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July 5, 2022

British Columbia Utilities Commission
Suite 410, 900 Howe Street
Vancouver, BC
V6Z 2N3

Attention: Mr. Patrick Wruck, Commission Secretary

Dear Mr. Wruck:

**Re: FortisBC Energy Inc. (FEI)**

**Application for Acceptance of Demand Side Management (DSM) Expenditures for 2023**

Pursuant to section 44.2 of the *Utilities Commission Act*, FEI hereby applies to the British Columbia Utilities Commission for acceptance of the attached updated DSM Expenditures for 2023.

If further information is required, please contact Sarah Wagner, Regulatory Projects Manager, at (250) 469-6081.

Sincerely,

**FORTISBC ENERGY INC.**

***Original signed:***

Diane Roy

Attachments

cc (email only): Registered parties in the FEI 2019-2022 DSM Expenditures Plan and FEI Annual Review for 2022 Delivery Rates proceedings

# FortisBC Energy Inc.

# 2023 Demand Side Management Plan

**July 5, 2022**

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# 1. INTRODUCTION

FortisBC Energy Inc. (FEI or the Company) submits this Application for Acceptance of Demand-Side Management (DSM) Expenditures for 2023 (Application) to the British Columbia Utilities Commission (BCUC) pursuant to section 44.2(1)(a) of the *Utilities Commission Act*, R.S.B.C. 1996, c. 473 (UCA). FEI's proposed 2023 DSM expenditure schedule is set out in Table 4-1 of the Application, with total DSM expenditures of $141.077 million for 2023. FEI's proposed 2023 DSM expenditures are supported by the 2023 DSM Plan found in Appendix A, which provides details on each of FEI's program areas and individual DSM programs, including cost-effectiveness test results.

The 2023 DSM Plan is a continuation of many of the cost-effective programs previously accepted in FEI's 2019-2022 DSM Plan[1], with some additions and modifications including activities that support the transition to advanced DSM programming such as deep retrofits, gas heat pumps and dual fuel hybrid heating systems. FEI is filing a one-year plan because new policy direction included in the late-2021 CleanBC Roadmap to 2030 (Roadmap) is anticipated to result in changes to the Demand-Side Measures (DSM) Regulation before 2024 that are likely to have implications for FEI's DSM portfolio. Further background on FEI's rationale for a one-year plan is included in section 3.1.

Table 1-1 summarizes FEI's proposed 2023 DSM expenditures and associated energy savings reflecting FEI's 2023 DSM Plan included as Appendix A, compared to FEI's accepted 2022 DSM expenditures and associated energy savings. FEI's proposed 2023 DSM expenditures are set out in more detail in Table 4-1.

**Table 1-1: 2023 DSM Plan Expenditures and Savings**

| DSM Plan | Expenditures ($000s) | Energy Savings (GJ) |
|---|---|---|
| 2023 | 141,077 | 1,601,386 |
| 2022 | 106,293 | 1,150,189 |

Accepted expenditures pursuant to Order G-138-18, Order G-135-21 and Order G-301-21

The information presented in the 2023 DSM Plan involved a collaborative working effort between FEI DSM program personnel and Posterity Group, an energy efficiency consulting firm that also assisted both FEI with its recently filed 2022 Long-Term Gas Resource Plan (2022 LTGRP)[2] and FortisBC Inc. (FBC) with its recently filed 2023-2027 DSM Expenditure Plan[3]. More details on the approach undertaken to develop the DSM Plan can be found in section 1 of the DSM Plan (Appendix A).

1 Order G-10-19.
2 FEI's 2022 LTGRP was filed May 9, 2022 with the BCUC.
3 FBC filed its 2023-2027 DSM Expenditure Application on June 6, 2022.

FEI's proposed DSM expenditure schedule is also supported by FEI's 2021 Annual DSM Report included as Appendix B. The 2021 Annual DSM Report describes the results of FEI's 2021 programs, most of which FEI is proposing to continue. As indicated in the 2021 Annual DSM Report, FEI continues to deliver a cost-effective portfolio of DSM programs and activities.

As set out in the Application, FEI's proposed DSM expenditure schedule is consistent with British Columbia's energy objectives and FEI's 2022 LTGRP, meets the adequacy and cost-effectiveness requirements of the Demand-Side Measures Regulation, and responds to government policy encouraging an increase in DSM to support greenhouse gas (GHG) emission reduction targets.

The Application demonstrates that the proposed DSM expenditures are in the public interest and FEI requests that they be accepted by the BCUC.

# 2. APPROVALS SOUGHT AND PROPOSED REGULATORY PROCESS

FEI seeks an order pursuant to section 44.2(3) of the UCA accepting the 2023 DSM expenditure schedule set out in Table 4-1 of the Application, with total DSM expenditures of $141.077 million for 2023.

In addition, FEI is seeking approval of:

- proposed changes to its existing funding transfer rules as set out in Section 7.1.1;
- a new variance allowance rule on total portfolio expenditures, as set out in Section 7.1.2;
- forecast rate base additions accounting treatment as set out in Section 7.2; and
- a rate base deferral account to capture the regulatory costs associated with the review of this Application, as set out in Section 7.3.

A draft Order is attached as Appendix C.

The 2023 DSM Plan included in Appendix A was developed with the help of information gathered through consultation with various program stakeholders and interested parties. Given the extensive consultation that provided multiple opportunities for review and feedback with key stakeholders as detailed in Section 4.1 of the Application, and to accommodate a BCUC decision on the Application before the end of the year, FEI submits that a written public hearing with one round of Information Requests is appropriate for the review of this Application and proposes the following regulatory timetable.

**Table 2-1: Proposed Regulatory Timetable**

| Regulatory Timetable | Date (2022) |
|---|---|
| Registration of Interveners | Friday, July 29 |
| BCUC Information Request No. 1 | Friday, July 29 |
| Intervener Information Request No. 1 | Friday, August 5 |
| FEI Response to Information Request No. 1 from BCUC and Interveners | Friday, September 2 |
| FEI Final Submission | Wednesday, September 21 |
| Intervener Final Submission | Wednesday, October 12 |
| FEI Reply Submission | Friday, October 28 |

# 3. BACKGROUND AND REQUIRED CONSIDERATIONS

## 3.1 *Demand-Side Management Drivers & Consistency with Government Policy*

Government focus on reducing greenhouse gas (GHG) emissions is an important factor driving FEI's 2023 DSM Plan. The Province of British Columbia has been committed to reducing GHG emissions since initial objectives were introduced in the 2007 BC Energy Plan. In recent years, B.C. Government policy has evolved and continues to support carbon emissions reductions through increasing natural gas energy efficiency.

In 2018, FEI released its Clean Growth Pathway that charts a path to BC's 2050 GHG emissions reduction targets and realizes additional non-GHG-related benefits. The Clean Growth Pathway will leverage the decarbonization potential of both the gas and electric energy systems in supporting provincial GHG emission reductions, as well as the affordability, reliability, resiliency, and economic development advantages in pursuing a diversified approach to decarbonization. FEI's Clean Growth Pathway is supported by four key pillars:

- **Pillar 1:** Transitioning to renewable and low-carbon gases to decarbonize the gas supply;
- **Pillar 2:** Investing in DSM programs in support of energy efficiency and conservation measures to reduce energy use among residential, commercial and industrial customers;
- **Pillar 3:** Investing in low-carbon transportation infrastructure to reduce emissions in this sector; and
- **Pillar 4:** Investing in LNG to lower GHG emissions in marine fueling and global markets.

On May 9, 2022, FEI filed its 2022 LTGRP with the BCUC, which provided further detail on the four pillars of the Clean Growth Pathway. This Application addresses the second pillar only – energy efficiency and conservation. The continued and expanded investment in energy efficiency and conservation initiatives for FEI's customers comprises the second pillar of the Clean Growth Pathway and is delivered through this Application.

In 2021, the Roadmap introduced the concept of "a GHG emissions cap that will require gas utilities to undertake activities and invest in technologies to further lower GHG emissions from the fossil natural gas used to heat homes and buildings and power some of our industries."[4] The Roadmap also noted that "the B.C. Utilities Commission will have a mandate to review gas utilities' plans, investments and expenditures to ensure they're aligned with the GHG emissions cap and cost effective".[5] The new GHG emissions cap is a significant policy shift to a compliance-based model and, at the time of this Application, supporting legislation has not been introduced, although it is anticipated before the end of 2022 in the form of a Greenhouse Gas Reduction Standard

4 CleanBC Roadmap to 2030, p 29 CleanBC Roadmap to 2030 (gov.bc.ca).
5 CleanBC Roadmap to 2030, p 29 CleanBC Roadmap to 2030 (gov.bc.ca).

(GHGRS). The GHGRS is described in the Roadmap as a 6 megatonne cap on GHG emissions in BC's buildings and industrial sectors. Collectively, the GHGRS represents a 47 percent reduction in emissions compared to 2007 levels. The Province envisions natural gas utilities, including FEI, as holding the obligation to meet this cap. The GHGRS is an overarching policy that encompasses other related, enabling policies including the DSM Regulation.

The Roadmap's stated direction for enhancing energy efficiency programs is to include more support for building-envelope improvements and high efficiency heat pumps, including gas heat pumps and hybrid dual fuel heating systems. The Roadmap also stated that after 2030, all new space and water heating equipment sold and installed in B.C. will be at least 100 percent efficient. The Roadmap further indicates that there will be updated regulations to shift the focus of utility-funded efficiency programs to support market readiness for future standards and codes and that consumers will see more support for building-envelope improvements such as insulation and better windows, and all kinds of high efficiency heat pumps – electric, gas and hybrid.

As the implications of this new policy direction to the DSM Regulation are still being determined, FEI believes a one-year DSM Plan for 2023 is a prudent interim approach to allow time for the Roadmap-related provincial legislative and regulatory process to proceed. This one-year DSM Plan includes activities that support the transition to advanced DSM programming such as deep retrofits, gas heat pumps and dual fuel hybrid heating systems. FEI views this DSM Plan as year one of a five-year overall DSM vision and, assuming applicable legislation is enacted in time, intends to follow this one-year plan with a four-year DSM Plan to align with FBC's 2023-2027 DSM plan. This overall five-year DSM vision, in alignment with the Roadmap, requires significant investment in the newer advanced DSM areas, resulting in the increased expenditures being proposed in the 2023 DSM Plan. Much of these increased expenditures are proposed to reside within the Innovative Technologies program area as investigation and testing are required to prove out these newer advanced DSM areas.

FEI's 2023 DSM Plan continues to include incentives for highest efficiency gas equipment as significant opportunities still exist in the market to advance GHG emission reductions through customer adoption of these measures. While the 2023 DSM Plan and FEI's five-year DSM vision include testing and ultimately developing customer programs for the advanced DSM items cited in the Roadmap, incentives for high efficient gas equipment are still required in order to meet provincial objectives. FEI notes that with renewable gas supply growth[6], continuing to promote installation of this equipment in market will enable both short-term and long-term GHG emission reductions as in the short-term DSM measures will result in immediate GHG emission savings and in the longer-term more renewable gas will come online to further those emission savings.

FEI's 2023 DSM Plan proposes an increase in expenditures, driven by the objectives in FEI's Clean Growth Pathway, the 2022 LTGRP, and the Roadmap, to accelerate the adoption of the

[6] B.C. Renewable and Low-Carbon Gas Supply Potential Study, page 4: https://www.cdn.fortisbc.com/libraries/docs/default-source/news-events/bc-renewable-and-low-carbon-gas-supply-potential-study-2022-03-11.pdf.

above noted advanced DSM initiatives. Table 3-1 below shows the planned 2023 DSM expenditure compared to the previously accepted 2022 expenditure.

**Table 3-1: Comparison of 2023 Proposed DSM Expenditures to 2022 Accepted DSM Expenditures**

| Program Area | Total Utility Expenditure (000's) | | |
|---|---|---|---|
| | 2023 | 2022 | Variance |
| Residential | $43,994 | $34,816 | 26% |
| Commercial | $26,570 | $19,800 | 34% |
| Industrial | $6,848 | $8,462 | -19% |
| Low Income | $13,251 | $10,984 | 21% |
| Conservation Education and Outreach | $9,713 | $9,433 | 3% |
| Innovative Technologies | $25,960 | $11,871 | 119% |
| Enabling Activities | $12,010 | $8,921 | 35% |
| Portflio Activities | $2,730 | $1,979 | 38% |
| ALL Programs | $141,077 | $106,266 | 33% |

Accepted expenditures pursuant to Order G-138-18, Order G-135-21 and Order G-301-21

Table 3-2 below displays the forecast energy savings and GHG emission reductions resulting from the 2023 DSM Plan.

**Table 3-2: 2023 DSM Plan Energy Savings & GHG Emission Reductions**

| Indicator | Year | Total Natural Gas Savings | GHG Emission Reductions |
|---|---|---|---|
| **Net Incremental Annual Gas Savings (GJ/yr) and GHG Reductions (t CO2e/yr)[1]** | 2023 | 1,601,386 | 82,632 |
| **NPV of Net Gas Savings (GJ/yr) and GHG Reductions (t CO2e)[2]** | | 14,433,377 | 744,762 |

*Notes to Table:*

[1] Net incremental gas savings are after consideration of free ridership and spill over. GHG reductions are based on long run combustion emission factor of 0.0516 t CO2e/GJ for natural gas from Ministry of Environment & Climate Change Strategy.

[2] NPV in this context refers to including the entire stream of savings into the future (by measure life) and annualizing that to present time to show the total value of the stream of savings.

Through market transformation of higher efficiency natural gas equipment, and investing in the acceleration of advanced DSM adoption, FEI's 2023 DSM Plan supports provincial government policy to reduce carbon emissions. In FEI's view, the BCUC's consideration of government direction and policy must weigh heavily in favour of FEI's proposal to increase investment in DSM programs.

## 3.2 *LEGAL FRAMEWORK*

FEI is filing the Application pursuant to section 44.2(1)(a) of the UCA, which provides that a utility may file "a statement of the expenditures on demand-side measure the public utility has made or anticipates making during the period addressed by the utility". As shown in the 2023 DSM Plan (Appendix A), all proposed activity qualifies as "demand side measures" as defined under the UCA. Section 44.2(2) of the UCA provides that demand-side measure expenditures must be the subject of a BCUC-accepted expenditure schedule before they are included in rates.

Pursuant to section 44.2(3) and (4), the BCUC must accept the expenditure schedule if it considers the schedule to be in the public interest, or it may accept a part of the schedule. In considering whether a demand-side measure expenditure schedule put forward by a public utility other than BC Hydro and Power Authority (BC Hydro) is in the public interest, the BCUC must consider the following criteria according to section 44.2(5):

- the applicable of British Columbia's energy objectives,
- the most recent long-term resource plan filed by the public utility under section 44.1, if any,
- the extent to which the schedule is consistent with the applicable requirements under sections 6 and 9 of the *Clean Energy Act*,[7]
- if the schedule includes expenditures on demand-side measures, whether the demand-side measures are cost-effective within the meaning prescribed by regulation, if any, and
- the interests of persons in British Columbia who receive or may receive service from the public utility.

The required considerations are addressed in Sections 3.3, 3.4 and 6.

The consideration of "adequacy" as defined in section 2 of the DSM Regulation is discussed in Section 3.5 below, and a discussion of the consistency of FEI's 2023 DSM Plan with government climate policy is provided in Section 3.1.

FBC notes that the BCUC Decision and Order G-10-19 accepting FEI's 2019-22 DSM Expenditure Application did not include any directives with respect to FEI's next DSM expenditure filing.

[7] Sections 6 and 9 of the Clean Energy Act relate to electricity self-sufficiency and BC Hydro domestic long-term sales contracts, respectively, and are not applicable to FEI or this Application.

## 3.3 *CONSISTENCY WITH BRITISH COLUMBIA ENERGY OBJECTIVES*

British Columbia's energy objectives are defined and set out in section 2 of the *Clean Energy Act* (CEA). The applicable energy objectives and how FEI's proposals support those objectives are set out in Table 3-3 below.

