

ONTARIO NATURAL GAS DEMAND SIDE MANAGEMENT TECHNICAL RESOURCE MANUAL

Introduction

This TRM is a document that is filed with the Ontario Energy Board (OEB) to provide essential information and source materials underpinning prescribed energy savings assumptions and/or calculations for a number of energy efficient technologies that are or may be in the future promoted by the Ontario gas utilities' energy efficiency programs.

The efficiency measures addressed by the TRM are prescriptive and quasi-prescriptive measures that lend themselves to standardized assumptions and algorithms, and for which estimated average savings can be determined to be reasonably accurate. The TEC provided Energy and Resource Solutions Inc. ("ERS") with a prioritized list of measures to include in the first version of the TRM.

The assumptions and algorithms represent accepted engineering practice and have been substantiated with third party sources and data specific to Ontario and/or geographic areas with similar climates, to the extent possible and when applicable.

Natural gas savings are reported in gross cubic meters (m³) of natural gas. Additional impacts of electric and water savings have been included where applicable. Measure life and incremental cost have also been provided. The measures are organized by market, measure category, and end-use.

This TRM includes measures that have been considered by the utilities, or might be considered in the future. It should be noted that the TRM is a technical reference document and as such inclusion in the TRM does not imply that it is appropriate to include a measure in the utilities' portfolio in a given program year.

Version History

The TRM is a dynamic document that will be periodically updated with new information supported by substantiated references. The TRM Version Date and Revision History table presented below briefly summarizes the history of the evolution of the introductory sections of the TRM. Similar tables summarize the development of assumptions for each individual measure in the technical sections of the TRM.

TRM Version Date and Revision History

Filing Date and Docket Number	Version	Reasons for Update
December 21, 2016 (EB-2016-0246)	1.0	Original *

* Version 1 (Original) of this TRM was developed by ERS. The TRM was commissioned by the Technical Evaluation Committee (“TEC”)¹, and was managed by a sub-committee of the TEC. Upon its completion, the ongoing management of the TRM will be overseen by the OEB with input from the Evaluation Advisory Committee (“EAC”)².

Purpose of the TRM

The objectives of the TRM are as follows:

- Provide transparent, standardized (where applicable), and substantiated assumptions and/or calculation algorithms for efficiency measure savings, costs and lifetimes, as well as their underlying sources.
- For each measure, establish the conditions under which the savings or other assumptions apply.
- Provide a basis from which stakeholders, such as utility/program administrators and independent third parties, can estimate the savings achieved for the Ontario energy efficiency portfolios.
- Support cost-effectiveness calculations for projects undertaken and funded by the utility efficiency programs.³
- Provide access to a chronology of the changes over time to measure assumptions – including the rationale used to support changes.

The purpose of the TRM does not include:

- Determination of free ridership or spillover values as they are more a function of program design than they are of technology specific factors.
- Recommendation of potential energy efficiency measures to utilities.
- Recommendation of program design structures or features.
- Methodologies for determining the potential savings for custom measures.

Measure Outline

Each measure follows a consistent format that includes the following components.

¹ The TEC consists of utility representatives from each of Union Gas and Enbridge Gas Distribution as well as intervenor representatives and independent members with technical expertise. In its role to establish DSM technical and evaluation standards for natural gas utilities in Ontario, the TEC commissioned the development of the original TRM.

² The OEB outlined a structure to evaluate the results of Natural Gas Demand Side Management (DSM) programs from 2015 to 2020. The EAC will provide input and advice to the OEB on the evaluation and audit of DSM results. The committee will consist of representatives from non-utility stakeholders, independent experts, staff from the Independent Electricity System Operator (IESO), and observers from the Environmental Commissioner of Ontario and the Ministry of Energy, all working with OEB staff.

³ The TRM includes several, but not all of the key inputs to be used in such calculations. Specifically, annual savings (gas, electric and water), incremental costs and measure lives are included, but net-to-gross ratios, non-measure (program) costs and avoided costs are not included.

Version Date and Revision History

This section tracks the history of the measure development, including when the measure documentation was filed and approved by the OEB as well as classification for its application (see table below).

Substantiation Document Version History Header Table

Version Date and Revision History	
Version History	
OED Filing Date	
OEB Approval Date	
End Date	
Sector → End Use → Technology → Measure Category	

Sector

“Sector” refers to the market categories (Residential, Multi-Residential, Commercial⁴) for which the measure substantiation document applies.

