summary of Recommendations ⁴

#	Finding	Recommendation	Recommended in 2015	Applies to			Primary Outcome		
				Union	Enbridge	Evaluation	Reduce Costs	Improve Accuracy	Decrease Risk
CE1	All overhead is still applied at the sector level rather than the program level.	A: Allocate “sector”-level administrative cost and overhead to each individual program	✓	✓	✓		✓	✓	
CE2	Water avoided costs are still based on water rates.	A: Explore the possibility of better defining water costs	✓		✓		✓	✓	
CE3	The utilities used different discount rates.	A: Use a consistent real discount rate of 4% when using real streams of benefits and costs.	✓	✓	✓	✓		✓	
CE4	EUL is inconsistently applied for accelerated projects.	A: Include separate fields in the tracking data to explicitly communicate accelerated, annual and cumulative savings.		✓			✓		
CE5	A reduction factor accounting for removals and non-installs was applied to savings and resource costs.	A: Do not adjust resource costs if the costs are still incurred by the program, even if the equipment is removed.		✓			✓		

CE1. Finding: In 2015, the EC recommended that “sector”-level administrative costs and overhead be allocated to each individual program and the utilities report program-

⁴ 2016 Natural Gas DSM Annual Verification Report, October 30, 2018, Table 58, page 35

level cost-effectiveness results. In 2016, there are still inconsistencies in how administrative and overhead costs are allocated. For example, Union identifies administration and evaluation costs at the scorecard level whereas Enbridge details spending as direct and indirect at the OEB-defined program level and then has an explicit 'overhead' spend at the scorecard level. To facilitate the analysis, the EC recommends that the utilities report spending in a consistent format and apportion the overhead costs to individual programs.

Recommendation A: Allocate "sector"-level administrative cost and overhead to each individual program and report program-level cost-effectiveness results. Explicit allocation of general administration and evaluation costs will allow for easier cost-effectiveness calculations at the program level.

ENBRIDGE RESPONSE: As outlined in Enbridge's 2015-2020 DSM Plan (EB-2015-0049), where possible, Enbridge allocates these costs at the program level – i.e. Resource Acquisition, Low Income and Market Transformation. In some instances, as acknowledged in the Board's framework where this is not possible, administration and overhead costs may be reflected at the portfolio level.

CE2. Finding: Water avoided costs are still based on water rates. The utilities followed the EC's 2015 approach and reduced the water avoided costs by 75% to simulate the removal of the fixed-cost portion of the rate. As is the case for gas and electricity, water avoided costs should only include the marginal impact from reduced consumption. Fixed costs (which, in our experience, can represent about 75% to 80% of water costs) must be excluded. On the other hand, water rates are often predominantly or exclusively variable, notably to promote conservation, and are thus a bad proxy of avoided costs.

Recommendation A: Explore the possibility of better defining water avoided costs.

Outcome: Better defined water avoided costs will result in more accurate cost effectiveness values, reducing the risk of less accurate values.

ENBRIDGE RESPONSE: This recommendation was not directed to Enbridge however, Enbridge concurs with the EC that water avoided costs should only include the marginal variable impact from reduced consumption. In the 2015 verification, the EC recommended a 75% reduction to avoided water costs (which are based on average retail water costs across Enbridge's service territory) as a means to better estimate avoided water costs. Enbridge repeated this approach in 2016.

CE3. Finding: While the discount rate appears to be aligned there was a methodological inconsistency between utilities. Union calculated their discount rate using 4% as their real discount rate and an inflation rate of 1.68% to get a combined discount rate of 5.7472%. Enbridge did not show how their discount rate was calculated and simply applied a discount rate of 5.75%.

Recommendation A: Both utilities should use identical discount rates.

ENBRIDGE RESPONSE: Enbridge followed the EC's recommendation from the 2015 verification and calculated the discount rate using 4% as the real discount rate with an inflation rate of 1.68%. In the same way the EC applied the calculation in 2015, Enbridge simply rounded the combined discount rate to 2 significant digits consistent with most other values utilized by the EC.

CE4. Finding: EUL and cumulative gross savings were not provided in a consistent manner in the Enbridge program tracking database extract. The EUL inconsistency is

the result of a work-around for advanced (Accelerated) projects used by Enbridge to report accurate dual baseline savings estimates and first year savings. Communicating the work-around consistently with the evaluation team led to some rework.

Recommendation A: Include separate fields in the program tracking database for EUL, RUL, gross first year annual savings, gross post-RUL annual savings, NTG, gross cumulative savings, net cumulative savings, and net first year savings.

Outcome: Improved data integrity results in less evaluation risk and more accurate savings totals. Proving each of the key savings types and their components allows evaluation to confirm that the savings provided are internally consistent.

ENBRIDGE RESPONSE: Enbridge will explore how to more clearly and consistently capture and provide details for accelerated projects in the future.

CE5. Finding: Enbridge applied a reduction factor to both the resource savings and costs for some measures to account for the percent of non-installs and removals. The adjustment factor is correctly applied to the savings; however, it should not be applied to the costs as costs are still incurred.

Recommendation A: Do not adjust resource costs to account for non-installations or removals.

Outcome: A more accurate representation of the costs incurred by the program.

ENBRIDGE RESPONSE: Enbridge concurs with the EC's recommendation. Enbridge acknowledges there were very few instances, with very minor impacts, where a reduction factor applied to savings was also incorrectly applied to costs for showerhead

and faucet prescriptive measures. Enbridge will work to correct this moving forward.