**Table 3-3: BC's Energy Objectives Met by FEI DSM Activity**

| Energy Objective | FEI DSM Portfolio |
|---|---|
| (b) to take demand-side measures and to conserve energy, including the objective of the authority reducing its expected increase in demand for electricity by the year 2020 by at least 66%; | FEI's DSM proposals are designed to implement cost-effective (as defined by the DSM Regulation) demand-side measures.<br>See Section 3.5 of this Application. |
| (d) to use and foster the development in British Columbia of innovative technologies that support energy conservation and efficiency and the use of clean or renewable resources; | FEI's 2023 DSM Plan includes provision for Innovative Technology projects.<br>See Appendix A, Section 8. |
| (g) to reduce BC greenhouse gas emissions<br>(i) by 2012 and for each subsequent calendar year to at least 6% less than the level of those emissions in 2007,<br>(ii) by 2016 and for each subsequent calendar year to at least 18% less than the level of those emissions in 2007,<br>(iii) by 2020 and for each subsequent calendar year to at least 33% less than the level of those emissions in 2007,<br>(iv) by 2050 and for each subsequent calendar year to at least 80% less than the level of those emissions in 2007, and<br>(v) by such other amounts as determined under the Greenhouse Gas Reduction Targets Act; | FEI's DSM programs will result in substantial natural gas savings and commensurate reductions in greenhouse gas emissions of 82,632 annual tonnes CO2e. |
| (i) to encourage communities to reduce greenhouse gas emissions and use energy efficiently; | All of FEI's DSM programs encourage communities to reduce greenhouse gas emissions and use energy efficiently.<br><br>Local government and institutional strategic energy planning, and Community Education and Outreach, are enabled through Supporting Initiatives.<br>See Appendix A Section 7 and 9.<br><br>Provisions for, and further development of, the BC Energy Step Code are included within Program areas and the Community Energy Specialists program.<br>See Section 3 and Appendix A, Sections 3,4,6,9, and 9. |
| (k) to encourage economic development and the creation and retention of jobs; | FEI's DSM Programs have a broad impact on the provincial economy as measured through employment impacts. See Appendix D, Section 7.3. |

In FEI's view, the BCUC's consideration of British Columbia's energy objectives must weigh heavily in favour of FEI's proposal to continue and expand investment in cost-effective DSM programs.

## 3.4 CONSISTENCY WITH LONG-TERM GAS RESOURCE PLAN

When considering whether to accept a utility's expenditure schedule under section 44.2 of the UCA, the BCUC must consider the utility's most recent long-term resource plan filed under section 44.1 of the UCA.

FEI filed its 2022 LTGRP with the BCUC on May 9, 2022. The 2022 LTGRP is currently under review by the BCUC and covers a planning horizon from its 2019 base year until 2042.

FEI's 2023 DSM Plan (Appendix A) is informed by both the results from the 2021 Conservation Potential Review (CPR) and the 2022 LTGRP. Section 5 of the 2022 LTGRP examines the impact of FEI's long-term forecast for DSM activity on gas demand, projected gas delivery rates, and GHG emissions across alternate future scenarios over the 20-year LTGRP planning horizon, and examines the impact of three different levels of DSM expenditures within the LTGRP planning scenario – FEI's Diversified Energy Scenario. This analysis of long range DSM potential presented in the LTGRP is based on the findings of FEI's 2021 CPR (included as Appendix D of this Application, and Appendix C-1 of the 2022 LTGRP).

The selection of the High DSM setting in the 2022 LTGRP Diversified Energy (Planning) Scenario is based on both the availability of cost-effective demand-side measures, the objectives of FEI's Clean Growth Pathway, and the need for FEI to reduce GHG emissions in alignment with the Roadmap. The High DSM Setting maximizes the energy savings potential and therefore the potential to reduce GHG emissions by accelerating building retrofits, high performance new construction and energy efficiency in commercial and industrial processes. The choice of the High DSM Setting is also consistent with the feedback from the Resource Planning Advisory Group (RPAG), Energy Efficiency and Conservation Advisory Committee (EECAG) and other stakeholder engagement sessions for FEI to undertake high levels of DSM.

Section 9.2.1 of the 2022 LTGRP also acknowledges that since the 2021 CPR was completed, additional information has emerged on key energy efficiency technologies (deep energy retrofits, gas heat pumps and hybrid heating systems) that was not modelled in the 2021 CPR. FEI includes these important technologies along with the measures included in the 2022 LTGRP High DSM expenditure setting as part of FEI's plan to realize energy savings and reduce GHG emissions over the planning horizon.

### 3.4.1 2023 DSM Plan Forecast and Consistency with 2022 LTGRP DSM Settings

Since the 2017 LTGRP, FEI has been increasing its annual investments in DSM programs to reduce energy demand from residential, commercial and industrial customers through its commitment to the Clean Growth Pathway. Over the 2019-2022 planning period, FEI forecasts an investment of $353 million in DSM programs, with the 2021 DSM portfolio expenditure being three times greater than the 2018 DSM portfolio. This trajectory of increasing expenditures continues with the proposed 2023 DSM Plan and exemplifies FEI's long-term commitment to obtaining energy savings in line with the High DSM setting in the 2022 LTGRP's Diversified Energy (Planning) Scenario that is part of FEI's five-year vision for increasing DSM activity.

In developing the 2023 DSM Plan, FEI considers the inputs and results of the 2022 LTGRP DSM analysis which was based on the 2021 CPR. While there is alignment with the LTGRP, the 2023 DSM Plan also addresses policy and technology advancements that are changing rapidly and have evolved since the CPR and the 2022 LTGRP Analysis were completed. The following discussion highlights areas of alignment between the 2023 DSM Plan and the 2022 LTGRP, as well as areas where the DSM Plan is advancing beyond the LTGRP including the following considerations:

- The energy savings between the LTGRP and DSM Plan are closely aligned. The energy savings achieved in the 2022 LTGRP High DSM Setting are 1.7 million incremental GJs while the DSM Plan energy savings are 1.6 million incremental GJs;
- The 2022 LTGRP recommended pursuing the high DSM expenditure setting to reach energy savings and related GHG emission reduction targets as a key pillar in the Clean Growth Pathway. The 2023 expenditures in the high DSM setting for the LTGRP are $235 million. While the 2023 DSM Plan total expenditures are lower at $141 million, the 2023 spending does represent a step change from 2022 planned DSM expenditures of $106 million, indicating a transition toward this increased level of DSM activity;
- The 2023 DSM Plan total expenditure is less than the LTGRP DSM high setting in 2023 for the following reasons:
    - The LTGRP analysis is a long-term outlook on DSM potential, using 2019 as a base year for its analysis. It does not consider program design that incorporates ramp up requirements for new measures and programs or potential ramp down of old measures.
    - The high DSM setting in the LTGRP assumed incentives covering up to 100 percent of incremental costs, or maximum market potential, in order to speed market transition and accelerate retrofits for energy and emission reductions, whereas for this transitional one-year 2023 period the DSM Plan focused more on optimizing the costs of energy savings and maintains an average incentive level which is closer to the historical benchmark of 50 percent of incremental cost for high efficiency equipment; and
- The Clean BC Roadmap, published after the 2022 LTGRP's DSM analysis was completed, has signaled a policy shift away from supporting many traditional gas equipment DSM measures and toward advanced DSM activities. The DSM Plan incorporates a faster transition toward more advanced gas DSM measures through higher expenditures for pilot projects and

related innovative technologies associated with advanced DSM measures than was incorporated in the CPR and the 2022 LTGRP DSM analysis.

The 2022 LTGRP projects that, as part of a long-term plan for implementing DSM activities, FEI will continue a portfolio of DSM initiatives that is cost effective and adequate pursuant to the DSM Regulation, consisting of residential, commercial, industrial, low income, innovative technologies, conservation education and outreach as well as enabling DSM activities. The 2022 LTGRP contemplates that FEI will implement this long-term plan via successive DSM plans which take into account the prevailing market, regulatory, and end-use technology conditions. Within this framework, FEI's proposed DSM expenditure schedule and attached 2023 DSM Plan are consistent with the 2022 LTGRP. The 2023 DSM Plan reflects a cost effective and adequate portfolio that includes the initiatives presented in the 2022 LTGRP and reflects an increase in expenditures over prior years, ramping up towards the High DSM Setting in future DSM expenditure plans.

## 3.5 *ADEQUACY PURSUANT TO THE DSM REGULATION*

A public utility's plan portfolio is adequate for the purposes of Section 44.1 (8) (c) of the UCA regarding long-term resource plans, only if the plan portfolio includes the items listed in Table 3-4, as set out in section 3 of the DSM Regulation.

While the DSM Regulation adequacy requirements are applicable to long-term resource plans, since they are related to the demand-side measures, FEI addresses how the 2023 DSM Plan is compliant with each of these considerations in Table 3-4 below:

**Table 3-4: DSM Plan Compliance with DSM Regulation**

| DSM Regulation Adequacy | 2023 DSM Plan Compliance |
|---|---|
| a) a demand-side measure intended specifically<br>i. to assist residents of low-income households to reduce their energy consumption, or<br>ii. to reduce energy consumption in housing owned or operated by<br>A. a housing provider that is a local government, a society as defined in section 1 of the Societies Act, other than a member-funded society as defined in section 190 of that Act, or an association as defined in section 1 (1) of the Cooperative Association Act, or<br>B. the governing body of a first nation,<br>if the benefits of the reduction primarily accrue to<br>C. the low-income households occupying the housing,<br>D. a housing provider referred to in clause (A), or<br>E. a governing body referred to in clause (B) if the households in the governing body's housing are primarily low-income households | The Low Income section of the 2023 DSM Plan (Appendix A, Section 6) shows plans for FEI to continue to offer programs that help low-income households and housing societies, including First Nations housing and co-operatives, save energy. |
| | |
| b) if the plan portfolio is submitted on or after June 1, 2009, a demand-side measure intended specifically to improve the energy efficiency of rental accommodations | FEI will be continuing with the Rental Apartment Efficiency Program (RAP). As referenced in the Commercial sections of the 2023 DSM Plan (Appendix A, Section 4.3.4), the RAP targets improving the energy efficiency only of rental apartment buildings. |
| | |
| c) an education program for students enrolled in schools in the public utility's service area | The Conservation Education and Outreach section of the 2023 DSM Plan (Appendix A, Section 7) includes continuation of the School Education Program (Appendix A, Section 7.1.4) which includes programming for grade schools and post-secondary institutions in FEI's service area. |
| d) if the plan portfolio is submitted on or after June 1, 2009, an education program for students enrolled in post-secondary institutions in the public utility's service area. | |

| DSM Regulation Adequacy | 2023 DSM Plan Compliance |
|---|---|
| | |
| e) one or more demand-side measures to provide resources as set out in paragraph (e) of the definition of "specified demand-side measure",[8] representing no less than<br>i. an average of 1% of the public utility's plan portfolio's expenditures per year over the portfolio's period of expenditures, or<br>ii. an average of $2 million per year over the portfolio's period of expenditures | The Enabling Activities section of the 2023 DSM Plan includes Codes & Standards (Appendix A, Section 9.1.2), which forecasts expenditures of $1.411 million to meet the 1 percent adequacy requirement. This equates to 1 percent of the overall forecast portfolio expenditures over the 2023 DSM Plan period. |
| | |
| f) one or more demand-side measures intended to result in the adoption by local governments and first nations of a step code or more stringent requirements within a step code. | BC Energy Step Code support is included within the following programs listed in the 2023 DSM Plan (Appendix A):<br>• Residential New Home Program (section 3.3.1)<br>• Commercial Performance Program – New Buildings (section 4.3.3)<br>• Enabling Activities – Codes & Standards (section 9.1.2)<br>• Enabling Activities – Community Energy Specialist Program (section 9.1.5) |

## 3.6 *INTERESTS OF PERSONS WHO MAY RECEIVE SERVICE*

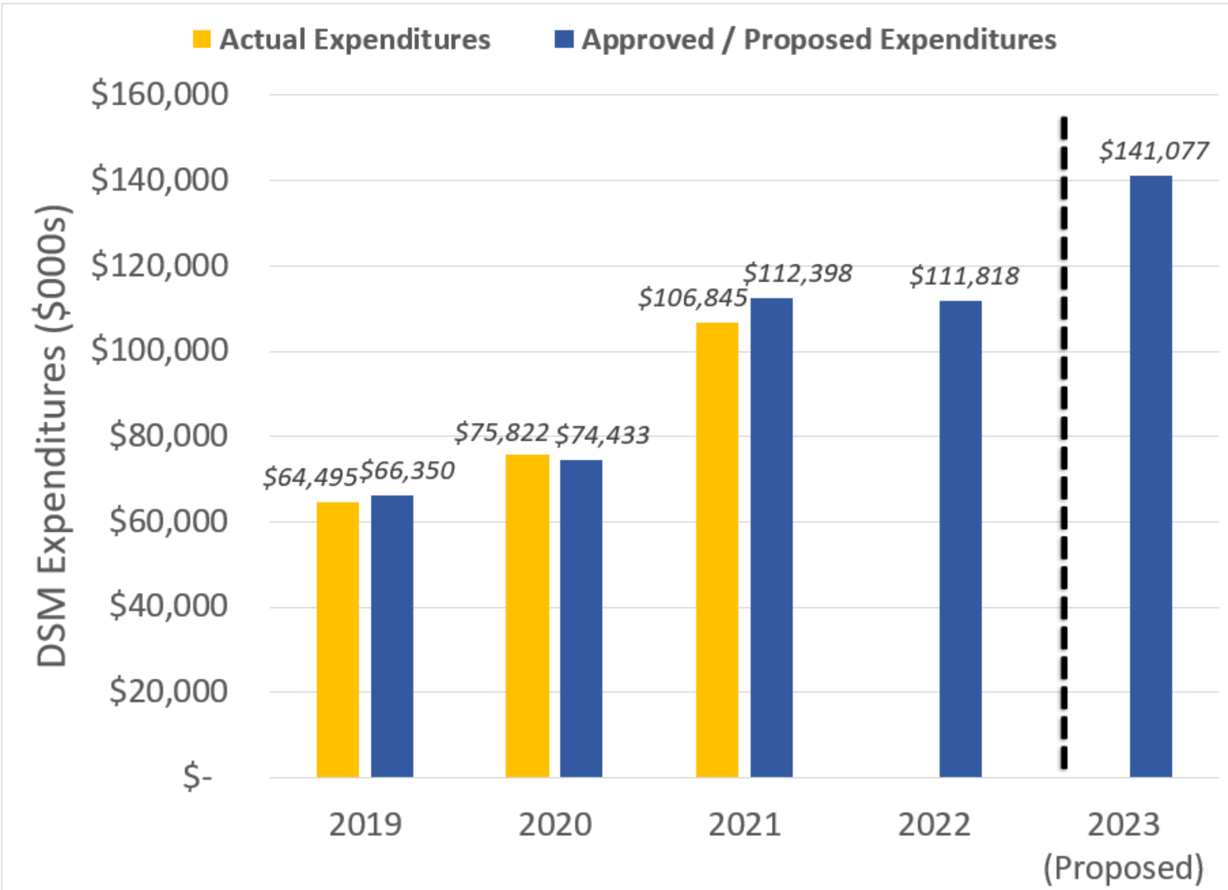
FEI submits that the proposed DSM expenditures are in the interests of customers and potential customers as they encourage energy efficiency and conservation, reduce GHG emissions, are beneficial to the economy and are cost-effective. Individual customers that avail themselves of DSM measures will reduce their natural gas consumption and, all else equal, their natural gas bills.

[8] In section 1 of the DSM Regulation, Paragraph (e) of the definition of “specified demand side measure” is: “(e) financial or other resources provided (i) to a standards-making body to support the development of standards respecting energy conservation or the efficient use of energy, or (ii) to a government or regulatory body to support the development of or compliance with a specified standard or a measure respecting energy conservation or the efficient use of energy in the Province”.

# 4. 2023 DSM PLAN AND PROPOSED EXPENDITURES

FEI's DSM expenditures have continually increased year over year to annual levels consistently in excess of $100 million. For historical reference, Figure 4-1 shows total FEI DSM expenditures since 2019, the first year of the most recently approved DSM Plan.