- **Commercial:** A location providing goods and services such as businesses or institutions, e.g. retail, hospitals, universities, etc. Industrial facilities are also included in this category, however, industrial process improvements are typically custom measures and not addressed by the TRM.
- **Multi-residential:** According to Ontario Regulation 282/98, the multi-residential property class is property used for residential purposes that has seven or more self-contained units,⁵
- **Residential:** According to Ontario Regulation 282/98, the residential property class is property used for residential purposes that has less than seven self-contained units⁶. Typically this includes single detached, semi-detached, row house and/or duplex.

Though Low-Income is a market type and not a market sector, it is appropriate to provide a definition for clarity as all substantiation documents apply to the Low-Income market unless otherwise noted.

Low-Income: Low income residential utility customers face a much higher ‘energy burden’ (i.e. percent of household income devoted to energy costs) than median and higher income households. The OEB Guidelines (EB-2014-0134) provide additional detail around eligibility criteria for low-income utility customers in Section 6.4 on page 11.

⁴ All Commercial sub docs apply to the Industrial market unless otherwise noted.

⁵ <https://www.ontario.ca/laws/regulation/980282#BK4>

⁶ Ibid

End Use

“End Use” refers to service provided by the equipment (e.g. space heating, water heating, or food service).

Technology

“Technology” refers to the type of equipment (e.g. Adaptive Thermostat).

Measure Category

“Measure category” refers to the general decision types outlined in the OEB Filing Guidelines to the Demand Side Management Framework for Natural Gas Distributors (2015-2020). These decision types characterize how savings and costs are estimated relative to a frame of reference or “base case” that specifies what would have happened in the absence of the utility program. The decision types are defined as follows:

- **Early Replacement** – a measure category where a utility energy efficiency program has caused a customer to replace operable equipment with a higher efficiency alternative (also referred to as advancement).⁷

Example: An operating unit heater is replaced with a more efficient radiant heater.

- **Natural Replacement** –

a measure category where the equipment is replaced on failure or where a utility energy efficiency program has not influenced the customer decision to replace but once the decision has been made, the utility program influences a higher efficiency alternative.

Example – An operational gas water heater is replaced because of visible rust, and a more efficient water heater, promoted by the program, is installed.

- **New Construction** – efficiency measures in new construction or major renovations, whose baseline would be the relevant code or standard market practice.

Example – A project design team, influenced by the program, specifies a high efficiency boiler rather than the least cost code compliant, or predominant industry practice, option.

⁷ Some customers replace equipment when their existing equipment fails. For a variety of reasons (e.g. concern about energy or maintenance costs, better integration with other building systems, a desire to be able to plan for downtime rather than react to an emergency, etc.), other customers replace equipment before it fails. The key to an “early replacement” designation is that the utility program caused something to be replaced before it otherwise would have been.

- **Retrofit** – a measure category that includes the addition of an efficiency measure to an existing facility such as insulation or air sealing to control air leakage.

Example – An ozone treatment system is added to an existing commercial laundry system in order to facilitate using lower water temperatures.

Note - A single substantiation document may be applicable to multiple categories, and will be identified as such.

Substantiation Document Summary Table

Each substantiation document includes a summary table (see Table 1) outlining critical prescribed savings values or quasi-prescriptive savings factors, key measure parameters, incremental cost, measure life, and applicability factors.

Table 1. Substantiation Document Measure Summary Table

Parameter	Definitions
Measure Category	Retrofit, early replacement, new construction, or time of natural replacement. These terms are defined in the Measure Categorization section.
Baseline Technology	The existing condition, code compliant, or standard practice measure depending upon the measure category.
Efficient Technology	The installed high efficiency measure as described in the substantiation document
Market Type	Commercial, Residential, Multi-Residential,
Annual Natural Gas Savings	Expressed in cubic meters for prescriptive measures. Expressed as a savings factor (e.g. m ³ /lb) for quasi-prescriptive measures.
Annual Electric Savings	Expressed in kWh for applicable measures.
Annual Water Savings	Expressed in litres for applicable measures
Measure Life	The length of time that a measure is expected to be functional and performing as predicted.
Incremental Cost (\$)	The incremental cost is the difference in cost between the high efficiency technology and the baseline technology. The incremental cost includes incremental installation costs where appropriate.
Restriction	Describes any limitations to the applicability of the measure's prescribed savings or relationships, such as minimum size or applicable building types.

Overview

This section introduces the technology, describes the energy savings strategy of the measure, and lists other descriptive details.

Application

This section describes market sector or other parameters where the technology in question may be applied. For example, it could address the history of code changes and why the substantiation document savings only apply to homes of a certain vintage or businesses of a certain size. It commonly relates to the restriction section in the summary table.