2. CPSV recommendations

Energy Savings and Program Performance Recommendations⁵

#	Energy Savings and Program Performance		Applies to			Primary Beneficial Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Increase Customer Satisfaction	Decrease Risk
1	Both utilities exhibit a strong commitment to accurate energy savings estimate	The utilities should continue in their commitment to accuracy.	✓	✓				✓	✓
2	The CPSV effort found realization rates near 100% and identified adjustments for most projects.	Continue performing custom savings verification on a regular basis.			✓				✓
3	Relative precision targets were met or surpassed for all programs	Use error ratio assumptions from the results provided in this report in future evaluation years, but with more conservative bounding than performed this year.			✓	✓			✓
4	Some measures have difficult-to-define baseline technologies.	Establish a policy to define rules around energy savings calculation for fuel switching and district heating/cooling measures.	✓	✓	✓				✓
5	Review of documentation for gross evaluation showed that several projects were high free rider risks.	Review projects with large incentives for free ridership risk. Develop clear program rules that allow the utility to reject free rider projects.	✓	✓			✓		✓
6	Influence adjustments were made to projects that adjusted the gross savings for "net" or program influence reasons.	Increase transparency of "influence adjustments" and do not include in gross savings	✓				✓	✓	✓
7	There is not a clear policy to determine "standard" baselines.	Establish a clear policy to determine and define "standard" baselines	✓	✓	✓	✓			✓

⁵ 2016 Natural Gas DSM Annual Verification Report, October 30, 2018, Table 59, page 41

#	Energy Savings and Program Performance		Applies to			Primary Beneficial Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Increase Customer Satisfaction	Decrease Risk
8	Some measures in each utility program are routine maintenance or periodic repairs that are considered standard care in other jurisdictions.	Establish a clear policy regarding eligibility of maintenance and repair measures for the programs.	✓	✓	✓	✓			✓
9	The programs did not consistently account for interactivity among measures.	Add an interactivity check to the programs' internal QC process for savings estimates.	✓	✓	✓	✓			✓

ES1. Finding: Both utilities exhibit a strong commitment to accurate energy savings estimates. Both utilities have made significant investments in developing calculation tools which model savings accurately. For example, Union's dock door seal calculator is well considered and designed, and Enbridge's Etools calculator is very thorough in attempting to model savings for key measures.

Both utilities chose to retain engineers with strong understanding of their customers' building and process systems and showed a commitment to finding accurate savings estimates. On several occasions, both on the phone and in writing, the evaluation team suggested a value that would have increased savings in a way that the utility program engineer did not think was valid. When this happened, neither utility was shy in suggesting that we may want to make a more conservative choice.

Recommendation: The utilities should continue in their commitment to accuracy.

Outcome: Accurate energy savings.

ENBRIDGE RESPONSE: Enbridge intends to continue to strive for accurate savings calculation estimates in line with the Company's dedication to continuous

improvement in its DSM program efforts. Enbridge has been a leader in refining savings calculations for many technologies and are recognized as subject matter experts in many areas throughout the industry. Enbridge will continue to look for opportunities to improve approaches and calculation tools with consideration for new information and learnings.

ES2. Finding: The CPSV effort this year found realization rates near 100% and identified adjustments for most projects. Across the programs a near equal number of adjustments increased and decreased savings and one third of projects had a large adjustment (verified savings more than 20% different from tracked).

Recommendation: Continue performing custom savings verification on a regular basis. Even a study that results in an adjustment of near 100% is still valuable because the programs know that their savings estimates will be reviewed. Knowing a review will be conducted improves the quality of ex ante estimates. The review itself also results in information that improves future program savings estimates.

Outcome: Accurate energy savings.

ENBRIDGE RESPONSE: This recommendation was not directed to Enbridge however, Enbridge generally concurs that completing custom savings project verification on a regular basis is useful. As discussed at the EAC recently, the committee has considered the frequency of undertaking CPSV. For example, a review which spans multiple years may be more efficient while still maintaining an appropriate scope in terms of the breadth of project results reviewed. Further, in accordance with the EC's recommendation for Low Income in 2016, multiple years of consistent and solid verification results merit consideration for the application of a weighted realization rate based on prior years' findings.

It should be noted that the EC reported that the utilities generally produced solid ex ante engineering estimates of savings that were not systematically biased. The EC further noted that much of the CPSV adjustment variation in gross realization rates was due to changes in operating conditions observed at the time of verification. It is broadly acknowledged that such conditions are often difficult to anticipate in ex ante savings estimation. This reality was exacerbated in the 2016 effort given that these verifications were being completed often 2 years or more after the project was completed. In these cases, changes in operating conditions can lead to larger adjustments.

ES3. Finding: Relative precision targets were met or surpassed for all programs. The sample design incorporated the previous year's error ratios ("ERs") and averaged them with the assumption used in 2015. ERs were further bounded (minimum ER was 0.25, maximum 0.60) to limit the risk of over- or under- collecting data. There was one segment (Union Commercial) where precision was not as good as expected.

Recommendation: The process used to develop error ratios assumptions from the results provided in this report should be continued in future evaluation years, possibly with more conservative bounding (potentially increasing the maximum ER) to avoid under-collection of data for any segments.

Outcome: Realistic estimates of error ratios result in an appropriate amount of data collected to meet targets.

ENBRIDGE RESPONSE: This recommendation was not directed to Enbridge however, it is important to highlight the prudence of maintaining balance between ensuring results meet a suitable threshold of statistical significance while also ensuring customers are not overly burdened by excessive and repeated sampling. Enbridge is of the view that the sampling in 2016 more reasonably met this balance

than in the 2015 effort.

ES4. Finding: Some measures (e.g., geothermal heat pumps, combined heat and power, and those that save district heating energy) have difficult-to-define baseline technologies. Multiple different baselines are possible for these projects depending on how one looks at the scope of the project: how non-gas energy changes and offsite gas use are considered in savings estimates are two of the challenging aspects.

Recommendation: Consider establishing a policy to define rules around energy savings calculations and baselines for fuel switching and district heating/cooling measures.

Outcome: Less risk of adjustment and a better alignment between province energy efficiency goals and program implementation.

ENBRIDGE RESPONSE: Enbridge is expected to adhere to DSM policies and guiding principles as defined by the Board in the 2015-2020 DSM Framework and Guidelines.