**Figure 4-1: FEI Annual Total DSM Expenditures 2019 to 2022[9]**




FEI's proposed DSM expenditures for the 2023 period reflect the 2023 DSM Plan in Appendix A which includes the following program areas: Residential, Low Income, Commercial, Conservation Education and Outreach, Industrial, Innovative Technologies, and Enabling Activities. The 2023 DSM Plan is intended to provide program details and projected cost-effectiveness results for FEI's proposed portfolio of DSM program area activity over the 2023 time period.

The following subsections describe FEI's consultation with stakeholders undertaken as part of the development of the 2023 DSM Plan, FEI's DSM expenditures forecast by program area, FEI's new and previously approved programs, and FEI's DSM guiding principles.

[9] 2021 approved expenditures pursuant to Order G-126-22.

## 4.1 CONSULTATION

A key input in the development of the 2023 DSM Plan was information gathered through consultation with various program stakeholders and interested parties. FEI undertook an in-depth and varied consultation process which followed these general guiding principles:

- Include any type of interaction (whether oral or written) that allows adequate expression and consideration of views;
- Make a genuine effort which allows sufficient time for feedback;
- Consultation involves the statement of a proposal not yet finally decided on, listening to what others have to say, considering their responses, and then deciding what to do;
- Make available sufficient information to enable parties who are consulted to be adequately informed and therefore able to make "intelligent and useful" responses;
- Agreement is not required (although consultation does require more than mere telling, or presenting);
- "Consultation" is not equated with "negotiation". Negotiation implies a process that has as its objective arriving at agreement. Strive for something mutually agreeable but not something which is expected to get agreement across the board;
- Approach the matter with an open mind, and be prepared to change or even start a process afresh; and
- Provide reasonable opportunity for interested parties to provide feedback.

FEI engaged in and documented just under 60 consultation interactions related to the 2023 DSM Plan. Examples of consulted entities include: communities, customers, contractors, manufacturers, Indigenous groups, energy advisors, interest groups, partners, program implementers, post secondary institutions, and the Energy Efficiency and Conservation Advisory Group (EECAG). The forms of consultation included workshops, webinars, surveys, and individual outreach. FEI also provided confidential draft versions of the 2023 DSM Plan to EECAG members for review and input.

Most of the key learnings from these consultations was market data refinement which was then considered and assessed within program plans and included ideas for program design and how to expand programs and program reach. A consistent piece of feedback received from the consultations was general endorsement for how DSM is managed and operated by FEI. Satisfaction appeared to be high for FEI in this area and none of the consultations suggested that any significant change in approach was required.

FEI also received directional feedback from the consultations. This feedback included the following:

- Continue to support Energy Advisors;
- More education, training and resources for customers, contractors and consultants;
- Broaden the collaboration within the value chain;
- Energy concierge and financing support needed for deep energy retrofits;
- Support hybrid systems and gas heat pump adoption;
- Expand eligible measure set; and
- Expand Indigenous specific support.

This feedback was taken into account in the development of the 2023 DSM Plan. Given this consultation process, FEI believes that the 2023 DSM Plan includes a fair representation of stakeholder and customer interests and is positioned well to achieve the energy savings forecast within.

## 4.2 *DSM EXPENDITURE FORECAST BY PROGRAM AREA*

FEI is requesting acceptance of DSM expenditures for 2023 of $141.077 million. FEI is forecasting annual DSM expenditures in each of the program areas as outlined in Table 4-1. These expenditures are stated in “as-spent” dollars. If accepted, these are the values that FEI will report actual spending against in its Annual DSM Reports. These are the same values shown in Exhibit 1 of the 2023 DSM Plan (Appendix A).

**Table 4-1: FEI DSM Expenditures - 2023 Forecast, Shown in As Spent Dollars**

| Program Area | Incentives | Non-Incentives | Total Expenditures |
|---|---|---|---|
| Residential | 39,196 | 4,798 | 43,994 |
| Commercial | 21,442 | 5,128 | 26,570 |
| Industrial | 5,787 | 1,061 | 6,848 |
| Low Income | 10,348 | 2,903 | 13,251 |
| Conservation Education and Outreach | - | 9,713 | 9,713 |
| Innovative Technologies | 18,838 | 7,122 | 25,960 |
| Enabling Activities | 5,662 | 6,349 | 12,010 |
| Portfolio Activities | - | 2,730 | 2,730 |
| **Total ($000s)** | **$101,273** | **$39,804** | **$141,077** |

The table above provides forecast 2023 DSM expenditures, including increases compared to 2022 as noted in Table 3-1 for the Residential, Commercial, Low Income, Conservation Education and Outreach, Innovative Technologies, and Enabling areas. The main drivers of the increases in expenditures compared to 2022 are as follows.

- The forecast increase in expenditures in the Residential program area is primarily due to higher program participation and the inclusion of Part 9 Residential BC Energy Step Code 5 homes in the Residential program area that were previously supported in Innovative Technologies.
- The forecast increase in expenditures in the Commercial program area is primarily due to support for Gas Absorption Heat Pumps in Prescriptive and Performance Programs.
- The forecast increase in expenditures in the Low Income program area is primarily due to the increased support in the Direct Install Program.
- The forecast increase in expenditures in the Conservation Education and Outreach program area is primarily due to the increase in funding in community initiatives.
- The forecast increase in expenditures in the Innovative Technologies program area is primarily due to offers focused on Deep Retrofits, Gas Heat Pumps and additional planned pilots including Residential dual fuel (or hybrid) heating.
- The forecast increase in expenditures in the Enabling program area is primarily due to an increase within Codes and Standards with continued support in adoption of the Part 9

Residential BC Energy Step Code and expanded efforts in the Trade Ally Network which support industry training and trade partners.

- The forecast decrease in expenditures in the Industrial program area is due to short-term fluctuation of committed participants within the performance program for 2023.

Further details on the forecast expenditures for each program area can be found in the 2023 DSM Plan (Appendix A).

## 4.3 *NEW AND PREVIOUSLY APPROVED PROGRAMS*

The program structure listed in the 2023 DSM Plan includes the existing programs from the 2019-2022 DSM Plan period. In some cases, new measures have been added to existing programs. Any new measures are cited in the applicable program area section of the 2023 DSM Plan.

Table 4-2 below lists the programs and activities from the 2023 DSM Plan compared to how they have been most recently labeled in the 2021 Annual Report. In the Residential, Commercial, and Low Income program areas, some previously approved programs have been consolidated. The 2023 DSM Plan (Appendix A) provides further program details and program descriptions.

**Table 4-2: Program Area Structure**

| 2021 Annual Report | 2023 DSM Plan |
|---|---|
| **Residential** | |
| Home Renovation Rebate Program | No Change |
| New Home Program | No Change |
| Rental Apartment Efficiency Program (RAP) *Residential Portion* | Consolidated RAP under Commercial |
| **Commercial** | |
| Prescriptive Program | Prescriptive |
| Performance Program – Existing Buildings | No Change |
| Performance Program – New Buildings | No Change |
| Rental Apartment Efficiency Program (RAP) *Commercial Portion* | Consolidated Residential RAP under Commercial |
| **Industrial** | |
| Performance Program | No Change |
| Prescriptive Program | No Change |
| Strategic Energy Management Program | No Change |

| 2021 Annual Report | 2023 DSM Plan |
|---|---|
| **Low Income** | |
| Self Install Program | No Change |
| Direct Install Program | No Change |
| Prescriptive Program | No Change |
| Support Program | No Change |
| Performance Program | Previously included under Support Program |
| **Conservation Education & Outreach** | |
| Residential Customer Engagement Tool | Customer Engagement Tool |
| Residential Education Program | No Change |
| Commercial Education Program | No Change |
| School Education Program | No Change |
| **Innovative Technologies** | |
| Technology Screening | Technology Screening Studies |
| Pilot Project Expenditures | Pilot Projects - Dual Fuel Hybrid Heating |
| | Pilot Projects - Gas Heat Pump |
| | Pilot Projects – Other Projects |
| Deep Retrofits – Residential | Pilot Projects – Deep Retrofits |
| Deep Retrofits – Commercial | |
| **Enabling Activities** | |
| Trade Ally Network | No Change |
| Codes and Standards | No Change |
| Conservation Potential Review[10] | No Change |
| Reporting Tool & Customer Application Portal | No Change |
| Customer Research | No Change |
| Commercial Energy Specialist Program | No Change |
| Community Energy Specialist Program | No Change |

[10] FEI will not be seeking expenditure for Conservation Potential Review for the 2023 DSM Plan period.

## 4.3 DSM GUIDING PRINCIPLES

FEI's DSM guiding principles are listed below.

1. Programs will have a goal of being universal, offering access to energy efficiency and conservation for all residential, commercial and industrial customers, including low income customers.
2. C&EM expenditures will have a goal of incentive costs exceeding 50 percent of the expenditures in a given year.
3. C&EM expenditure schedule plans and results will be analyzed on a program, sector and portfolio level basis, with acceptance based at the portfolio level.
4. The combined Total Resource Benefit/Cost, including the Modified Total Resource Benefit/Cost where applicable, of the Portfolio will have a ratio of 1 or higher.
5. FEI will submit its annual DSM Report to the BCUC, by the end of the first quarter of each year that details the results of the previous year's activity.
6. The DSM Plan will be compliant with the applicable sections of the UCA and the Clean Energy Act, and with the DSM Regulation as amended from time to time.
7. FEI will seek collaboration for programs from other parties, such as governments, other utilities, and equipment suppliers and manufacturers in recognition of the broader societal benefits resulting from successful program development and implementation.
8. Conservation Education and Outreach will be an integral part of FEI's DSM activities.
9. DSM expenditure schedules will be multi-year so as to create the funding certainty necessary to support effective implementation in the marketplace.[11].
10. Programs will support market transformation by incenting efficient measures through customers and/or trade allies (contractors, equipment manufacturers, distributors, retailers, etc.), developing trade ally capacity, and supporting codes and standards development and implementation.
11. FEI will retain a DSM stakeholder group (EECAG), comprised of government, industry, trades, manufacturers, non-governmental organizations, advocacy groups, other utilities and customers to provide it with strategic advice. Additionally, FEI will undertake program area specific stakeholder consultation(s) on effective program design and implementation.

FEI will continue to be guided by these principles in designing and carrying out its DSM program activities.

[11] This Application proposes a one-year DSM Plan to enable time for new provincial legislation with the intent to follow with a four-year DSM Plan.

# 5. COST EFFECTIVENESS APPROACH

## 5.1 *COST-EFFECTIVENESS UNDER THE DSM REGULATION*

FEI's proposed DSM portfolio for 2023 is cost effective, with a Portfolio (TRC/MTRC hybrid) cost effectiveness result of 1.4, based on the methodology set out in section 4 of the DSM Regulation. FEI submits that the current approach to determining the cost-effectiveness of its DSM programs is comprehensive, benefits customers and should be used for 2023. The following sections explain these cost-effectiveness tests and demonstrate that the 2023 DSM Plan meets the requirements of the DSM Regulation.

### 5.1.1 Portfolio-Level Analysis

Section 4(1) of the DSM Regulation stipulates that the BCUC, in determining the cost-effectiveness of a demand-side measure proposed in an expenditure portfolio or a plan portfolio, may compare the costs and benefits of (a) a demand-side measure individually, (b) with other demand-side measures in the portfolio or (c) the portfolio as a whole.

The portfolio-level analysis (option (c) above) remains the appropriate method for testing the cost-effectiveness of the 2023 DSM Plan for the following reasons:

- The portfolio approach to measuring the cost-effectiveness of DSM expenditures has been in place for many years and remains an effective means of assessing the performance of DSM activities. The BCUC first determined that assessment of cost-effectiveness be based on the portfolio as a whole in its decision on FEI's 2008 DSM Application[12] and, since then, has reached the same determination in each of its subsequent decisions on FEI's DSM expenditure applications. Continued use of the portfolio approach will provide more flexibility for FEI to implement programs that meet customer needs while addressing the requirements of the DSM Regulation and maintaining a cost-effective portfolio. Alternatively, implementing cost effectiveness at some level below the Portfolio, such as at the program area or individual program level, is likely to be more restrictive on programs for some customer groups (Residential customers, for example) due to more restrictive cost-effectiveness requirements.

[12] Order G-36-09.

- According to Sections 4(4) and 4(5) of the DSM Regulation, the BCUC must, at a minimum, use the portfolio approach in assessing the cost effectiveness of "specified demand-side measures"[13] and "public awareness programs".[14]

- A portfolio approach to cost-effectiveness analysis promotes FEI's goal of making DSM accessible to all customers. Residential programs, for example, often have difficulty passing the Total Resource Cost test (TRC) and even the modified TRC test (MTRC) per the DSM Regulation on a program-by-program basis, and low income programs are especially challenged by the cost-effectiveness test. Moving away from a portfolio approach might result in fewer DSM programs being available to residential and low-income customers.

- The portfolio approach permits FEI to encourage increasing levels of efficiency in natural gas equipment. Equipment that is relatively new to the market may have a higher initial cost due to the fact that it has not yet reached economies of scale. A program based on such equipment is more likely to have low TRC and MTRC results. Although the near-term results of such a program might be unfavourable, the long-term prospects for such equipment to provide benefits to customers could be significant. The Portfolio level cost-effectiveness analysis can absorb some of these types of programs without failing the cost-effectiveness tests.

To ensure that the portfolio meets a combined TRC/MTRC of 1 on an annual basis, FEI will continue its practice of monitoring DSM programs on a monthly basis. This practice will allow FEI to identify trends in cost-effectiveness related to program and portfolio expenditures and make adjustments as needed. For information purposes, FEI will also continue to report on individual DSM program cost-effectiveness results in its DSM Annual Reports along with the individual program cost-effectiveness projections provided in the 2023 DSM Plan included as Appendix A.

### 5.1.2 Total Resource Cost Test

The TRC is calculated at the Portfolio level by comparing the costs of the portfolio to the total value of the benefits of the programs contained in the portfolio. The DSM Regulation also includes special consideration for specified measures (Section 4(4)) and low income programs (Section 4(2)). The cost-effectiveness of a specified demand-side measure must be determined by the cost effectiveness of the portfolio as a whole.

The DSM Regulation also includes special treatment for specified measures (section 4(4)) and low income programs (section 4(2)). Specifically, section 4(4) of the DSM Regulation states that

[13] "Specified demand-side measures" include: education programs for students, funding for energy efficiency training, funding for codes and standards development, funding to support development of or compliance with a specified standard, a community engagement program and a technology innovation program.

[14] A "public awareness program" means a program delivered by a public utility (a) to increase the awareness of the public, including the public utility's customers, to conserve energy or use energy efficiently, or (b) increase participation by the public utility's customers in other demand-side measure activities proposed by the public utility.

the cost-effectiveness of a "specified demand-side measure" must be determined by the cost effectiveness of the portfolio as a whole. Under section 1 of the DSM Regulation, specified demand-side measures include: education programs; energy efficiency training; community engagement programs; technology innovation programs; and resources supporting the development of energy conservation or efficiency standards. FEI has specified demand-side measures within its Conservation Education and Outreach, Innovative Technologies and Enabling Initiatives program areas.

For a demand-side measure intended specifically to assist residents of low-income households (which would include the activity defined within FEI's Low Income program area) the BCUC must use, "in addition to any other analysis the BCUC considers appropriate," the TRC test and in doing so for natural gas programs include the Zero Emission Energy Alternative (ZEEA - see Section 7.1.3.1 below) as the avoided cost and then increase the value of the benefit of the DSM measure by 40 percent. FEI has applied this approach in the cost-effectiveness analysis of the Low Income programs presented in the 2023 DSM Plan.

### 5.1.3 Modified Total Resource Cost Test

Subsections 4(1.1) and (1.5) of the DSM Regulation allow for the use of a MTRC for up to 40 percent of the natural gas DSM portfolio, excluding specified demand-side measures. FEI manages its activities to stay within this MTRC Cap, as shown in Exhibit 4 of the 2023 DSM Plan (Appendix A). The MTRC includes two additional components described below: the use of a zero-emission energy supply alternative (ZEEA) in determining avoided cost of energy for DSM, and the inclusion of non-energy benefits (NEB) to customers and the utility. At the portfolio level, the combination of the MTRC benefits for those programs that require use of the MTRC and the TRC benefits for all other programs are compared to the portfolio costs in what is referred to as the 'Portfolio' test in Table 5-1 below and in Exhibit 3 of Appendix A. A 'Portfolio' test result of one or better means that the Portfolio as a whole passes the required cost effectiveness test under the current and applied for method discussed in Section 7.1.1.