Baseline Technology

This section provides a definition of the efficiency level of the baseline equipment used to determine energy savings beyond baseline, including any standards or ratings if appropriate. The baseline also may include statements regarding the presumed type of equipment that will be replaced or upgraded. For example, the baseline equipment for commercial infrared heaters is presumed to be a unit heater as opposed to a central system. It may also include statements regarding part-load conditions⁸.

Table 2 for each measure summarizes the baseline technology.

Table 2. Baseline for Energy Conservation Measure

Type	Efficiency
Type of measure	Baseline Efficiency

Efficient Technology

This section provides a definition of the criteria for the efficient equipment used to determine the delta energy savings including any standards or ratings if appropriate.

Table 3 for each measure summarizes the efficient technology.

Table 3. Efficient Technology for Energy Conservation Measure

Type	Minimum Efficiency
Type of measure or equipment	Minimum level of efficiency

Energy Impacts

This section identifies the type of energy impacts resulting from implementing the measure (e.g. natural gas savings, electric savings/penalties), and explains how this measure causes the change, in narrative form.

Natural Gas Savings Algorithm

This section presents the algorithm(s) utilized to estimate the natural gas savings for the measure. In some cases the algorithms are used to derive an average natural gas savings for the

⁸ Part-load performance is the ability of the system to handle energy use at conditions lower than the rated capacity of equipment. For example, a boiler may be sized to meet a maximum capacity to meet the load during the coldest day of the year. However, during warmer temperatures, the equipment will operate at some part-load depending on its ability to turn down to a lower firing rate. The operation and efficiency of the boiler will vary depending on the load conditions.

measures, while for other measures (i.e. quasi-prescriptive) the algorithm(s) represent the derivation of a gas savings factor to be used given certain project assumptions.

Electric and/or Water Savings Algorithm

This section outlines the approach for determining any secondary impacts on other resources, such as electricity and water, and is included as needed.

Assumptions

This section provides a reference table listing key assumptions that impact the measure savings analysis (e.g. hours of operation, equivalent full-load hours, weather criteria, load factors). For some measures, additional assumptions regarding hours of operation or the amount of time equipment or appliances are being used is provided, as applicable. It also provides references for the assumptions used in the measure analysis.

Savings Calculation Example

This section provides an example of a savings calculation. In the case of a quasi-prescriptive measure, application of the associated savings factor is explained.

Uses and Exclusions

This section outlines circumstances where a prescribed savings value is not appropriate.

Measure Life

This section provides the technology's measure life and any qualifying circumstances (e.g. evidence of regular maintenance).

Incremental Cost

This section describes the technology's incremental cost and any additional considerations pertaining to its determination. Incremental cost is dependent on the measure category. The utilities follow the OEB Guidelines' (EB-2014-0134) direction regarding the application of incremental costs as outlined in Section 9.1.1- Net Equipment Costs (pg. 26/27). The incremental cost has been indexed to 2015 and is expressed in Canadian dollars.

References

This TRM aims to provide best available and substantiated information collected at the time of its production. References (many available online) to documents are provided for each key assumption. Examples of references deemed appropriate for this TRM include:

- Efficiency program evaluations conducted both in Ontario and other jurisdictions within Canada and United States;
- Government studies on the performance and/or cost of efficiency technologies – within Ontario, other parts of Canada, the U.S. or outside North America when applicable;
- Other published research on the performance and cost of efficiency measures; within Ontario, other parts of Canada, the U.S. or outside North America when applicable;

- Information collected directly from key technology manufacturers and/or other parts of the supply chain for the technology in Ontario (e.g. distributors, contractors, etc.)

Additional TRM Notes

This TRM includes prescribed (prescriptive and quasi-prescriptive) savings estimates that are expected to serve as average, representative values for the province of Ontario. All information is presented on a per-measure basis. In using the measure-specific information in this TRM, it is important to keep the following notes in mind:

- Measure lives serve to represent the Ontario market and include measure persistence unless otherwise noted.
- In general, the baselines included in the TRM are intended to reflect average practices and conditions in Ontario.

Common Assumptions Table (see Appendix A)

Where assumptions are shared between multiple technologies, they have been gathered in a Common Assumptions table (Appendix A). Among these common assumptions, London, Ontario was selected as a default climate zone, due to its elevation and annual average temperature cycle.

In addition to weather-related assumptions, the common assumptions include efficiencies for different types of equipment, common conversions, local conditions that would impact measures like average water temperature, heat content of natural gas, etc.