ES5. Finding: Through the gross verification process, we reviewed project documentation and had conversations with customers about their installed measures. While the focus of this report is not on net savings, we did observe a handful of projects (out of the 122 evaluated) that appeared to be clearly at high risk for free ridership. These projects included maintenance type measures, projects that were far along in planning prior to utility involvement, projects with very short paybacks, and projects that included significant non-energy benefits.

Recommendation: Review projects with large incentives for free ridership risk. Develop clear program rules that allow the utility to reject free rider projects.

Outcome: Increased savings, reduced risk of free ridership, more efficient use of program funds.

ENBRIDGE RESPONSE: To the extent possible, Enbridge is committed to reducing free ridership in its Commercial/Industrial Custom offers and has taken a number of steps, as outlined in its DSM Mid-Term Submission (EB-2017-0127) with this objective in mind. Receiving feedback from the EC is an important component of the continuous improvement cycle. The delay in the current EM&V process has hindered the utility's' ability to respond to learnings year to year. It would be helpful if the EC provided specific project examples rather than general comments.

ES6. Finding: Union made influence adjustments to projects that adjusted the gross savings for "net" or program influence reasons. Accounting of which projects had these adjustments was not maintained by Union and the adjustments were included in different places in project calculation workbooks, making their identification and validation challenging. In addition, the program NTG was also applied to these projects, effectively double discounting savings in scorecards.

Recommendation: If Union chooses to continue making influence adjustments to the savings upon which it calculates savings, it should make these adjustments more transparent and exclude them from the reported gross savings for the program in scorecards. Instead the specific project influence adjustment should be included in the scorecard in place of the general program or domain level NTG factor.

Outcome: Reduced risk of double adjustments.

ENBRIDGE RESPONSE: This recommendation is not directed to Enbridge.

ES7. Finding: There is not a clear policy to determine what standard to use for replace on burnout or new construction baselines. The 2016 verification used a

code or minimum available baseline where required, in alignment with the 2015 net-to-gross study. Without a clear policy there is uncertainty for all stakeholders as to what the appropriate baseline should be. This uncertainty affects all aspects of the programs, including what measures are offered, what incentives are paid and how measures are evaluated.

Recommendation: Establish a clear policy to determine and define baseline standards where an “industry standard” baseline would be applicable.

Outcome: Consistency of approach across utilities, evaluators and studies will reduce risk of adjustment and evaluation cost.

ENBRIDGE RESPONSE: Enbridge adheres to DSM policies and guiding principles as defined by the Board in the 2015-2020 DSM Framework and Guidelines. In the case of new construction, in line with standard practice in other jurisdictions, code requirements are generally used for baseline consideration. In replace on burnout scenarios, for a given technology, where there exists a supported, evidenced based report to inform an industry standard practice, the utility would apply this standard as the appropriate baseline. In the absence of a supported industry standard, Enbridge attempts to seek an external data source to inform a reasonable approach or consider site-specific information to inform the baseline.

ES8. Finding: Some measures in each utility program are routine maintenance or periodic repairs that are considered standard care in other jurisdictions.

Recommendation: Establish a clear policy regarding eligibility of maintenance and repair measures for the programs.

Outcome: Reduced free ridership risk.

ENBRIDGE RESPONSE: Enbridge is expected to adhere to DSM policies and guiding principles as defined in the 2015-2020 DSM Framework and Guidelines. It should be noted however, that as an internal policy Enbridge does not support routine maintenance projects in the Commercial/Industrial custom offer.

ES9. Finding: The programs did not consistently account for interactivity among measures. In several cases, we saw an overestimation of the combined boiler efficiency improvement yielded by the addition of linkageless controls and condensate heat recovery measures and an overestimation of savings for subsequent measures that interact with earlier measures within the same program year.

Recommendation: Add an interactivity check to the programs' internal QC process for savings estimates.

Outcome: More accurate savings estimates and a reduced evaluation risk.

ENBRIDGE RESPONSE: Enbridge agrees that interactivity should be accounted for when estimating savings for custom projects and makes an effort to account for interactivity across multiple projects. Enbridge intends to review its process further to examine how it might improve reviews with consideration for interactivity.

Verification Process Recommendations ⁶

#	Verification Process		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Increase Customer Satisfaction	Decrease Risk
10	DNV GL was unable to obtain access to all the equipment at all the sites selected for verification.	Modify contracts to require participants to agree to comply with EM&V as part of the requirements for participation in the program.	✓	✓		✓			✓
11	Future evaluations should consider large HVAC to be high rigour rather than standard rigour.	Consider large HVAC measures for higher rigour verification.			✓				✓

VF 10.Finding: DNV GL was unable to obtain access to all the equipment at all the sites selected for verification. Both Enbridge and Union have several large projects with industrial companies, including food processing, refineries, and other industries. In many cases, the customer refused to provide SCADA (Supervisory Control and Data Acquisition) system data or similar trend data to allow a reasonable verification of the project. This means we were unable to do more than a reasonableness check on the savings.

A review of the Enbridge contract shows that the customer is not required to provide the information that is necessary for EM&V. The most relevant sections are:

- Item 6: Payment of the Incentive Payment is subject to the completion of a satisfactory site inspection of the improvements, including the installed equipment by an authorized representative of Enbridge.

⁶ 2016 Natural Gas DSM Annual Verification Report, October 30, 2018, Table 60, page 43

- Item 9: Upon request within eighteen months of the commissioning date of the Project, and with reasonable notice, the Customer agrees to provide authorized representatives of Enbridge with access to the Project, and with required information or data relating to the project for the purposes of the Application and these General Terms and Conditions.

Neither of these are sufficient for EM&V.

Recommendation: Modify contracts to require participants to agree to comply with EM&V as well as utility representatives as part of the requirements for participation in the program.