#### *5.1.3.1 Zero-Emission Energy Supply Alternative (ZEEA)*

The benefits of demand side measures in the standard TRC calculation include the avoided cost of new energy transmission capacity and the avoided cost of the energy. In calculating the MTRC, the ZEEA is applied to these standard benefits in determining the avoided cost of energy. Use of the ZEEA recognizes that avoiding natural gas use has similar GHG emission reduction benefits to that of employing clean electricity to meet that energy need. The ZEEA is defined in the DSM Regulation as BC Hydro's long run marginal cost (LRMC) of acquiring electricity generated from clean or renewable resources in British Columbia.

At the time of writing, the ZEEA value used in the MTRC calculation is $106/MWh[15], or 29.45/GJ. The source for this number is BC Hydro's Waneta 2017 Transaction Application to the BCUC that established BC Hydro's LRMC at $106/MWh in F2018$.[16] This value is consistent with the value used to calculate the MTRC for FEI's DSM 2021 Annual Report. For Low Income programs the ZEEA is applied when calculating the TRC (see Section 7.1.2).

#### *5.1.3.2 Inclusion of Non-Energy Benefits*

Section 4(1.1)(c) of the DSM Regulation requires the BCUC to allow the inclusion of Non-Energy Benefits (NEBs), the amount of which may be determined either by the BCUC based on evidence from the utility or by using a deemed 15 percent adder to the benefits side of the MTRC calculation. FEI has chosen to use the 15 percent NEB adder in its MTRC calculations for the 2023 DSM Plan.

## 5.2 *COST EFFECTIVENESS RESULTS*

While the TRC and mTRC continue to be the governing tests that FEI uses to determine the cost-effectiveness of its DSM Plan on a portfolio basis, the Company has also historically reported and considered a range of other industry standard cost-effectiveness tests, including the Ratepayer Impact Measure (RIM)[17], the Utility Cost Test (UCT)[18] and the Participant Cost Test (PCT)[19] applied at the program, program area, and portfolio levels. These cost-effectiveness tests are from the California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects (California Manual)[20]. **Error! Reference source not found.** shows the standard test results at the portfolio level and demonstrates that the 2023 DSM Plan is cost effective under the standard TRC test and also under the mTRC, UCT and PCT tests. Although the 2023 DSM Plan does not pass the RIM test, the BCUC may not determine that a proposed DSM measure is not cost effective based on the result of the RIM test.[21]

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[15] FEI notes that BC Hydro has suggested a new, lower LRMC value in their 2021 Integrated Resource Plan, but since BC Hydro's Integrated Resource Plan remains under review by the BCUC, FEI has not included it for the purposes of the one-year DSM Plan, as it has yet to be determined, per the DSM Regulation, that "the commission is satisfied" that this new value "represents the authority's long-run marginal cost of acquiring electricity generated from clean or renewable resources in British Columbia".

[16] Table 3 on Page 19 of 90, Appendix N, British Columbia Hydro and Power Authority Waneta 2017 Transaction Application ~ Project No.1598933, http://www.bcuc.com/ApplicationView.aspx?ApplicationId=604.

[17] The Ratepayer Impact Measure (RIM) test measures what happens to customer bills or rates due to lost utility revenues and recovery of costs caused by the program (incentives + administration) less avoided costs (e.g. power purchase reductions).

[18] Referred to as Program Administrator Cost Test in the California Manual. The Program Administrator Cost Test measures the net costs of a demand side management program as a resource option based on the costs incurred by the program administrator (including incentive costs) less avoided costs e.g. power purchase reductions.

[19] The Participants Test is the measure of the quantifiable benefits (Utility incentive, reduction in utility bills) and costs (principally the Measure cost) to the customer due to participation in a program.

[20] California Public Utilities Commission, 2001. California Standard Practice Manual – Economic Analysis of Demand Side Program and Projects. Retrieved from: https://www.cpuc.ca.gov/-/media/cpuc-website/files/uploadedfiles/cpuc_public_website/content/utilities_and_industries/energy_-_electricity_and_natural_gas/cpuc-standard-practice-manual.pdf.

[21] Demand Side Measures Regulation, Section 4 (6).

**Table 5-1: 2023 DSM Plan Portfolio Level Cost Effectiveness Results – All Tests**

| | TRC | Portfolio | UCT | PCT | RIM |
|---|---|---|---|---|---|
| Total Portfolio | 0.7 | 1.4 | 0.7 | 2.0 | 0.4 |

Note to Table: The cost effectiveness test result called 'Portfolio' in this Table reflects the use of the modified total resource cost test (MTRC) for up to 40 percent of the portfolio per the DSM regulation as explained in Section 7.1.3 below.

# 6. EVALUATION, MEASUREMENT & VERIFICATION

FEI considers Evaluation, Measurement and Verification (EM&V) to be an important aspect of the overall DSM program lifecycle. Program evaluation is critical for assessing program performance in order to identify program improvements as well as assess the measure and program assumptions used to calculate program cost effectiveness. Evaluation plans are developed at the program design stage and re-examined later when more program information is available. As more programs reach maturity and enough program data becomes available, FEI will complete more program evaluations at appropriate times in the program life cycles. Two key aspects of FEI's EM&V activities are addressed in the following discussion: the Evaluation Plan, and FEI's EM&V Framework.

## 6.1 *EVALUATION PLAN*

Appendix E contains FEI's DSM Evaluation Plan covering 2023 for its EM&V activities, including evaluations for process, impact, market analysis and communications, as well as measurement and verification activities for its current and planned DSM programs and pilots. Overall program expenditures reported in Section 5.2 include costs for EM&V activities: however, the EM&V costs are also reported in the Evaluation Plan to provide an easy-to-view summary of the evaluation expenditures together with this one-year Evaluation Plan. The total proposed expenditure for program evaluation and M&V activities to be conducted from 2023 is approximately $2.9 million or 2 percent of FEI's overall planned portfolio expenditures. This proposed budget aligns with FEI's EM&V Framework, historical evaluation expenditures, and industry general practice for budget spending on EM&V activities.

In preparing the Application, FEI considered the results of more recent industry surveys on evaluation expenditures. Survey results obtained from E Source, an energy efficiency consultancy serving gas and electric utilities throughout North America, indicate that for utilities with DSM expenditures of between US$32 and US$100 million, evaluation budgets are on average 2.7 percent, and that the proportion of DSM expenditures on evaluation decreases as the size of the portfolio increases.[22] Utilities with expenditures greater than US$100 million tend to spend just under 2.1 percent on evaluation. The Consortium for Energy Efficiency (CEE) found that Canadian utilities spent about 3 percent of their overall DSM budgets on evaluation.[23]

It is important to note the definitions that are used for what is and is not included in the EM&V budgets vary significantly between utilities and program administrators. FEI has carefully considered evaluation needs and submits that its evaluation plan is adequate to conduct the appropriate number of program evaluations and effective in keeping evaluation expenditures at a reasonable level consistent with its EM&V Framework and in comparison to other jurisdictions.

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[22] E Source Poster: How Much do Utilities Spend on Evaluation? 2019. Prepared from data available in E Source DSM Insights 2019.

[23] CEE Annual Industry Report – State of the Efficiency Program Industry, Section 4. Consortium for Energy Efficiency, 2020.

## 6.2 EM&V Framework

FEI developed an EM&V Framework in 2012 documenting the background, objectives, principles and general practices that guide FEI's approach, resources and timeframes for EM&V activities. The framework addressed the BCUC's directive from the 2012-2013 RRA Decision.[24] The EM&V Framework was finalized in 2013 and updated in 2018 taking into consideration feedback received from the EECAG and FEI's evaluation partners. FEI has since been conducting EM&V activities in keeping with the 2018 update of the EM&V Framework. FEI will continue to review industry standards and best practices to ensure the EM&V Framework is up to date.[25] Appendix F contains the current EM&V Framework.

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24 https://fbcdotcomprod.blob.core.windows.net/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/g-44-12_feu-2012-13rr-decision-web.pdf.

25 The Companies refer to the California Evaluation Framework. June 2004. TecMarket Works, IPMVP – Concepts and Options for Determining Energy and Water Savings. Efficiency Valuation Organization. January 2012. for guidance of the industry standards and best practices.

# 7. ADDITIONAL APPROVALS SOUGHT

## 7.1 *FUNDING TRANSFERS AND VARIANCES*

The following sections detail FEI's proposed changes to the funding transfer rules within the DSM portfolio that were previously approved as part of its 2019-2022 DSM Expenditure Plan Application and proposes an additional allowed percentage variance to the total portfolio expenditures in the final year of the Plan.

Section 7.1.1 details FEI's proposed changes for the rules for transfers between Program Areas within the same year (funding transfer);

Section 7.1.2 details FEI's proposal for an allowed percentage variance above the approved DSM expenditures for the 2023 DSM Plan.

### 7.1.1 Funding Transfers

The FortisBC Energy Utilities (FEU) 2012 and 2013 Revenue Requirements and Natural Gas Rates Decision (RRA Decision) established the current rules with respect to FEI's ability to transfer DSM funding under an approved DSM expenditure schedule as follows:

> Accordingly, the Commission approves the movement of funding to a maximum of 25 percent from one approved Program Area to another approved Program Area without prior approval of the Commission. In cases where a proposed transfer into an approved Program Area is greater than 25 percent of that approved Program Area, prior Commission approval is required. Finally, the transfer of funds … to Innovative Technologies … will require prior Commission approval.[26]

It should be noted that as with all plans, the 2023 DSM Plan is subject to change in response to changes in market conditions, customer responses to programs, input from stakeholders including program partners, and changes in government policy. FEI requires the flexibility to be able to adjust to new information, program results and opportunities through the test period without the time required for a full BCUC review.

FEI agrees that the funding transfer rules established for the 2012-2013 test period and retained for the 2014-2018 and 2019-2022 periods provide some flexibility to respond to changes in the execution of its DSM programs. However, FEI is proposing some changes to the rules to overcome some of the challenges of working within the transfer rules. These proposed changes still provide the necessary boundaries to ensure that the DSM portfolio still aligns with the approved portfolio deemed to be in the public interest.

FEI is proposing the following changes to the funding transfer rules:

[26] BCUC Order G-44-12, page 173.

- **Remove the requirement for approval of transferred funds into a program area:** FEI is proposing that only the transfer of funds greater than 25 percent **out of** a program area should be required. This change ensures that the limits on the amount any one program area can lose funding are still in place but eliminates the limits on how much one program area can gain. FEI submits that the greater concern in executing the portfolio is ensuring that no program area is reduced significantly to the benefit of another program area. FEI would still report on transfers into and out of program areas in its annual reporting to the BCUC.
- **Remove the requirement of prior approval:** FEI will endeavor to file for approval as soon as it is aware that a transfer above 25 percent is required; however, often it is not known for certain until it is about to occur or already occurring. Additionally, it is difficult to forecast the exact amount of the transfer above 25 percent ahead of its occurrence, and time is required to draft and submit an application to the BCUC.
- **Including Innovative Technologies Program Area in the Transfer Rules:** The following section 7.1.1.1 provides further explanation of why it is appropriate to include the Innovative Technologies Program Area within the transfer funding rules.

In summary, FEI is requesting the following funding transfer rules to be in place for its 2023 DSM Plan:

> In cases where a proposed transfer out of an approved program area is greater than twenty five percent of that program area's accepted expenditures for the year in question, BCUC approval is required.

#### *7.1.1.1 Transferring Funds into and out of Innovative Technologies*

The Innovative Technologies Program Area was originally excluded from the Funding Transfer Rules in the RRA Decision due to the technologies in this program area being separately reviewed in the BCUC's Alternative Energy Services Inquiry (AES Inquiry)[27]. Specifically, the Innovative Technologies program area funding request for 2012 and 2013 included expenditures for Natural Gas Vehicles, an activity that was separately being addressed in the AES Inquiry. At the time of the BCUC's Decision and Order G-44-12, the issue regarding the approval to expend C&EM (previously Energy Efficiency and Conservation (EEC)) funds for activity relating to Natural Gas Vehicles was outstanding and therefore the BCUC excluded the Innovative Technologies Program Area from the Funding Transfer Rules.

FEI respectfully submits that it is now appropriate to include the Innovative Technologies Program Area in the Funding Transfer Rules and allow FEI to transfer expenditures up to 25 percent of the program area budget into the program area without BCUC approval for the following reasons:

[27] BCUC Order G-44-12, page 175.

- There are no programs or technologies within this program area that are being reviewed in separate regulatory processes as was the case for FEI's 2012 and 2013 DSM expenditure request; and
- The programs within the Innovative Technologies Program Area do not contain expenditures for programs or technologies that are also FortisBC Alternative Energy Services (FAES) projects.
- Due to the rapid developments within this Program Area, funding flexibility is important to be able to nimbly adjust to support new opportunities as they emerge or to be able to transfer funding to other program areas should funding requirements become lower than anticipated.

Including Innovative Technologies within the Funding Transfer Rules will allow FEI the same flexibility it currently has for the rest of its program areas to respond to changes in the market within 25 percent of the overall approved budget.

### 7.1.2 Total Portfolio Variance Allowance

FEI is seeking approval of an allowed variance above the accepted DSM expenditure amount in the final year of a DSM expenditure schedule without prior approval from the BCUC. In the case of the 2023 DSM Plan, FEI is proposing that actual DSM expenditures may exceed 2023 accepted DSM expenditures by no more than five percent without prior approval from the BCUC. This means that FEI has additional flexibility to overspend 2023 approved expenditures by $7.1 million.

FEI will continue to seek to spend the accepted expenditure amount, However, it is difficult to accurately forecast to the level of precision where FEI will spend exactly 100 percent of its DSM portfolio and no more or less. Actual DSM Plan expenditures are determined by many factors outside FEI's control, including changes in market conditions and customer responses to programs. In FEI's view, a variance allowance of five percent provides the necessary flexibility to respond to any conditions outside of FEI's control that might require additional spending above approved.

Therefore, FEI is requesting the following variance allowance rule be in place for its 2023 DSM Plan:

> FEI is permitted to exceed total accepted expenditures in the final year of a DSM expenditure schedule by no more than five percent without prior approval from the BCUC.

The funding transfer rules and the variance allowance will all serve to provide FEI with the flexibility to manage its DSM portfolio more effectively.

## 7.2 Accounting Treatment

FEI is proposing to increase the amount it includes in in its rate base DSM Deferral account on a forecast basis from the currently approved $30 million to $60 million, effective for 2023. This is consistent with FEI's actual historical DSM spending (as shown in Figure 4-1) and with the spirit of the Decisions accompanying Orders G-44-12 and G-10-19 as described further below.

Under the current approved treatment, $30 million of expenditures are forecast in the rate base DSM Deferral account each year and the difference between the $30 million forecast and actual/projected expenditure levels, up to the approved amount, are accounted for in FEI's non-rate base DSM Deferral account, attracting a weighted average cost of capital (WACC) return. The closing balance of the non-rate base DSM Deferral account is then transferred to FEI's rate base DSM Deferral account at the beginning of the following year.

As background, FEI received approval from the BCUC to increase its then-existing $15 million rate base account limit to $30 million per year as part of its 2019-2022 DSM Application, as expenditures had been consistently greater than $30 million per year under the DSM portfolio over the preceding three years (2015 to 2017). The BCUC approved FEI to include $30 million in forecast annual additions to the rate base DSM Deferral account for the years 2019 through 2022.[28]

As shown in Figure 4-1, DSM expenditures have exceeded $60 million for the past three years (2019 through 2021), and FEI's expenditures are forecast to exceed $100 million for years 2022 and 2023. FEI expects that at least that level of expenditures to be maintained for the foreseeable future. Aligning the amount forecast in the rate base DSM Deferral account each year more closely with the actual expenditures reduces the financing costs added to the deferral account, and reduces overall costs to customers on the non-rate base portion of the DSM Plan expenditures. As per existing approved practice, FEI will account for the balance of spending, up to the approved FEI funding amount and greater than $60 million, in FEI's non-rate base DSM Deferral account. Consistent with approved practice, the ending balance of the non-rate base DSM Deferral account will be transferred to FEI's rate base DSM Deferral account at the beginning of the following year. FEI's rate base DSM deferral account will continue to be amortized in rates over the approved amortization period of 10 years.

## 7.3 2023 DSM Expenditure Schedule Deferral Account

FEI is also seeking approval within this Application of a rate base deferral account to capture the regulatory costs associated with the review of this Application and proposes to amortize the costs over one-year starting in 2023 to match the time period that the DSM Plan will be in place.

[28] Appendix A to Order G-10-19, page 19.

# 8. CONCLUSION

The 2023 DSM Plan is a continuation of all of the cost-effective programs previously accepted in FEI's 2019-2022 DSM Plan[29], with some additions and modifications including activities that support the transition to advanced DSM programming such as deep retrofits, gas heat pumps and dual fuel hybrid heating systems. FEI is filing a one-year plan because new policy direction included in the late-2021 CleanBC Roadmap to 2030 is anticipated to result in changes to the DSM Regulation before 2024 that are likely to have implications for FEI's DSM portfolio.

As set out in the Application, FEI's proposed DSM expenditure schedule is consistent with British Columbia's energy objectives and FEI's 2022 LTGRP, meets the adequacy and cost-effectiveness requirements of the Demand-Side Measures Regulation, and responds to government policy encouraging an increase in DSM to support greenhouse gas (GHG) emission reduction targets.

The Application demonstrates that the proposed DSM expenditures are in the public interest and FEI requests that they be accepted by BCUC.

[29] Order G-10-19.

# Appendix A

# FEI 2023 DSM PLAN

# FortisBC Energy Inc. (FEI)
# 2023 DSM Expenditures Plan Report

## **Final Report**

Date: 30 June 2022

**Posterity Group**
**43 Eccles St, 2nd Floor – Unit 2**
**Ottawa, ON K1R 6S3**

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# 1 Introduction

## 1.1 Background and Objectives

This 2023 Demand Side Management (DSM) Plan covers the 2023 FortisBC Energy Inc. (FEI) Conservation and Energy Management (C&EM) funding request for the following previously approved energy efficiency program areas and supporting initiatives:

- Residential
- Commercial
- Industrial
- Low Income
- Conservation Education and Outreach
- Innovative Technologies
- Enabling Activities
- Portfolio Level Activities

This DSM Plan covers all of FEI's natural gas service territory. In addition, this plan includes details of the programs and measures under each program area, along with their associated costs, energy savings, and the results of their cost-effectiveness.

Many of the programs in this DSM plan are part of FEI's existing DSM portfolio previously accepted in the 2019 – 2022 DSM Expenditure Plan and subsequent applications for updated and additional DSM expenditures for 2021 to 2022. The activities and measures within some of the programs have been updated, and several new initiatives have been added within the approved program areas. The updates reflect FEI's on-going efforts to respond to changing market conditions and to integrate operational lessons learned from current implementation activities.

As with all plans, this DSM Plan is subject to changes in market conditions, customer responses to programs, consultation input from stakeholders, including program partners, and changes in government direction and policy. Therefore, information and forecasts listed in the Program Profiles represent best estimates as of the filing of this DSM Plan and are subject to adjustments, as required.

## 1.2 Approach

The DSM Plan project team completed the following major steps to develop this DSM Plan:

- Reviewed current programs, the most recent DSM plan, recent annual DSM reports, and other relevant regulatory filings
- Reviewed and extracted guidance from 2021 Long Term Gas Resource Plan (LTGRP) and 2021 Conservation Potential Report (CPR)
- In collaboration with FEI program managers, discussed and finalized strategic direction (for each program and for the overall portfolio) and program functions

- Conducted interviews with program managers to discuss each program's successes, barriers, possible improvements, and planned activities
- Developed draft DSM portfolio budget and program options
- Gathered feedback from internal and external stakeholders such as program managers, FEI management team, and Energy Efficiency & Conservation Advisory Group (EECAG)[1]
- Revised and finalized budget, program offerings, measures, and cost effectiveness results

## 1.3 Report Organization

The remainder of this DSM Plan is organized in the following sections:

- Section 2 provides a summary of the overall **DSM Portfolio**.
- Section 3 describes the individual programs and their savings and cost-effectiveness results for the **Residential Program Area**.
- Section 4 describes the individual programs and their savings and cost-effectiveness results for the **Commercial Program Area**.
- Section 5 describes the individual programs and their savings and cost-effectiveness results for the **Industrial Program Area**.
- Section 6 describes the individual programs and their savings and cost-effectiveness results for the **Low Income Program Area**.
- Section 7 describes the individual programs and their budgets for the **Conservation Education and Outreach**.
- Section 8 describes the **Innovative Technologies** activities that are required for the 2023 DSM Plan period and their budgets.
- Section 9 describes the **Enabling Activities** that are required for the 2023 DSM Plan period and their budgets.
- Section 10 describes the **Portfolio Level Activities** that are required for the 2023 DSM Plan period and their budgets.
- Section 11 provides a summary of the DSM Plan findings.
- Appendix A-1 provides details on the **Sources for the Measure Assumptions**

[1] The Energy Efficiency and Conservation Advisory Group (EECAG) provides insight and feedback on FEI's portfolio of DSM activities and related items.

## 1.4 Notes

The following general notes apply to all sections of this report:

- Totals in the tables may not add exactly due to rounding.
- A “Non-Program Specific Expense” line item is included in the exhibits for each program area. These planned expenditures represent the costs that are attributable to that program area but support multiple programs and, therefore, are not specific to only one program. Generally, these expenditures represent items such as training, travel, marketing materials and consulting services that support the overall program area. The amounts in this plan are based primarily on past reported non-program specific expenses with scaling up factored in as deemed appropriate.

# 2 DSM Program Portfolio Results

## 2.1 Introduction

This section presents an overview and summary of FEI's 2023 DSM Plan. It shows the total proposed expenditures, estimated natural gas savings and the associated cost-effectiveness.

The DSM portfolio has been organized into the following program areas:

- Residential Energy Efficiency Program Area
- Commercial Energy Efficiency Program Area
- Industrial Energy Efficiency Program Area
- Low Income Energy Efficiency Program Area
- Conservation Education and Outreach Initiatives
- Innovative Technologies Program Area
- Enabling Activities

## 2.2 Overall Portfolio Results

The overall DSM program results are summarized in the following exhibits. All exhibits presented in this document present expenditures in 2023 dollars.

- Exhibit 1 provides a summary of expenditures, and represents the total budget requested by FEI for the 2023 DSM plan.
- Exhibit 2 presents the results for the total DSM program portfolio including natural gas and emissions savings, and cost-effectiveness.
- Exhibit 3 presents the annual expenditures for the programs that require the Modified TRC (MTRC) adder and compares these expenses to those of the overall portfolio.
- Exhibit 4 presents the results for the total DSM program portfolio broken down by program area.

Exhibit 1 - 2023 Total DSM Expenditures by Program Area ($000s)

| Program Area | Incentives | Non-Incentives | Total Expenditures |
|---|---|---|---|
| Residential | 39,196 | 4,798 | 43,994 |
| Commercial | 21,442 | 5,128 | 26,570 |
| Industrial | 5,787 | 1,061 | 6,848 |
| Low Income | 10,348 | 2,903 | 13,251 |
| Conservation Education and Outreach | - | 9,713 | 9,713 |
| Innovative Technologies | 18,838 | 7,122 | 25,960 |
| Enabling Activities | 5,662 | 6,349 | 12,010 |
| Portfolio Activities | - | 2,730 | 2,730 |
| **Total ($000s)** | **$101,273** | **$39,804** | **$141,077** |

Exhibit 2 – DSM Portfolio Expenditures, Natural Gas and Emissions Savings, and Cost-Effectiveness

| | Total |
|---|---|
| Utility Expenditures - Incentives ($000s) | $101,273 |
| Utility Expenditures - Non-Incentives ($000s) | $39,804 |
| Utility Expenditures - Total ($000s) | $141,077 |
| Net Incremental Annual Natural Gas Savings (GJ / Year) | 1,601,386 |
| NPV of Net Natural Gas Savings (GJ) | 14,433,377 |
| Net Incremental Annual Emissions Savings (tCO2e / Year) | 82,632 |
| NPV of Emissions Saved (tCO2e) | 744,762 |
| TRC | 0.7 |
| MTRC | 3.3 |
| Portfolio[2] | 1.4 |
| UCT | 0.7 |
| PCT | 2.0 |
| RIM | 0.4 |

[2] Includes the MTRC adder for programs that require it (i.e., TRC/MTRC hybrid)

### Exhibit 3 - Summary of the Expenditures for Programs that Require the MTRC Adder

| Program | Total Expenditures ($000s) |
|---|---|
| Residential New Home | 12,835 |
| Residential Home Renovation | 30,314 |
| **All MTRC Programs** | **43,149** |
| **Entire Portfolio** | **141,077** |
| **Portfolio MTRC Ratio (%)** | **31%** |

### Exhibit 4 – Portfolio Natural Gas Savings and Cost-Effectiveness by Program Area

| Program Area | Incremental Annual Gas Savings, Net (GJ) | NPV Gas Savings, Net (GJ) | TRC | MTRC | UCT | PCT | RIM |
|---|---|---|---|---|---|---|---|
| Residential | 250,319 | 3,096,575 | 0.4 | 1.6 | 0.5 | 1.2 | 0.3 |
| Commercial | 563,816 | 5,881,225 | 1.2 | 5.4 | 1.6 | 2.1 | 0.7 |
| Industrial | 628,423 | 4,658,207 | 2.8 | 14.2 | 4.7 | 3.5 | 1.0 |
| Low Income | 77,408 | 797,369 | 2.1[3] | | 0.4 | 2.2 | 0.3 |
| Conservation Education and Outreach | 81,420[4] | | | | | | |
| Enabling Activities | Savings Not Estimated | | | | | | |
| Innovative Technologies | Savings Not Estimated | | | | | | |
| Portfolio Level Activities | Savings Not Estimated | | | | | | |
| **Total** | **1,601,386** | **14,433,377** | **0.7** | **3.3** | **0.7** | **2.0** | **0.4** |

[3] Section 4 of the BC Demand-Side Measures Regulation, as amended in March 2017, requires the use of the Zero Emission Energy Alternative and a 40 percent benefit adder in calculating the TRC for Low Income programs

[4] These projected energy savings are applicable only to the Customer Engagement Tool and the Portfolio overall. All other energy savings from the Conservation Education and Outreach Program area are not estimated.

# 3 Residential Program Area

In this DSM plan, the Residential Program Area consists of two programs:

- Home Renovation Program
- New Home Program

A third program, the Rental Apartment Efficiency Program (RAP), was, in part, included in the residential portfolio in the previous DSM plan. In this DSM plan, this program is being consolidated under the Commercial Program Area.

The **Home Renovation Program** encourages customers to take a whole home approach to their energy efficiency upgrades by consolidating space heating, water heating and building envelope measures into one overarching program. This program is a collaboration between FEI, other BC utilities and the Ministry of Energy, Mines and Low Carbon Innovation's (EMLI) CleanBC Better Homes program.

Retail offers directed towards the home renovation segment are included in this program. FEI collaborates with BC Hydro, retailers, and distributors to offer point-of-sale incentives on several low-cost and easy to install measures such as washers, dryers, draft proofing, water savers and connected thermostats.

The **New Home Program** aligns with and provides incentives for the tiers of the BC Energy Step Code for Part 9 Buildings, as per the Demand-Side Measures (DSM) Regulation Section 3[5]. The Amendment supports the BC Utilities' ability to provide incentives for builders who adopt and comply with the Energy Step Code in municipalities across BC. FEI, in partnership with FortisBC Inc. (FBC), supports local governments in their adoption of the Step Code as part of an ongoing initiative for market transformation to high performance homes. FEI and its program partners[6] support[7] this adoption through builder and trades outreach, training, and customer education about the benefits of high-performance homes and other initiatives. Rebates for ENERGY STAR appliances in new homes are available for additional energy savings.

The Home Renovation and New Home programs enable FEI customers to reduce their energy consumption and support industry to improve overall home performance. The rebates, policy support, customer and industry engagement are critical to promoting BC's culture of conservation and fostering market transformation to higher efficiency solutions in the residential sector.

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[5] BC Utilities Commission Act, Demand-Side Measures Regulation (BC Reg. 326/2008) Section 3.1 (f), amended March 24, 2017

[6] These initiatives may be partially co-funded by program partners FortisBC Electric (FBC), BC Hydro, the BC Ministry of Energy, Mines and Low Carbon Innovation (EMLI) and BC Housing

[7] Industry support funds may be provided through the Program funding envelope, or where appropriate, the Enabling Activities funding envelopes.

## 3.1 Key Changes in New Plan

Compared with the previous DSM Plan, the 2023 DSM Plan has the following key updates in the Residential program area:

- The Rental Apartment Efficiency Program (RAP) will not be a program under FEI's Residential Program Area. The program has been consolidated under the Commercial Program Area. RAP is administered in collaboration with FBC. In this DSM plan, the program will be included under the commercial program area.
- Step 2 and Step 3 new home code measures are ramped down to align with the BC Building Code updates with focus shifting to the higher Step 4, and 5 measures.
- Addition of high performance windows and doors and comprehensive air sealing as new measures under the Home Renovation Program.
- Removal of residential incentives for non-condensing storage water heaters in both the Home Renovation and New Home programs to further support the transition in condensing technology.

**Collaborations with Utility Partners, Government and Industry**

The Residential Program area will continue to partner with electric utilities (FBC and BC Hydro), government, trade associations, and other partners to increase program awareness and expand activities to support the home performance sector to build capacity and deliver quality workmanship.

## 3.2 Program Budget and Savings

Exhibit 5 shows the annual incentive, non-incentive, and total expenditures for the residential program area by program. Exhibit 6 shows the natural gas savings and cost-effectiveness for each residential program.