Outcome: Reduced evaluation costs and risks. Participant non-compliance requires evaluators to request documentation for a large backup sample, and to survey and/or visit additional sites to obtain sufficient data for the evaluation. The process of contacting a site and getting a refusal costs time and money, as does the substitution of an additional site to make up for the unobtained data. In some cases, there might not be additional sites to sample, in which case the evaluation estimates will have lower precision than they would with full compliance.

ENBRIDGE RESPONSE: Enbridge encourages its customers to comply, cooperate and participate with all EM&V activities. At the same Enbridge recognizes it is important to be respectful that customers are busy running businesses and requests for customers' time should not be overly burdensome. Up until the 2015 verification, virtually 100% of sampled participants selected for verification have complied with verification related requests. In recent verification efforts, in some cases, Enbridge received feedback from customers that onerous time requirements and/or specific data requests made of customers may not have been considered reasonable and/or compromised customer privacy or safety policies. In addition, the delay between project completion and third party evaluation may have discouraged customers from

participating fully in the verification because the appropriate person that should respond was now not available. Notwithstanding the foregoing, Enbridge has strengthened language in the custom offer application to include specific wording as follows: “The Customer agrees to participate in any follow-ups surveys, studies, audits, evaluations or verifications conducted by Enbridge or its agents in connection with the Program. Enbridge reserves the right to independently verify the information in this Application.”

VF11. Finding: Large HVAC and HVAC controls projects proved more complex to evaluate than planned.

Recommendation: Future evaluations should consider large HVAC to be high rigour rather than standard rigour.

Outcome: Better alignment of rigour with uncertainty will improve accuracy of savings estimates and provide more cost-effective evaluation.

ENBRIDGE RESPONSE: This recommendation is not directed to Enbridge.

Documentation and Support Recommendations⁷

#	Documentation and Support		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Increase Customer Satisfaction	Decrease Risk
12	Incremental improvement in project documentation by both utilities was observed in the 2016 CPSV. Project documentation for some projects lacked sufficient details to allow evaluators to reproduce the calculations made by program staff or third-party vendors.	Take steps to improve documentation: <ul style="list-style-type: none"> • Implement an electronic tracking system that archives all materials • Include explicit sources for all inputs and assumptions in the project documentation. • Store background studies and information sources with the project files and make them available to evaluators. • Provide evaluators full access to customer data. • Provide pre- and post-installation photos, where available. • Document and provide internal M&V documents where available. • Institute a checklist as part of project closeout to ensure all relevant project documentation is assembled as ready for verification 	✓	✓			✓		✓
13	Explanations of complex projects were not consistently clear making it hard to understand what process is producing energy savings.	Improve clarity and details of documentation explaining the source of energy savings for complex projects.	✓	✓					✓

⁷ 2016 Natural Gas DSM Annual Verification Report, October 30, 2018, Table 61, page 43

#	Documentation and Support		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Increase Customer Satisfaction	Decrease Risk
14	Ex ante savings estimates based on annual energy consumption for industrial sites did not always include sufficient information documenting production.	Include site production totals in relevant years in the savings estimates based on annual energy consumption for industrial sites	✓	✓					✓
15	Enbridge Boilers use a 73% assumed thermal efficiency for in situ boilers that have been in place for more than 10 years.	Estimate boiler degradation from name plate efficiency to determine the baseline boiler efficiency rather than a flat number	✓	✓					✓
16	Pipe insulation is a significant source of savings for the Union Gas programs. Documentation for the source of factors used in calculations and of in situ conditions was not consistently provided.	Document baseline conditions of pipe insulation (and other measures) using photos and text descriptions to provide context. Explicitly tie the documentation of baseline condition to the heat loss rate used for the savings calculation.	✓	✓					✓
17	Enbridge documentation did not always include a prose explanation and supporting documentation for baseline types (ROB, ER) and remaining useful life (RUL).	Always complete the "Base Case Overview" in the form with a prose description of the base case. The description should reference included emails and photos to document in situ conditions and features that are carried over into the baseline system.		✓					✓
18	The utilities should use longer duration data in ex ante savings estimates when possible.	Use longer duration data in ex ante savings estimates. When time periods less than a year are used, documentation should be provided to indicate why the period used is applicable to a full year and why a full year was not able to be used.	✓	✓		✓			✓

#	Documentation and Support		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Increase Customer Satisfaction	Decrease Risk
19	In situ boiler name plate information, age and operating condition are all helpful for determinizing the designed performance and reasonable range of actual efficiency for the system as well as providing context to better determine remaining useful life (RUL)	Document in situ boiler name plate information, age and operating condition for all projects where boiler efficiency affects savings	✓	✓					✓
20	Items that may be obvious to the ex ante team can be non-obvious to an outside party.	Review ex ante documentation from an outside perspective to help identify gaps	✓	✓					✓
21	At large sites with multiple spaces containing similar equipment, ex ante documentation did not always identify which space or piece of equipment was affected by the project.	Include additional descriptions of spaces and equipment affected to differentiate among similar spaces and equipment at the site.	✓	✓					✓
22	Invoices were not always included with documentation, and sources for incremental costs were not always clear.	Ensure that incremental costs are supported by invoices or other documentation, especially for add-on and optimization measures where the total cost and incremental cost are likely to be the same.	✓	✓				✓	✓
23	Larger projects appeared to fall under the same documentation standards as smaller projects.	Increase the amount of documentation and source material for projects that have greater energy savings.	✓	✓					✓

#	Documentation and Support		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Increase Customer Satisfaction	Decrease Risk
24	Union's custom project summary workbook is a good approach to documentation. The workbook is not used in a consistent manner across all projects.	Consider providing more training or adding quality control steps to ensure the summary workbook front page is completed and stored in a consistent manner. Identify a common approach for common measures and, if necessary, document deviations and the reasons for the deviations in a clearly labelled field on the summary sheet.	✓			✓			✓
25	Enbridge Etools does not sufficiently document sources of inputs and assumptions.	Use a consistent summary workbook.		✓		✓			✓

DS12. Finding: Incremental improvement in project documentation by both utilities was observed in the 2016 CPSV. Project documentation for some projects lacked sufficient details to allow evaluators to reproduce the calculations made by program staff or third-party vendors. Specific issues included:

- Project data or details missing
- Insufficient measure-level details to fully describe what was installed
- Descriptions that were difficult to understand
- Use of black box tools
- Hardcoded information in calculation spreadsheets
- Undocumented assumptions

- Sources referenced but not included or available, such as feasibility studies and historical analysis of energy use that was left out of the project documentation.
- Input adjustments that approximate other effects, but are not explained.
- Insufficient access to customer data (by customers).
- Modelling files that could not be opened.
- Adjustments to savings estimates for safety or influence that were not clearly marked, sourced, or carried out in a consistent fashion.