Exhibit 5 – Residential Program Area Expenditures by Program ($000s)

| Program Area | Incentives | Non-Incentives | Total Expenditures |
|---|---|---|---|
| Home Renovation | 27,879 | 2,435 | 30,314 |
| New Home | 11,318 | 1,517 | 12,835 |
| Non-Program Specific Expenses | - | 846 | 846 |
| **Total ($000s)** | **$39,196** | **$4,798** | **$43,994** |

Exhibit 6 - Residential Natural Gas Savings and Cost-Effectiveness by Program

| Program Area | Incremental Annual Gas Savings, Net (GJ) | NPV Gas Savings, Net (GJ) | TRC | MTRC | UCT | PCT | RIM |
|---|---|---|---|---|---|---|---|
| Home Renovation | 210, 293 | 2,521,053 | 0.4 | 1.7 | 0.6 | 1.2 | 0.3 |
| New Home | 40,025 | 575,523 | 0.3 | 1.3 | 0.3 | 1.4 | 0.2 |
| Non-Program Specific Expenses | - | - | - | - | - | | |
| **Total** | **250,319** | **3,096,575** | **0.4** | **1.6** | **0.5** | **1.2** | **0.3** |

## 3.3 Program Profiles

### 3.3.1 Home Renovation Program

**Exhibit 7 – Residential Home Renovation Program Details and Expenditures**

| | |
|---|---|
| Program Description | The program will promote energy-efficiency home retrofits in collaboration with Utility Partners, as well as federal, provincial, and municipal governments. In addition to rebates, initiatives include capacity building for trades, ensuring high quality installations and providing opportunities to promote home labeling through EnerGuide home evaluations. |
| Target Sub-Market | Residential |
| New vs. Retrofit | Retrofit |
| Partners | BC Hydro, FortisBC Inc., Municipal, Provincial and Federal Government |
| Sources | Sources for measure assumptions included in Appendix A-1 |

**Exhibit 8 – Residential Home Renovation Program Expenditures by Type**

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | 27,879 |
| Admin | 704 |
| Communication | 398 |
| Evaluation | 107 |

| | |
|---|---|
| Labour[8] | 1,226 |
| Total | $30,314 |

Exhibit 9 – Residential Home Renovation Program Details by Measure

| Measure | Forecasted Participation in 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Furnace | 8,551 | $1,900 | $840 | $100 | 4.52 | - | 18 | 31% | - |
| Communicating Thermostat | 3,420 | $250 | $150 | - | 2.60 | 200 | 12 | 25% | - |
| Communicating Thermostat – Retail | 3,200 | $250 | $100 | - | 2.60 | 200 | 12 | 25% | - |
| Boiler | 300 | $3,200 | $1,000 | $100 | 5.27 | - | 18 | 31% | - |
| Combination System | 600 | $3,091 | $1,200 | $100 | 6.70 | - | 20 | 32% | - |
| EnerChoice Fireplace | 4,500 | $132 | $500 | $100 | 7.40 | - | 15 | 39% | - |
| Condensing Storage Tank Water Heater | 100 | $1,800 | $1,000 | - | 10.10 | - | 13 | 21% | - |
| Condensing Tankless Water Heater | 7,350 | $3,300 | $1,000 | $50 | 11.40 | - | 20 | 21% | - |
| Attic Insulation | 2,006 | $1,326 | $717 | - | 8.70 | - | 30 | 20% | - |

[8] Labour is considered to be an administrative expenditure and has been listed separately throughout all program profiles in this DSM plan in order to clearly identify FEI's estimated labour expenditures.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Insulation | 299 | $2,714 | $900 | - | 20.60 | - | 30 | 20% | - |
| Crawlspace and Basement Insulation | 320 | $838 | $824 | - | 5.30 | - | 30 | 20% | - |
| Other Insulation | 159 | $1,167 | $649 | - | 6.60 | - | 30 | 20% | - |
| Drain Water Heat Recovery | 100 | $738 | $250 | - | 4.25 | - | 25 | 3% | - |
| Bonus Offers | 3,040 | - | $306 | - | - | - | 1 | - | - |
| Appliance Maintenance | 50,000 | - | $35 | - | - | - | 1 | - | - |
| Air Sealing - Contractor Incentive | 2,006 | $2,183 | $500 | - | 16.40 | - | 15 | - | - |
| Draftproofing - Door Sweeps and Frame Kits | 4,400 | $8 | $4 | - | 0.05 | - | 6 | 20% | - |
| Draftproofing - Caulking, Foam, Tapes, Foam Rope | 13,000 | $6 | $3 | - | 0.05 | - | 6 | 20% | - |
| EnergyStar Washer ($25) | 300 | $77 | $50 | - | 1.00 | 69 | 14 | 20% | - |
| EnergyStar Dryer | 10 | $50 | $100 | - | 0.70 | - | 12 | - | - |
| Showerheads and Aerators | 4,630 | $21 | $8 | - | 1.90 | 288 | 10 | - | - |
| High Performance Windows and Doors | 15,000 | $475 | $100 | - | 0.32 | - | 18 | 34% | - |
| **Weighted Average Per Participant** | | $499 | $212 | $14 | 2.1 | 22 | 8.6 | 7.5% | |

### 3.3.1 New Home Program

**Exhibit 10 – Residential New Home Program Details**

| | |
|---|---|
| Program Description | The New Home Program will provide financial incentives in support of energy-efficient building practices for the Residential sector. The program supports the BC Energy Step Code and educates builders and consumers about the benefits of energy-efficient new homes. |
| Target Sub-Market | Residential |
| New vs. Retrofit | New |
| Partners | BC Hydro, FortisBC Inc., Municipal, Provincial and Federal Government |
| Sources | Sources for measure assumptions included in Appendix A-1 |

**Exhibit 11 – Residential New Home Program Expenditures by Type**

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | 11,318 |
| Admin | 355 |
| Communication | 300 |
| Evaluation | 20 |
| Labour | 842 |
| **Total** | **$12,835** |

Exhibit 12 – Residential New Home Program Details by Measure

| Measure | Forecasted Participation in 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| STEP 2 (Single Family Dwelling) | 300 | $2,632 | $3,000 | - | 6.16 | -1 | 30 | 22% | - |
| STEP 2 (Townhome/Rowhome) | 50 | $5,204 | $3,000 | - | 9.51 | 61 | 30 | 23% | - |
| STEP 3 (Single Family Dwelling) | 950 | $4,955 | $4,000 | - | 11.06 | 18 | 30 | 12% | - |
| STEP 3 (Townhome/Rowhome) | 450 | $6,928 | $4,000 | - | 12.90 | -71 | 30 | 12% | - |
| STEP 4 (Single Family Dwelling) | 165 | $9,342 | $6,000 | - | 20.96 | 43 | 30 | 10% | - |
| STEP 4 (Townhome/Rowhome) | 150 | $7,761 | $6,000 | - | 16.64 | -89 | 30 | 10% | - |
| STEP 5 (Single Family Dwelling) | 40 | $17,000 | $10,000 | - | 42.40 | - | 30 | 10% | - |
| STEP 5 (Townhome/Rowhome) | 10 | $12,750 | $10,000 | - | 31.80 | - | 30 | 10% | - |
| Condensing Storage Tank Water Heater | 125 | $1,590 | $1,000 | - | 10.10 | - | 13 | 21% | - |
| Condensing Tankless Water Heater | 1,100 | $1,790 | $1,000 | - | 11.40 | - | 20 | 21% | - |
| Combination Systems | 500 | $3,091 | $1,200 | - | 6.70 | - | 18 | 32% | - |
| Drain Water Heat Recovery | 30 | $580 | $250 | - | 3.37 | - | 30 | 5% | - |
| EnerChoice Fireplace | 750 | $132 | $500 | - | 5.00 | - | 15 | 39% | - |
| Communicating Thermostat | 650 | $250 | $100 | - | 2.60 | 200 | 12 | 25% | - |
| ENERGY STAR Dryers | 50 | $50 | $100 | - | 0.70 | - | 14 | - | - |
| **Weighted Average Per Participant** | | **$3,079** | **$2,127** | **-** | **9.3** | **21** | **21.9** | **22%** | **-** |

# 4 Commercial Program Area

In this DSM plan, the Commercial Program Area consists of four programs:

- Prescriptive Program
- Performance Program - Existing Buildings
- Performance Program - New Buildings
- Rental Apartment Efficiency Program

The **Prescriptive Program** offers rebates for the purchase and installation of specific qualifying measures. All such rebates conform to a simple archetype: market participants are informed of the fixed rebate amounts, qualifying measures are installed at a customer's location, and the rebates are provided to reduce the capital cost of the higher efficiency measures. Program delivery includes various adaptations of the archetype to suit the specific nature of both the measures and the target markets. For example, some rebates may be delivered directly to the end user, whereas others may see the rebate provided to midstream market actors, such as a product supplier. Communication materials and channels are adapted to suit the requirements of different target markets, and for the purpose of customer engagement some rebates are grouped in ways that are logical for a particular target market.

The **Performance Program – Existing Buildings** provides incentives to encourage larger commercial customers to identify, assess, and implement custom building energy-efficiency projects for existing buildings. The program is administered jointly with FBC, providing customers with a one-stop program in the FEI service territory to evaluate and implement building-scale energy efficiency projects. FEI Energy Solutions staff members provide technical and engineering support, customer outreach and engagement for the Performance Program. Under the program, smaller commercial customers are also provided with energy assessments.

The **Performance Program - New Buildings** encourages the design of high-performance commercial buildings. Capital incentives are available for customers that design new buildings that exceed BC Building Code. This program includes support for large commercial new construction, which is centred on encouraging the integration of the BC Energy Step Code objectives into the design of high-performance commercial buildings, while allowing for non-step code pathway as well. This program also includes a new construction offer for small commercial new construction buildings with a conditioned area smaller than 50,000 square feet.

The **Rental Apartment Efficiency Program (RAP)**, in collaboration with FBC, provides the direct installation of in-suite measures, like low flow showerheads, and faucet aerators for rental suites in multi-unit residential buildings (MURBs). There are three components to this program. To start, participants are provided with direct install of in-suite energy efficiency upgrades completed by an agent of FEI. Next, participants are provided with energy assessments, which may recommend building-level energy efficiency upgrades such as condensing boilers, high efficiency water heaters and control upgrades. Lastly, participants are provided with support in implementing the energy efficiency recommendations and applying for rebates. As previously mentioned, RAP will no longer be a program under FEI's residential program area and has been consolidated under the commercial program area.

## 4.1 Key Changes in New Plan

Compared to the previous DSM Plan, the 2023 DSM Plan has the following key updates in the Commercial program area:

- Rental Apartment Efficiency Program (RAP) has been consolidated under the Commercial program area. Previously the RAP expenses were split between the Residential and Commercial program areas.
- Gas heat pumps and hybrid heating system measures, such as hybrid Rooftop Units (RTUs) have been added under the Prescriptive program.
- Addition of condensing boiler heating plant and domestic water heater system optimization measures under the Prescriptive program.

**Collaborations with Utility Partners, Government, and Industry**

The Commercial program area will continue to seek out and develop partnerships with utilities, government, trade associations, and others to increase program awareness and expand activities in support of its objective to maximize natural gas efficiency in the commercial market.

## 4.2 Program Budget and Savings

Exhibit 13 shows the annual incentive, non-incentive, and total expenditures for the commercial program area by program. Exhibit 14 shows the natural gas savings and cost-effectiveness for each commercial program.

Exhibit 13 – Commercial Program Area Expenditures by Program ($000s)

| Program Area | Incentives | Non-Incentives | Total Expenditures |
|---|---|---|---|
| Prescriptive | 7,464 | 2,292 | 9,756 |
| Performance | 8,292 | 1,050 | 9,342 |
| Performance New Construction | 4,036 | 585 | 4,621 |
| RAP | 1,649 | 451 | 2,100 |
| Non-Program Specific Expenses | - | 750 | 750 |
| **Total ($000s)** | **$21,442** | **$5,128** | **$26,570** |

Exhibit 14 - Commercial Natural Gas Savings and Cost-Effectiveness by Program

| Program Area | Incremental Annual Gas Savings, Net (GJ) | NPV Gas Savings, Net (GJ) | TRC | MTRC | UCT | PCT | RIM |
|---|---|---|---|---|---|---|---|
| Prescriptive | 275,637 | 3,128,305 | 1.4 | 6.7 | 2.3 | 2.5 | 0.8 |
| Performance | 210,543 | 1,940,611 | 1.0 | 5.1 | 1.5 | 1.9 | 0.6 |
| Performance New Construction | 35,809 | 415,736 | 1.1 | 2.7 | 0.6 | 1.1 | 0.4 |
| RAP | 41,828 | 396,573 | 2.9 | 12.8 | 1.4 | 7.9 | 0.7 |
| Non-Program Specific Expenses | - | - | - | - | - | | |
| **Total** | **563,816** | **5,881,225** | **1.2** | **5.4** | **1.6** | **2.1** | **0.7** |

## 4.3 Program Profiles

### 4.3.1 Prescriptive Program

**Exhibit 15 – Commercial Prescriptive Program Details**

| | |
|---|---|
| Program Description | This program provides rebates for the installation of high efficiency natural gas equipment and appliances in various applications including space heating, water heating, and commercial food service. Simple rebates are provided for equipment that meet specific performance standards, as opposed to the Performance Program which requires more detailed analysis of measures as installed. The program will make use of midstream and downstream rebate delivery approaches, as warranted by the type of equipment and the market it is intended to serve. |
| Target Sub-Market | All commercial sub-sectors |
| New vs. Retrofit | New construction and retrofit |
| Partners | FortisBC Inc. |
| Sources | Sources for measure assumptions included in Appendix A-1 |

**Exhibit 16 – Commercial Prescriptive Program Expenditures by Type**

| | Expenditures ($000s) - 2023 |
|---|---|
| Incentives | 7,464 |
| Admin | 623 |
| Communication | 534 |
| Evaluation | 107 |
| Labour | 1,028 |
| **Total** | **$9,756** |

Exhibit 17 – Commercial Prescriptive Program Details by Measure

| Measure | Forecasted Participation - 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Condensing Boiler Heating Plant Optimization | 250 | $19,283 | $12,488 | $200 | 396.36 | - | 20 | - | - |
| Domestic Water Heater System Optimization | 60 | $3,705 | $2,162 | $200 | 93.20 | - | 20 | - | - |
| Condensing Volume Boiler | 27 | $22,230 | $4,033 | $100 | 182.70 | - | 15 | 18% | - |
| Condensing Tankless Water Heater | 60 | $5,368 | $924 | $100 | 115.00 | - | 17 | 38% | - |
| Food Services Efficiency Measures | 60 | $50,000 | $25,000 | $2,500 | 1500.00 | - | 20 | 20% | - |
| Low Flow Spray Valves | 50 | $115 | $115 | - | 15.99 | - | 12 | 20% | - |
| Condensing Make Up Air Unit | 50 | $3,900 | $1,500 | $200 | 110.00 | 3,720 | 18 | 5% | - |
| Furnace | 70 | $1,840 | $800 | $200 | 6.90 | 280 | 18 | - | - |
| HVAC Controls - Kitchen DCV | 20 | $22,885 | $7,500 | - | 293.00 | 33,393 | 8 | 5% | - |
| Condensing Unit Heaters | 40 | $1,548 | $900 | $200 | 14.88 | -223 | - | - | - |
| Vortex DeAerators | 15 | $35,080 | $10,000 | - | 330.00 | 22,500 | 18 | - | - |
| Gas Underfired Broilers | 31 | $1,900 | $1,200 | $300 | 128.06 | - | 12 | - | - |
| Air Curtains | 5 | $6,287 | $2,000 | - | 441.00 | - | 15 | 18% | - |
| Pipe and Tank Insulation | 20 | $15,000 | $10,000 | - | 100.00 | - | 11 | 18% | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Steam Boilers | 10 | $25,000 | $16,000 | - | 1203.00 | - | 20 | 18% | - |
| Hybrid Systems | 10 | $50,000 | $7,000 | $500 | 500.00 | - | 13 | 20% | - |
| Gas Heat Pump | 40 | $86,000 | $26,000 | $1,000 | 502.00 | - | 15 | - | - |
| Connected Thermostats | 10 | $159 | $100 | - | 4.00 | - | 15 | 20% | - |
| Boiler Additives | 250 | $3,386 | $1,000 | - | 155.00 | - | 5 | 18% | - |
| **Weighted Average Per Participant** | | **$14,628** | **$6,639** | **$299** | **286** | **1,019** | **13.9** | **10%** | **-** |

### 4.3.2 Performance Program – Existing Buildings

**Exhibit 18 – Commercial Performance Program (Existing Buildings) Details**

| | |
|---|---|
| Program Description | The program provides incentives to encourage participants to pursue a performance-based approach to achieving natural gas savings. The program encourages detailed analysis of integrated energy saving measures to help identify all technically feasible and cost-effective energy savings, and then follows up by providing support for the implementation of those measures. |
| Target Sub-Market | Medium to large commercial, institutional and multifamily residential |
| New vs. Retrofit | Retrofit |
| Partners | FortisBC Inc. |
| Sources | Sources for measure assumptions included in Appendix A-1 |

### Exhibit 19 – Commercial Performance Program (Existing Buildings) Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | 8,292 |
| Admin | 200 |
| Communication | 100 |
| Evaluation | 100 |
| Labour | 650 |
| **Total** | **9,342** |

### Exhibit 20 – Commercial Performance Program (Existing Buildings) Details by Measure

| Measure | Forecasted Participation - 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Studies - Retrofit | 25 | $32,500 | $8,097 | - | - | - | 1 | 4% | - |
| Capital Upgrades - Retrofit | 37 | $300,000 | $200,000 | - | 4,400.00 | 15,500 | 15 | 4% | - |
| Recommissioning (Studies & O&M) | 37 | $33,575 | $15,000 | - | 1,500.00 | - | 6 | 4% | - |
| Commercial Energy Assessments | 15 | $1,600 | $1,600 | - | 100.00 | - | 1 | 35% | - |
| **Weighted Average Per Participant** | | **$115,603** | **$72,741** | **-** | **1,928** | **5,031** | **7.2** | **8%** | - |

### 4.3.3 Performance Program – New Construction

Exhibit 21 – Commercial Performance Program (New Construction) Details

| | |
|---|---|
| Program Description | The program provides incentives to encourage participants to pursue a performance-based approach to achieving natural gas savings. The program encourages detailed analysis of integrated energy saving measures to help identify all technically feasible and cost-effective energy savings, and then follows up by providing support for the implementation of those measures. |
| Target Sub-Market | Medium to large commercial, institutional and multifamily residential |
| New vs. Retrofit | New construction |
| Partners | FortisBC Inc. |
| Sources | Sources for measure assumptions included in Appendix A-1 |

Exhibit 22 – Commercial Performance Program (New Construction) Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | 4,036 |
| Admin | 55 |
| Communication | 30 |
| Evaluation | 110 |
| Labour | 390 |
| **Total** | **$4,621** |

Exhibit 23 – Commercial Performance Program (New Construction) Details by Measure

| Measure | Forecasted Participation - 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Step Code - Whole Building | 9 | $380,000 | $204,111 | - | 2,000.00 | 240,000 | 17 | 4% | - |
| Non Step Code - Whole Building | 9 | $380,000 | $204,111 | - | 2,000.00 | 240,000 | 17 | 4% | - |
| Early Engagement | 5 | $2,500 | $2,500 | - | - | - | - | 4% | - |
| Small Commercial New Construction | 5 | $90,000 | $50,000 | - | 260.22 | - | 17 | 4% | - |
| Step Code Capacity Building - Charettes | 2 | $50,000 | $50,000 | - | - | - | - | 4% | - |
| **Weighted Average Per Participant** | | **$246,750** | **$134,550** | **-** | **1,243** | **144,000** | **13** | **4%** | **-** |

### 4.3.4 Residential Apartment and Hospitality Program (RAP)

**Exhibit 24 – Commercial RAP Program Details**

| | |
|---|---|
| Program Description | There are three components to this program. To start, participants are provided with direct install of in-suite energy efficiency upgrades completed by an agent of FortisBC. Next, participants are provided with energy assessments and recommendations for building-level energy efficiency upgrades such as condensing boilers, high efficiency water heaters and control upgrades. Lastly, participants are provided with support in implementing the energy efficiency recommendations and applying for rebates. |
| Target Sub-Market | Rental Apartment Buildings, Hotels, Motels. School Residences |
| New vs. Retrofit | Retrofit |
| Partners | FortisBC Inc. |
| Sources | Sources for measure assumptions included in Appendix A-1 |

**Exhibit 25 – Commercial RAP Program Expenditures by Type**

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | 1,649 |
| Admin | 220 |
| Communication | 150 |
| Evaluation | 47 |
| Labour | 34 |
| **Total** | **$2,100** |

Exhibit 26 – Commercial RAP Program Details by Measure

| Measure | Forecasted Participation - 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| RAP - Energy Assessments (Common Area) | 70 | $1,863 | $1,863 | - | 199.00 | - | 1 | - | - |
| RAP - Implementation Support Partial (Common Area) | 5 | $740 | $740 | - | - | - | 1 | - | - |
| RAP - Implementation Support Full (Common Area) | 15 | $4,585 | $4,585 | - | - | - | 1 | - | - |
| RAP - Condensing Boilers (Common Area) | 15 | $18,272 | $9,115 | - | 377.00 | - | 20 | 18% | - |
| RAP - Water Heaters (Common Area) | 5 | $20,639 | $2,749 | - | 180.00 | - | 12 | - | - |
| RAP - Recirculation Controls (Common Area) | 20 | $4,200 | $4,200 | - | 156.00 | 1.305 | 15 | - | - |
| 1.5GPM Showerheads (Gas) (Unit) | 6,020 | $4 | $19 | - | 1.30 | - | 25 | - | - |
| 1.5GPM Handheld Showerhead (Gas) (Unit) | 1,576 | $12 | $19 | - | 1.30 | 61 | 25 | - | - |
| 1.5GPM Bathroom Aerators (Gas) (Unit) | 5,485 | $1 | $9 | - | 0.80 | 18 | 25 | - | - |
| 1.5GPM Kitchen Aerators (Gas) (Unit) | 6,222 | $2 | $9 | - | 0.80 | - | 25 | - | - |
| **Weighted Average Per Participant** | | **$37** | **$85** | **-** | **2.20** | **11** | **25** | **-** | **-** |

# 5 Industrial Program Area

In this DSM plan, the Industrial Program Area consists of three programs:

- Prescriptive Program
- Performance Program
- Strategic Energy Management (SEM) Program

The **Prescriptive Program** includes fixed incentives for the purchase and installation of specific qualifying industrial measures. The prescriptive program provides rebates from energy efficient measures where the savings are well understood - and their installation is not typically part of a larger, more complex upgrade. Examples of such measures include air curtains, steam traps, and pipe insulation measures.

The **Performance Program** provides incentives to encourage customers to identify, assess and implement measures that use energy for process-related activities. The program is administered jointly with FBC, providing customers with a one-stop program in the FBC/FEI shared service territory and FEI only service areas to evaluate and implement industrial energy efficiency projects. FEI Energy Solutions staff members provide customer outreach and engagement for the Performance Program.

The Performance Program offers co-funding for plant-wide audits, feasibility studies, and implementation incentives. The plant-wide audit in the Performance Program provides incentives for customers to engage a qualified energy consultant to perform a high-level, whole facility audit to identify opportunities to use natural gas and electricity more efficiently within an industrial facility. The Feasibility Study offer in the Performance Program provides incentives to study a specific process or system within an industrial facility to use natural gas and electricity more efficiently. DSM incentives are available to encourage the implementation of cost-effective energy efficiency measures.

The **Strategic Energy Management (SEM) Program** is a comprehensive offering in collaboration with BC Hydro for large and medium industrial customers which provides them with energy modeling, energy efficiency coaching and strategic planning support to achieve both operational savings and to encourage larger capital upgrades. The program is administered in collaboration with BC Hydro as the electric utility outside of FortisBC’s shared service territory and with FBC within FortisBC’s shared service territory, as FBC has added this program into its latest DSM plan.

Two separate SEM tracks are as follows:

- Individual Support (Large Customers): FEI continues to provide individual incentives and support for energy modeling, monitoring, targeting, reporting and coaching for industrial customers that have an existing energy manager.
- Cohort Support (Medium Customers): For industrial customers without dedicated energy managers, FEI continues to bring together a group of industrial customers to work together and share knowledge related to building energy management in their facilities and receive group energy coaching and training.

## 5.1 Key Changes in New Plan

Compared with the previous DSM Plan, the 2023 DSM Plan has the following key update in the Industrial program area:

- In addition to BC Hydro, the SEM program will now be administered in collaboration with FBC and focus on natural gas and electricity savings.
- Addition of infrared heater measures under the Prescriptive program.

## 5.2 Program Budget and Savings

Exhibit 27 shows the annual incentive, non-incentive, and total expenditures for the industrial program area by program. Exhibit 28 shows the natural gas savings and cost-effectiveness for each industrial program.

Exhibit 27 – Industrial Program Area Expenditures by Program ($000s)

| Program Area | Incentives | Non-Incentives | Total Expenditures |
|---|---|---|---|
| Prescriptive | 1,891 | 211 | 2,102 |
| Performance | 3,308 | 373 | 3,680 |
| Strategic Energy Management (SEM) | 589 | 277 | 866 |
| Non-Program Specific Expenses | - | 200 | 200 |
| **Total ($000s)** | **$5,787** | **$1,061** | **$6,848** |

Exhibit 28 - Industrial Natural Gas Savings and Cost-Effectiveness by Program

| Program Area | Incremental Annual Gas Savings, Net (GJ) | NPV Gas Savings, Net (GJ) | TRC | MTRC | UCT | PCT | RIM |
|---|---|---|---|---|---|---|---|
| Prescriptive | 351,823 | 2,973,230 | 3.3 | 16.6 | 9.9 | 3.8 | 1.1 |
| Performance | 135,800 | 1,068,759 | 1.7 | 8.7 | 2.0 | 2.3 | 0.9 |
| Strategic Energy Management (SEM) | 140,800 | 616,219 | 6.0 | 31.8 | 4.7 | 10.9 | 0.9 |
| Non-Program Specific Expenses | - | - | | - | - | | |
| **Total** | **628,423** | **4,658,207** | **2.8** | **14.2** | **4.7** | **3.5** | **1.0** |

## 5.3 Program Profiles

### 5.3.1 Prescriptive Program

Exhibit 29 – Industrial Prescriptive Program Details

| | |
|---|---|
| Program Description | Prescriptive initiatives to encourage the implementation of efficient technologies for specific industrial processes using natural gas as an energy source. |
| Target Sub-Market | Large, medium and small industrial facilities |
| New vs. Retrofit | All measures available for both new construction and retrofit, except for the steam trap surveys and steam trap replacement (retrofit only) |
| Partners | FortisBC Inc. |
| Sources | Sources for measure assumptions included in Appendix A-1 |

Exhibit 30 – Industrial Prescriptive Program Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | 1,891 |
| Admin | 40 |
| Communication | 50 |
| Evaluation | 25 |
| Labour | 96 |
| **Total** | **$2,102** |

Exhibit 31 – Industrial Prescriptive Program Details by Measure

| Measure | Forecasted Participation - 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Process Boiler (Hot Water and Steam) | 15 | $22,748 | $14,451 | $200 | 912.00 | - | 20 | 18% | - |
| Air Curtains - Small Door | - | $2,019 | $1,300 | $200 | 46.04 | 204 | 15 | 18% | - |
| Air Curtains - Medium Door | - | $5,121 | $1,800 | $200 | 184.25 | 1,221 | 15 | 18% | - |
| Air Curtains - Large Door | 2 | $11,720 | $2,000 | $200 | 1,093.62 | 6,188 | 15 | 18% | - |
| Direct Contact Water Heater | 1 | $4,200 | $2,700 | $200 | 186.00 | - | 20 | 18% | - |
| Steam Traps Survey | 8 | $1,500 | $750 | $200 | - | - | - | 18% | - |
| Steam Traps Replacement | 5 | $10,432 | $4,000 | $200 | 1,153.44 | - | 6 | 18% | - |
| 1" insulation 0.5-1" HW pipe | 3 | $8,150 | $3,260 | $200 | 268.95 | - | 11 | 18% | - |
| 1" insulation ≥ 1" HW pipe | 3 | $8,150 | $3,260 | $200 | 521.60 | - | 11 | 18% | - |
| 1" insulation 0.5-1" LPS pipe | 4 | $8,150 | $3,260 | $200 | 603.10 | - | 11 | 18% | - |
| 1" insulation ≥ 1" LPS pipe | 4 | $8,150 | $3,260 | $200 | 1,173.60 | - | 11 | 18% | - |
| 1" insulation 0.5-1" HPS pipe | 4 | $8,150 | $3,260 | $200 | 1,051.35 | - | 11 | 18% | - |
| 1" insulation ≥ 1" HPS pipe | 4 | $10,188 | $3,260 | $200 | 2,037.50 | - | 11 | 18% | - |
| Tank Insulation 1" Low Temp | 3 | $134,968 | $16,144 | $200 | 14,530.05 | - | 11 | 18% | - |
| Tank Insulation 1" High Temp | 3 | $134,968 | $16,144 | $200 | 25,723.57 | - | 11 | 18% | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Tank Insulation 2" High Temp | 3 | $189,536 | $32,289 | $200 | 24,862.53 | - | 11 | 18% | - |
| Other Prescriptive Measures | 15 | $40,000 | $20,000 | $200 | 3,289.00 | - | 10 | 18% | - |
| Thermal curtains | 10 | $507,000 | $5,000 | $200 | 14,200.00 | - | 10 | 27% | - |
| Single Stage Infrared Heater | 1 | $9,084 | $800 | $200 | 300.00 | - | 17 | 18% | - |
| Two Stage Infrared Heater | 20 | $9,084 | $1,100 | $200 | 300.00 | - | 17 | 18% | - |
| Condensing Infrared Heater | 20 | $10,000 | $2,250 | $200 | 400.00 | - | 18 | 18% | - |
| **Weighted Average Per Participant** | | **$62,966** | **$14,574** | **$200** | **3,474** | **97** | **13.2** | **19%** | **-** |

### 5.3.2 Performance Program

**Exhibit 32 – Industrial Performance Program Details**

| | |
|---|---|
| Program Description | The Performance Program is a custom program to help industrial customers use natural gas more efficiently for process-related activities. The program provides funding for walkthrough-level plant-wide audits, detailed engineering feasibility studies and custom capital incentives to implement cost effective energy conservation measures (ECMs). |
| Target Sub-Market | Industrial Customers |
| New vs. Retrofit | New construction and retrofit |
| Partners | FortisBC Inc. |
| Sources | Sources for measure assumptions included in Appendix A-1 |

### Exhibit 33 – Industrial Performance Program Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | 3,308 |
| Admin | 100 |
| Communication | 30 |
| Evaluation | 50 |
| Labour | 193 |
| **Total** | **$3,680** |

### Exhibit 34 – Industrial Performance Program Details by Measure

| Measure | Forecasted Participation - 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Technology Implementation | 14 | $180,000 | $185,000 | - | 9,700 | - | 10 | - | - |
| Feasibility Study | 18 | $49,500 | $34,550 | - | - | - | 10 | - | - |
| Plant Wide Audit | 10 | $12,500 | $9,575 | - | - | - | 10 | - | - |
| **Weighted Average Per Participant** | | **$84,190** | **$78,754** | **-** | **3,233** | **-** | **10** | **-** | **-** |

### 5.3.3 Strategic Energy Management (SEM) Program

Exhibit 35 – Industrial SEM Program Details

| | |
|---|---|
| Program Description | A comprehensive approach to energy management to achieve sustainable energy and cost savings over the long term for larger FEI natural gas industrial customers. Components may include operation energy analytics, energy expert expertise and support, assistance with applications for other program offers, industry collaboration and support for conservation initiatives. May include pay-for-performance aspect for verified energy savings at the end of the program period or for achieving identified milestones. |
| Target Sub-Market | Large and medium industrial facilities |
| New vs. Retrofit | Retrofit |
| Partners | BC Hydro and FBC |
| Sources | Sources for measure assumptions included in Appendix A-1 |

Exhibit 36 – Industrial SEM Program Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | 589 |
| Admin | 105 |
| Communication | 75 |
| Evaluation | 25 |
| Labour | 72 |
| **Total** | **$866** |

Exhibit 37 – Industrial SEM Program Details by Measure

| Measure | Forecasted Participation - 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Individual, Large Customer | 8 | $40,000 | $40,000 | - | 20,000 | - | 5 | 20% | - |
| Cohort, Medium Customers | 8 | $24,000 | $24,000 | - | 2,000 | - | 5 | 20% | - |
| **Weighted Average Per Participant** | | **$32,0000** | **$36,800** | **-** | **11,000** | **-** | **5** | **20%** | **-** |

# 6 Low Income Program Area

This program area focuses on creating energy savings opportunities for low income customers - both through programs that low income customers can apply to and through programs that serve charities and housing providers, including Indigenous community housing providers, which in turn benefit FEI's low income customers.

This program area also contributes to meeting the "adequacy" component of the DSM Regulation Section 3, whereby a public utility's DSM portfolio is considered adequate when there is "a demand side measure intended specifically to assist residents of low income households to reduce their energy consumption"[9].

Furthermore, one of FEI's guiding principles of conservation and energy management is that "programs have a goal of being universal, offering access to energy efficiency and conservation for all residential and commercial customers, including low income..."[10]. FEI maintains its commitment to this principle by offering both no-cost and rebate programs to low income participants, along with an expanded array of programs that assist charities and housing providers.

In this DSM plan, the Low Income Program Area consists of five programs:

- Self Install Program
- Direct Install Program
- Prescriptive Program
- Performance Program
- Support Program

The **Self Install Program** is a program whereby low income participants receive Energy Savings Kits (ESK) or re-engagement kits which includes energy saving measures along with an instruction booklet and directions to access online "how to" videos. All measures are easy to install which participants install themselves. The Self Install program is a partnership program with FBC and BC Hydro.

The **Direct Install Program** is a program whereby low-income participants receive an in-home visit from a program contractor to assess their home's energy efficiency, install basic measures (e.g., high efficiency showerheads, faucet aerators, etc.) and provide customized energy efficiency coaching. Additionally, some participants qualify to receive more robust measures such as insulation and high efficiency natural gas furnaces. Partners in the Direct Install Program include FBC and BC Hydro.