Recommendation: Improve data quality. Possible steps include:

- Implement an electronic tracking system that archives all materials.
- Include explicit sources for all inputs and assumptions in the project documentation.
- Store background studies and information sources with the project files and make them available to evaluators.
- Provide evaluators full access to customer data.
- Provide pre- and post-installation photos, where available.
- Document and provide internal M&V documents where available.
- Institute a checklist as part of project closeout to ensure all relevant project documentation is assembled as ready for verification.

Outcome: Properly explaining and sourcing the savings calculation method and assumptions allows the evaluating engineer to more easily identify what needs to be verified. It also makes it easier to determine whether the methods and assumptions are reasonable and use ex ante assumptions rather than seek documented values elsewhere.

ENBRIDGE RESPONSE: Enbridge is gratified to hear that incremental improvements in project documentation were observed in the 2016 CPSV. Enbridge is committed to improving custom project documentation as appropriate in an effort to ensure that

detailed inputs and supporting evidence are clearly outlined for each project. Nonetheless, Enbridge will review these specific recommendations to investigate opportunities to improve project documentation quality and data quality moving forward.

DS13. Finding: Explanations of complex projects were not consistently clear making it hard to understand what process is producing energy savings. This was seen with large HVAC control projects with MUAs, AHUs, heat recovery projects, and custom process projects, and others.

Recommendation: Improve the documentation/explanation of the source of energy savings for complex projects that are related to complex systems. Use figures, diagrams, and equations as needed, especially for cascading or multi-staged measures. Parameters such as the heating source, and the efficient case peak and off-peak period flowrates and schedules should be recorded and sourced. If there are additional units not included in the measure, these should be documented and considered in savings estimates (even if the effect is zero).

Outcome: Increased accuracy of savings estimates. Reduced evaluation risk.

ENBRIDGE RESPONSE: Irrespective of the complexity of projects, Enbridge engineers strive to ensure project documentation reflects the relevant information to clearly describe each project. In some cases this may include supporting schematics, charts, calculations and equations to provide an explanation regarding the process producing energy savings. Enbridge will explore the recommendation for greater clarity on complex projects as part of its commitment to continuous improvement.

DS14. Finding: Ex ante savings estimates based on annual energy consumption for industrial sites did not always include sufficient information documenting production. The change in energy use pre- and post- measure is sensitive to changes in production.

Recommendation: Savings estimates based on annual energy consumption for industrial sites should include information from the site on amount of production in the years used. It's not enough to say "not much is changed, they run 24/7". If detailed production data are not available, the utilities should get percentage differences year to year (e.g., if year 1=100%; is year 2 exactly the same, or is it 95% or 110% of production the previous year).

Outcome: Documenting production changes and using them in savings estimates will improve accuracy and reduce evaluation risk.

ENBRIDGE RESPONSE: For projects moving forward, Enbridge will explore clarifying how it documents changes in production for industrial project savings based on annual energy consumption.

DS15. Finding: Enbridge Boilers use a 73% assumed thermal efficiency for in situ boilers that have been in place for more than 10 years. This is based on a 2% de-rate of a 2007 combustion efficiency study that found an average combustion efficiency of 74.6% for 39 boilers aged 12-38 years (average 24.5). The study, which Enbridge provided to the evaluation team, did not attempt to tie the degraded combustion efficiency to the original rated efficiency of the boilers. The study is also now more than 10 years old, so its findings are likely out of date and should only at most apply to 20-year-old or more boilers. For 2016, the evaluation used the 73% value since a better option was unavailable at the time.

Recommendation: Use a degradation from name plate efficiency to determine the baseline boiler efficiency rather than a flat number. The 2017 CPSV effort should include in the scope secondary research to determine a degradation factor or curve to be used for the 2017 and 2018 CPSV and could be incorporated by the utilities for the 2019 program year until primary research is completed or a better approach is developed.

Outcome: Improving this key assumption will improve savings estimates for a significant portion of savings in the Enbridge portfolio and the process would also be applicable to Union sites where baseline boiler efficiencies are required and not based on site tests of boiler performance.

ENBRIDGE RESPONSE: Enbridge acknowledges that a research effort to seek updated information is merited given the age of the study currently utilized to support the 73% assumed combustion efficiency. It should be noted however, Enbridge utilizes this assumption for application in atmospheric boiler projects only.

DS16. Finding: Pipe insulation is a significant source of savings for the Union Gas programs. Union estimates heat loss rate for damaged baseline insulation less than that from a simple bare pipe assumption, which is reasonable and appropriate. Documentation for the source of the factors used in the calculation and documentation (via photos and/or a description of the pipe insulation condition) was not consistently provided.

Recommendation: Document baseline conditions using photos and text descriptions to provide context. Tie the documentation of baseline condition to the heat loss rate used in a clear way.

Outcome: Improving documentation of baseline conditions and clarity in calculations will reduce evaluation risk improve consistency of approach among the Union engineering team.

ENBRIDGE RESPONSE: Though Enbridge strives to ensure its project documentation captures relevant information to support calculations, Enbridge recognizes there may be areas for improvement including documented substantiation regarding baseline conditions. Enbridge will review the recommendation for greater clarity on pipe insulation projects as part of its commitment to continuous improvement.

DS17. Finding: Enbridge documentation did not always include a prose explanation and supporting documentation for baseline types (ROB, ER) and remaining useful life (RUL). “See Etools for base case” is not sufficient: Etools is not designed to provide context and sources to support the values included.

Recommendation: Always complete the “Base Case Overview” with a prose description of the base case. The description should reference included emails and photos to document in situ conditions and features that are carried over into the baseline system.

Outcome: Improved descriptions and documentation will reduce evaluation risk and help Enbridge ensure that accurate information has been entered into Etools.

ENBRIDGE RESPONSE: Enbridge is committed to continue in its efforts to improve upon the comprehensiveness and clarity of all relevant project information, data and underlying input assumptions. Enbridge will review this recommendation with ESCs to ensure the “Base Case Overview” provides a prose description of the base case with supporting documentation where possible.

DS18. Finding: Duration of pre- post- data (energy consumption, production output, raw material consumption, etc.) used for savings estimates were too brief in several instances.

Recommendation: The utilities should use longer duration data in ex ante savings estimates when possible. When time periods less than a year are used, the utilities should document why the period used is applicable to a full year and why a full year was not able to be used.

Outcome: Increased accuracy of savings estimates.

ENBRIDGE RESPONSE: Enbridge will review the recommendation for greater clarification of pre- and post-data as part of its commitment to continuous improvement. It should be noted in the case of process load assessments, for example, where it can be established that energy consumption is consistent, data across shorter time periods may be sufficient.

DS19. Finding: The utilities did not always gather boiler nameplate data for in situ systems. The age and operating condition was also not always recorded or described. This was a concern on boiler projects, but also for projects where boiler efficiency has an effect on savings, such as greenhouses, pipe insulation and heat recovery.

Recommendation: In situ boiler name plate information, age and operating condition are all helpful for determining the designed performance and reasonable range of actual efficiency for the system as well as providing context to better determine remaining useful life (“RUL”)

Outcome: Improving documentation of the in situ boiler will reduce uncertainty in savings estimates and reduce evaluation risk.

ENBRIDGE RESPONSE: Enbridge makes an effort to include boiler nameplate data for in situ systems where available and applicable unless testing data can support a different efficiency. Enbridge will review the recommendation for greater documentation of the in situ boiler as part of its commitment to continuous improvement.

DS20. Finding: Items that may be obvious to the ex ante team can be non-obvious to an outside party. Examples from sites this year included in situ burners that could not be turned off and whether heating needs were equal to or greater than the amount of heat recovered.

Recommendation: Review ex ante documentation from an outside perspective to identify where documentation or explanation could be added.

Outcome: Reduced evaluation risk.

ENBRIDGE RESPONSE: It is challenging to anticipate which information may be non-obvious to the verifier however, Enbridge will consider the recommendation for greater documentation review as part of its commitment to continuous improvement.

DS21. Finding: At large sites with multiple spaces containing similar equipment, ex ante documentation did not always identify which space or piece of equipment was affected by the project.

Recommendation: Include additional descriptions of spaces and equipment affected to differentiate among similar spaces and equipment at the site.

Outcome: Reduced evaluation risk.

ENBRIDGE RESPONSE: Enbridge will review the recommendation to provide clarity differentiating among similar spaces and equipment at a site and to include additional descriptions of spaces and equipment affected, as part of its commitment to continuous improvement.

DS22. Finding: Invoices were not always included with documentation, and sources for incremental costs were not always clear.

Recommendation: Ensure that incremental costs are supported by invoices or other documentation, especially for add-on and optimization measures where the total cost and incremental cost are likely to be the same. Equipment replacement measures may require an additional standard efficiency quote to produce incremental cost.

Outcome: Incremental cost is an important component of simple payback, which is often used to judge the economic benefit of energy efficiency projects. It is also an input to some benefit-cost tests.

ENBRIDGE RESPONSE: Enbridge generally attempts to ensure that incremental costs are supported by including invoices or other documentation in the project file. In some instances, project costs may be included as part of an invoice(s) relating to broader work being completed at a customer site. In such cases, Enbridge estimates incremental costs using engineering judgment. For some projects, implementation may be supported with internal customer resources, in which case no invoice is generated to support costs. In these cases, Enbridge will ask the customer to estimate incremental costs based on their internal records.

DS23. Finding: Larger projects appeared to fall under the same documentation standards as smaller projects.

Recommendation: Increase the amount of documentation and source material for projects that have greater energy savings.

Outcome: Projects that are better documented tend to have more accurate savings estimates and receive fewer evaluation adjustments than those that are less documented. Large projects have a greater effect on overall savings adjustment factors. Therefore, large projects with better documentation are more likely to result in adjustment factors closer to 100%.

ENBRIDGE RESPONSE: Enbridge strives to ensure project documentation captures all relevant information to support and explain the project regardless of project size however, Enbridge will review the recommendation to increase the amount of documentation provided for projects with greater energy savings as part of its commitment to continuous improvement.

DS24. Finding: Union custom projects utilized a project application summary workbook that summarizes the key project inputs, calculations, and most details. In general, this is a good approach that facilitates internal review and evaluation. We also found that the

workbooks had improved source documentation relative to the 2015 projects. One challenge was that different projects used the workbook in different ways:

- The notes section was sometimes used to identify and highlight specific unique approaches and features in projects, but not always.
- Calculations internal to the summary page were consistent for most projects, but not all (additional factors were sometimes added).
- Sub-methods critical to the calculation were contained in hidden sheets.
- Safety and influence adjustments were inserted in different locations and not always explained.

Recommendation: Consider providing more training or adding quality control steps to ensure the summary workbook front page is completed and stored in a consistent manner. Identify a common approach for common measures and, if necessary, document deviations and the reasons for the deviations in a clearly labelled field on the summary sheet.

Outcome: A consistent summary workbook aids both internal and external quality assurance, quality control, and measurement and verification.

ENBRIDGE RESPONSE: This recommendation was not directed to Enbridge.

DS25. Finding: Enbridge Etools is used as both a calculation tool and as a communication tool with customers. While it appears to serve the needs of the program, this form of communication is difficult for the evaluation efforts.

- Etools does not easily allow for assumptions to be sourced within the record.
- Some Etools selections may be site-specific and some may be defaults; the calculator does not distinguish.
- Energy savings that are calculated outside of Etools are hard-entered in Etools but not always sourced.

Recommendation: Use a consistent summary workbook.

Outcome: A consistent summary workbook aids both internal and external quality assurance, quality control, and measurement and verification.

ENBRIDGE RESPONSE: Enbridge will review the recommendation for a consistent summary workbook as part of its commitment to continuous improvement.

Data Management Recommendations ⁸

#	Data Management		Applies to			Primary Outcome			
	Finding	Recommendation	Union	Enbridge	Evaluation	Reduce Costs	Increase Savings	Increase Customer Satisfaction	Decrease Risk
26 A	Neither Union nor Enbridge currently track participating customer or participating vendor contact information in their program tracking database. Providing the information to the evaluation puts significant burden on utility staff. In 2016, the data provided by utility staff was much more consistent and clear relative to 2015.	Track contacts associated with projects in the program tracking database.	✓	✓		✓		✓	✓
26 B		Strongly consider investing in relational program tracking databases.	✓	✓		✓	✓	✓	✓
26 C		Continue to use improved structure for data integrity in the evaluator request for contact information for the 2017 savings verification and evaluation.			✓	✓		✓	
27	The extracts from the utility program tracking database do not include dates for key project milestones.	Track and provide to evaluators dates for key milestones in the project.	✓	✓		✓			✓
29	EUL and cumulative gross savings were not provided in a consistent manner in the Enbridge program tracking database extract	Include separate fields in the program tracking database for all components of gross and net cumulative and first year savings.	✓	✓			✓		✓

⁸ 2016 Natural Gas DSM Annual Verification Report, October 30, 2018, Table 62, page 48

DM26. Finding: Neither Union nor Enbridge currently track participating customer or participating vendor contact information in their program tracking database. Providing the information to the evaluation puts significant burden on utility staff. In 2016, the data provided by utility staff was much more consistent and clear relative to 2015.

Recommendation A: Track contacts associated with projects in the program tracking database. At a minimum, the program tracking database should include:

- Project site address
- Customer mailing address
- Primary customer contact name
- Primary customer contact phone
- Primary customer contact email
- Primary customer contact mailing address
- Addresses are best tracked as multiple fields including:
 - Street address line 1
 - Street address line 2
 - City
 - Province
 - Postal code

Phone number fields should include data validation to enforce a consistent format and avoid missing or extra digit errors. Phone extensions should be tracked in a field separate from the ten-digit phone number and be restricted to numeric data only.

The best practice is to maintain contacts in a table separate from specific project or customer data. This allows for a single contact to be connected to multiple accounts and/or projects as necessary without creating duplication. This structure also makes it easier to associate multiple contacts with a single project, and decreases quality control costs.

Vendor contact information should also be tracked in the database, in the same table as the participating customer contact information. With a relational database, the contact ID from the table can be added to a project record in the role consistent with the contact's participation (such as vendor, decision maker, or technical expert) with a separate table that allows a single vendor contact to be associated with multiple projects.

Outcome A: Reduced burden on utility staff to seek contact information for projects, whether for internal or evaluation use. Reduced evaluation costs and improved sample design expectations.

ENBRIDGE RESPONSE: As detailed in its 2015-2020 Multi-Year Plan, Enbridge outlined the need for a DSM IT system replacement. The Board approved this request in its January 20th, 2016 Decision. As a result, Enbridge DSM is currently undergoing a system upgrade that will include improved tracking & reporting and CRM components. This system upgrade is expected to be rolled out in late 2018.

Recommendation B: The utilities should strongly consider investing in relational program tracking databases. Relational program tracking databases and customer relationship management ("CRM") systems allow for multiple contacts to be associated with a single account and/or project. The incremental cost of implementation is low if it is part of the initial database design, populated as projects are started, and updated once they are complete.

For the implementation team, a query-able one-stop shop for information provides a wealth of information that can improve delivery. For example, these databases can help programs understand how contractors work across projects, identify when projects have hit snags and need attention, and give the program team access to key customer context such as historical participation, and different contacts that have worked with the program.

For evaluation, this allows programs to easily clarify aspects of projects during implementation and to provide accurate, timely, and usable contact information to evaluators and verifiers.

Outcome B: Improved customer satisfaction from better delivery, and a reduced burden on utility staff for tracking information. A relational database would also streamline aggregation of program data for scorecards and make providing data simpler for annual savings evaluation and verification.

ENBRIDGE RESPONSE: As detailed in its 2015-2020 Multi-Year Plan, Enbridge outlined the need for a DSM IT system replacement. The Board approved this request in its January 20th, 2016 Decision. As a result, Enbridge DSM is currently undergoing a system upgrade that will include improved tracking & reporting and CRM components. This system upgrade is expected to be rolled out in late 2018.

Recommendation C: When the evaluation requests contact information for savings verification and evaluation, the contact request spreadsheet will continue to provide additional fields to enforce data integrity (e.g., specific fields for a parsed address and company name for the technical and decision-making contacts). If the program tracking databases are able to report contact information, this spreadsheet should be modified to reduce burden on utility staff while maintaining high levels of data integrity.

Outcome C: Reduced evaluation costs due to less data cleaning and research to fill missing information. Improved data collection with less returned advance letters and more accurate connection between projects and contacts.

ENBRIDGE RESPONSE: This recommendation was not directed to Enbridge.

DM27.Finding: The extracts from the utility program tracking database do not include dates for key project milestones. Enbridge's data did not include any dates and Union's included only the "install date."

Recommendation: Track and provide to evaluators dates for key milestones in the project. Dates for project start, installation, and those that define the program year provide useful context for interviewers that is not always easy to find in project documentation

Outcome: Improved data collection through more informed interviewers and reduced evaluation costs through less need to search for dates in documentation.

ENBRIDGE RESPONSE: Contrary to the EC's finding, Enbridge does track an installation date. This date was included in the tracking workbook for all offers with the exception of prescriptive which, though the installation date was recorded in the project file, for the purposes of the tracking workbook, the installation month was recorded. Also, it should be noted that not all projects will have a definitive start date. The program year is defined by the calendar year.

DM 29. Finding: EUL and cumulative gross savings were not provided in a consistent manner in the Enbridge program tracking database extract. The EUL inconsistency is the result of a work around for advanced (accelerated) projects used by Enbridge to report accurate dual baseline saving estimates and first year savings. Communicating the workaround consistently within the evaluation team led to some re-work.

Recommendation: Include separate fields in the program tracking database for:

- EUL
- RUL
- gross first year annual savings
- gross post-RUL annual savings
- NTG
- gross cumulative gross
- net cumulative savings
- net first year savings

Outcome: Improved data integrity results in less evaluation risk and more accurate savings totals. Providing each of the key savings types and their components allows evaluation to confirm that the savings provided are internally consistent.

ENBRIDGE RESPONSE: Enbridge will review the recommendation to include separate fields in the program tracking database as described above as part of its commitment to continuous improvement.

3. Measure Life Study Recommendations

Updates to Measure Lives:

ML1. Finding: Use a 15-year measure life for boiler controls. This does not include burner modifications, which are currently assigned a separate measure life by Union. Enbridge could consider adding a separate category for burner modifications, which would use a 20-year life similar to Union.

ML2. Finding: Increase the measure life for variable frequency drives for make-up air units to 15 years.

ML3. Finding: Reduce the measure life for loading dock door and ramp seals to 10 years to be consistent with what is used in other cold-weather jurisdictions.

ML4. Finding: Reduce the measure life for pipe insulation to 14 years, which is consistent with the industry average, and accounts for a portion of the insulation being installed outdoors or in hazardous environments where it is unlikely to last 20 years.

ML5. Finding: Use a measure life of 15 years for building automation systems, also known as energy management systems.

ENBRIDGE RESPONSE to ML1 – ML5: As directed by Board Staff through the EAC, Enbridge will move forward with the measure life changes to custom offers proposed in

the Measure Life Study for the purpose of reaching consensus (with application to 2017 targets as well as for application to 2017 shareholder incentive and LRAM calculations) but the utilities have concerns regarding the basis for which some conclusions were reached. These include:

- **Insulation:** The Measure Life Study recommends reducing the commercial/ industrial pipe insulation measure life from 20 to 14 years. However, the Study's 14 year measure life accounts for "hazardous and outdoor installs." The utilities are of the view that a pipe insulation installation classified as "hazardous" is specialized and should be treated separately. Such projects should not be averaged with a generalized/typical pipe insulation install. Outdoor insulation piping if installed properly should last at least 20 years. In addition, some sources provided for outdoor pipe insulation refer to residential hot water insulation installs. This type of install is not similar to industrial/commercial pipe insulation installs and should not be included in the average.
- **Energy Curtains.** The Study cites three sources for measure lives with an average of 13 years however the final value proposed was a measure life of 10 years.

Future Research:

ML6. Finding: As the top priority, conduct primary research on the type of pipe insulation projects installed in Ontario to determine the appropriate measure life.

ML7. Finding: As the second priority, conduct primary research on recently installed building automation systems to determine how current system measure lives deviate from the primary research conducted approximately 20 years ago.

ML8. Finding: Consider also studying dock door seals, either through vendor interviews or program participant interviews, to determine the appropriate measure life.

ML9. Finding: Collect on-going data, similar to the ASHRAE database referenced in the study, to confirm or deny the assumed measure lives for energy curtains, exhaust fan controls, boiler controls, heat exchangers, and “other” industrial equipment.

ENBRIDGE RESPONSE to ML6 – ML9: Enbridge agrees that further research should be considered to explore the areas recommended in the Measure Life Study. These studies should be prioritized in consultation with the EAC.

Updates to Custom Measure Life Table:

The Commercial/Industrial custom offer Measure Life Study recommends the measure lives outlined in the table below be adopted as the “default” values for custom programs.

Default measure lives recommended by the Measure Life Study⁹

Measure	Recommended Measure Life
All other industrial equipment	20
Boiler – Industrial Process	20
Boiler – Space heating	25
Pipe Insulation	14
Boiler – Domestic Hot Water	25
Boiler Controls	15
Energy Curtains	10
Heat Recovery – Commercial	15
Heat Recovery – Industrial	20
Exhaust Fan Controls	15
Heat Reflector Panels	15
Economizers – Conventional and condensing	20
Steam Trap	6
Infiltration Controls – Air Doors	15
Infiltration Controls – Dock Seals	10
IR Poly	5
VFD retrofit on MUA	15

⁹ 2016 Natural Gas DSM Annual Verification Report, October 30, 2018, Table 63, page 59

Heat Exchanger	17
Building Automation System	15
Ovens and Thermal Oxidizers	20
Reverse Osmosis Water Conditioner	20
Building Envelope	25

ENBRIDGE RESPONSE: Following discussion at the EAC – although not all EAC members agreed – it was concluded that results of Measure Life Study should apply starting with 2017 shareholder incentive and LRAM calculations. 2017 targets were also to reflect updates to the Measure Life Study because the Board’s Decision on the Multi-Year DSM 2015-2020 Plans notes "to calculate next year’s targets, the OEB directs the utilities to use the new, updated input assumptions and net-to-gross factors that are the result of the annual evaluation process." Since the Measure Life study was part of the 2016 evaluation effort, Enbridge’s 2017 targets will reflect the changes in measure life.