The **Prescriptive Program** provides rebates, implementation support, funding for energy studies, and training for housing providers. It also includes rebates for individual low-income customers and Indigenous communities' residential buildings. Prescriptive rebates provide a straightforward path for participants in energy efficiency programs. Prescriptive rebates are available for residential and

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[9] BC Utilities Commission Act, Demand Side Measures Regulation (BC Reg. 326/2008), Section 3.1 a, amended March 24, 2017

[10] Energy Efficiency and Conservation Programs Application, page 47, May 28, 2008

commercial measures such as furnaces, boilers and water heaters. For Indigenous communities, additional measures for health and safety (e.g., mould or asbestos removal), ventilation, air sealing, insulation and appliance maintenance are included.

The **Performance Program** provides incentives to support charities, non-profit housing providers, co-ops, and Indigenous communities to construct high-performance homes and commercial buildings. For example, participants access incentives by meeting the BC Energy Step Code standards for Part 3 and Part 9 buildings. The program will be administered jointly with FBC. These activities were formerly allocated to the Prescriptive Program Area.

The **Support Program** seeks to fund training and educational opportunities to enhance energy efficiency retrofit skills for people who experience barriers to employment.

## 6.1 Key Changes in New Plan

Compared with the previous DSM Plan, the 2023 DSM Plan has the following key updates in the Low Income Program Area:

- Engaging past Self-Install Program participants and offering supplementary free draft proofing measures.
- More funding has been allocated to the Direct Install Program Area with the intention of focusing on completing more work in manufactured homes and addressing more health and safety issues to enable energy efficiency work to proceed.
- Initiatives related to supporting the construction of high-performance residential and commercial buildings have been grouped under the Performance Program Area. These were formerly allocated under the Prescriptive Program Area.
- Funding for energy studies, training, and implementation support, which was formerly allocated to the Support Program Area, has been rolled up into other areas (where applicable).
- The Support Program Area has more funding allocated to facilitate multiple educational and training opportunities, as well as provide additional support to participants.
- Removal of residential incentives for non-condensing storage water heaters to further support the transition in condensing technology.

## 6.2 Program Budget and Savings

Exhibit 38 shows the annual incentive, non-incentive, and total expenditures for the Low Income Program Area by program. Exhibit 39 shows the natural gas savings and cost-effectiveness for each low income program.

Exhibit 38 – Low Income Program Area Expenditures by Program ($000s)

| Program Area | Incentives | Non-Incentives | Total Expenditures |
|---|---|---|---|
| Self Install | 468 | 142 | 610 |

| | | | |
|---|---|---|---|
| Direct Install | 5,920 | 1,490 | 7,410 |
| Prescriptive | 3,720 | 556 | 4,276 |
| Performance | 240 | 95 | 334 |
| Support | - | 336 | 336 |
| Non-Program Specific Expenses | - | 285 | 285 |
| **Total ($000s)** | **$10,348** | **$2,903** | **$13,251** |

Exhibit 39 – Low Income Natural Gas Savings and Cost-Effectiveness by Program

| Program Area | Incremental Annual Gas Savings, Net (GJ) | NPV Gas Savings, Net (GJ) | TRC | MTRC | UCT | PCT | RIM |
|---|---|---|---|---|---|---|---|
| Self Install | 27,120 | 188,624 | 11.0 | | 2.1 | 4.6 | 0.6 |
| Direct Install | 15,620 | 166,490 | 1.0 | | 0.2 | 1.8 | 0.1 |
| Prescriptive | 33,778 | 429,782 | 3.7 | | 0.7 | 2.4 | 0.4 |
| Performance | 890 | 12,473 | 1.0 | | 0.3 | 1.1 | 0.2 |
| Support | - | - | - | | - | | |
| Non-Program Specific Expenses | - | - | - | | - | | |
| **Total** | 77,408 | 797,369 | 2.1 | | 0.4 | 2.2 | 0.3 |

## 6.3 Program Profiles

### 6.3.1 Self-Install Program

Exhibit 40 – Low Income Self-Install Program Details

| | |
|---|---|
| Program Description | Participants that have the capabilities to perform basic installations on their own can receive a bundle of free basic energy efficiency measures delivered to their home address |
| Target Sub-Market | Low income homeowners, low income customers living in private rental suites |
| New vs. Retrofit | Retrofit |
| Partners | BC Hydro, FortisBC Inc. |
| Sources | Sources for measure assumptions included in Appendix A-1 |

Exhibit 41 – Low Income Self-Install Program Expenditures by Type

| Expenditures ($000s) – 2023 | |
|---|---|
| Incentives | 468 |
| Admin | 23 |
| Communication | 72 |
| Evaluation | 20 |
| Labour | 27 |
| **Total** | **610** |

Exhibit 42 – Low Income Self-Install Program Details by Measure

| Measure | Forecasted Participation - 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Energy Savings Kit | 12,000 | $35 | $35 | - | 2.16 | - | 9 | - | - |
| Re-engagement Kit | 4,000 | $12 | $12 | - | 0.30 | - | 1 | - | - |
| **Weighted Average Per Participant** | | **$29** | **$29** | **-** | **1.7** | **-** | **7** | **-** | **-** |

### 6.3.2 Direct Install Program

Exhibit 43 – Low Income Direct Install Program Details

| | |
|---|---|
| Program Description | Recognizing that some low income customers do not have the expertise and/or physical capabilities to install energy efficient measures themselves, this program aims to remove that barrier by having a program delivery agent/contractor perform the installation at no cost to them |
| Target Sub-Market | Low income homeowners living in single-family dwellings, townhomes, manufactured homes, or row homes, and housing providers |
| New vs. Retrofit | Retrofit |
| Partners | BC Hydro, FortisBC Inc. |
| Sources | Sources for measure assumptions included in Appendix A-1 |

Exhibit 44 – Low Income Direct Install Program Expenditures by Type

| Expenditures ($000s) – 2023 | |
|---|---|
| Incentives | 5,920 |
| Admin | 325 |
| Communication | 419 |
| Evaluation | 448 |
| Labour | 298 |
| **Total** | **$7,410** |

Exhibit 45 – Low Income Direct Install Program Details by Measure

| Measure | Forecasted Measure Participation - 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Energy Conservation Assistance | 2,000 | 2,118 | 2,960 | - | 7.81 | - | 15 | - | - |
| **Weighted Average Per Participant** | | **$2,118** | **$2,960** | **-** | **7.81** | **-** | **15** | **-** | **-** |

### 6.3.3 Prescriptive Program

**Exhibit 46 – Low Income Prescriptive Program Details**

| | |
|---|---|
| Program Description | The prescriptive program is to enable a straightforward path towards a rebate for specific residential and commercial energy efficiency measures |
| Target Sub-Market | Low income homeowners, charities and housing providers |
| New vs. Retrofit | Retrofit |
| Partners | BC Hydro, FortisBC Inc. |
| Sources | Sources for measure assumptions included in Appendix A-1 |

**Exhibit 47 – Low Income Prescriptive Program Expenditures by Type**

| Expenditures ($000s) – 2023 | |
|---|---|
| Incentives | 3,720 |
| Admin | 98 |
| Communication | 34 |
| Evaluation | 32 |
| Labour | 392 |
| **Total** | **$4,276** |

Exhibit 48 – Low Income Prescriptive Program Details by Measure

| Measure | Forecasted Participation - 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Furnace | 540 | $1,900 | $2,304 | $100 | 4.30 | - | 18 | - | - |
| Boiler | 38 | $3,200 | $2,000 | $100 | 5.79 | - | 18 | - | - |
| Communicating Thermostat | 95 | $250 | $150 | - | 2.60 | - | 12 | - | - |
| Condensing Tankless Water Heater | 184 | $3,300 | $2,500 | $50 | 11.40 | - | 20 | - | - |
| Condensing Storage Tank Water Heater | 2 | $1,800 | $2,500 | $50 | 10.10 | - | 13 | - | - |
| Two Upgrade Bonus | 180 | - | $300 | - | - | - | - | - | - |
| Attic Insulation | 50 | $1,326 | $1,922 | - | 8.70 | - | 30 | - | - |
| Wall Insulation | 11 | $2,714 | $1,422 | - | 20.60 | - | 30 | - | - |
| Ventilation | 40 | - | $1,200 | - | - | - | - | - | - |
| Crawlspace and Basement Insulation | 8 | $838 | $1,222 | - | 5.30 | - | 30 | - | - |
| Other Insulation | 4 | $1,167 | $1,779 | - | 6.60 | - | 30 | - | - |
| EnerChoice Fireplace | 22 | $132 | $750 | - | 7.40 | - | 15 | - | - |
| Combination System | 20 | $3,091 | $2,400 | $100 | 6.70 | - | 18 | - | - |
| Appliance Maintenance | 400 | - | $250 | - | - | - | - | - | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Commercial - Non-profit bundled measures | 121 | $8,508 | $7,620 | - | 165.00 | - | 20 | - | - |
| Commercial - Condensing Volume Boiler | 17 | $15,922 | $14,799 | - | 317.00 | - | 20 | - | - |
| Commercial - Condensing Tankless Water Heater | 13 | $4,288 | $5,121 | - | 89.40 | - | 17 | - | - |
| Commercial - Gas Heat Pump | 7 | $31,000 | $26,800 | $1,000 | 168.15 | - | 15 | - | - |
| Commercial - Furnace | 20 | $1,990 | $2,480 | - | 6.90 | - | 18 | - | - |
| Windows & Doors Tier 1 | 30 | $56 | $100 | | 0.23 | - | 25 | - | - |
| Windows & Doors Tier 2 | 30 | $116 | $200 | | 0.30 | - | 25 | - | - |
| Health & Safety | 40 | - | $1,000 | | - | - | - | - | - |
| **Weighted Average Per Participant** | | $1,908 | $1,988 | $41 | 18.0 | - | 12.3 | - | - |

### 6.3.4 Performance Program

Exhibit 49 – Low Income Performance Program Details

| | |
|---|---|
| Program Description | The performance program supports the adoption of the BC Energy Step Code and the construction of high-performance homes and commercial buildings |
| Target Sub-Market | Charities and housing providers |
| New vs. Retrofit | New |
| Partners | FortisBC Inc. |
| Sources | Sources for measure assumptions included in Appendix A-1 |

Exhibit 50 – Low Income Performance Program Expenditures by Type

| Expenditures ($000s) – 2023 | |
|---|---|
| Incentives | 240 |
| Admin | 19 |
| Communication | 8 |
| Evaluation | 6 |
| Labour | 62 |
| **Total** | **$334** |

Exhibit 51 – Low Income Performance Program Details by Measure

| Measure | Forecasted Participation - 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Commercial - Small Commercial New Construction (SCNC) | 1 | $90,000 | $50,000 | - | 260.00 | - | 17 | - | - |
| STEP 2 (Single Family Dwelling) | 2 | $2,632 | $4,000 | - | 6.16 | -1 | 30 | - | - |
| STEP 2 (Townhome/Rowhome) | 2 | $5,204 | $4,000 | - | 9.51 | 61 | 30 | - | - |
| STEP 3 (Single Family Dwelling) | 8 | $4,955 | $5,000 | - | 11.06 | 18 | 30 | - | - |
| STEP 3 (Townhome/Rowhome) | 7 | $6,928 | $5,000 | - | 12.90 | -71 | 30 | - | - |
| STEP 4 (Single Family Dwelling) | 5 | $9,342 | $8,000 | - | 20.96 | 43 | 30 | - | - |
| STEP 4 (Townhome/Rowhome) | 5 | $7,761 | $8,000 | - | 16.64 | -89 | 30 | - | - |
| STEP 5 (Single Family Dwelling) | 3 | $17,000 | $3,000 | - | 42.40 | - | 30 | - | - |
| Bundled residential new home measures | 27 | $535 | $363 | - | 3.88 | - | 13 | - | - |
| **Weighted Average Per Participant** | | $5,746 | $3,997 | - | 14.8 | -8 | 22.1 | - | - |

### 6.3.5 Support Program

Exhibit 52 – Low Income Support Program Details

| | |
|---|---|
| Program Description | Support program seeks to enhance energy efficiency retrofit skills for people who experience barriers to employment through training and educational opportunities |
| Target Sub-Market | Low income customers |
| New vs. Retrofit | New construction and retrofit |
| Partners | - |
| Sources | Sources for measure assumptions included in Appendix A-1 |

Exhibit 53 – Low Income Support Program Expenditures by Type

| Expenditures ($000s) – 2023 | |
|---|---|
| Incentives | - |
| Admin | 255 |
| Communication | 30 |
| Evaluation | 3 |
| Labour | 48 |
| **Total** | **$336** |

Exhibit 54 – Low Income Support Program Details by Measure

| Measure | Forecasted Measure Participation - 2023 | Incremental Cost ($) | Incentive ($) | Contractor Incentive ($) | Annual Gas Savings (GJ) | Annual Elec. Savings (kWh) | Measure Lifetime (Years) | Free Rider Rate (%) | Spillover Rate (%) |
|---|---|---|---|---|---|---|---|---|---|
| Residential Energy Efficiency Works | 25 | - | - | - | - | - | - | - | - |
| **Weighted Average Per Participant** | - | - | - | - | - | - | - | - | - |

# 7 Conservation Education and Outreach

The Conservation Education and Outreach (CEO) initiatives provide education about conserving energy and non-program specific outreach communications and engagement. This program area fosters a culture of conservation within the province by providing education to a broad range of customers and stakeholders, including hard-to-reach residential and commercial customers, and students. The goal of these programs is to inform customers on how to conserve energy (behaviour change) and to learn about incentive programs. The costs of CEO activities are included on the portfolio level and have an impact on the overall portfolio cost-effectiveness.

The CEO initiatives are designed to meet the DSM Regulation Section 3 adequacy requirements[11] and support specified public awareness programs and specified demand-side measures[12], while being subject to Section 4 of the DSM Regulation[13].

For the 2023 DSM plan, the suite of Conservation Education and Outreach customer offerings are organized into the following programs:

- Residential Education Program
- Customer Engagement Tool
- Commercial Education Program
- School Education Program

The **Residential Education Program** provides information to residential customers and the public on natural gas conservation and energy literacy through direct engagement, online tools, and general public marketing/advertising campaigns. Promotional undertakings include a multimedia rebate awareness campaign, engagement activities, educational seminars, and participation in home shows and community events. This includes outreach to low income and multilingual customers. Ongoing partnerships with Canadian Home Builders Associations and local sports organizations expand outreach opportunities.

The program includes the cost of producing materials for events and prizes for audience engagement, such as draft proofing kits, used at events targeting residential customers and children.

The **Customer Engagement Tool** program provides energy reports and other tools that provide energy consumption analysis to residential customers, increasing customer's awareness of energy efficiency and conservation while fostering conservation behaviours. These initiatives are in partnership with FBC and include an online portal where customers can access targeted energy conservation content and build awareness of FEI's other DSM offers. Savings are reported in FEI's annual DSM reports to the British

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[11] BC Utilities Commission Act, Demand Side Measures Regulation (BC Reg. 326/2008) Section 3.1(c)(d), amended March 24, 2017

[12] As specified in Section 1 of the BC Utilities Commission Act, Demand Side Measures Regulation (BC Reg. 326/2008) amended March 24, 2017

[13] BC Utilities Commission Act, Demand Side Measures Regulation (BC Reg. 326/2008) Section 4(4)(5), amended March 24, 2017

Columbia Utilities Commission. The Customer Engagement Tool will expand to include virtual energy audits, heat mapping, and a digital engagement tool for residential customers.

The **Commercial Education Program** provides ongoing communication and education about energy conservation measures as well as behavioural change educational programming that help commercial customers reduce their organization's energy consumption. Commercial Education includes small to large businesses in a variety of sub sectors such as retail, offices, multi-family residences, schools, hospitals, hospitality services and municipal/institutions.

Promotional activities include face-to-face engagement, print and online marketing, and participation in industry association meetings and tradeshows. FEI plans to continue the Efficiency in Action Awards, which recognizes commercial customers and community organizations for their innovation and leadership in energy efficiency and the natural gas savings achieved. These initiatives also guide and support energy specialists (or an energy manager) in their respective organizations or communities.

The **School Education Program** includes Energy is Awesome, an interactive virtual or in-class presentation for grades 1-5; Energy Leaders, a kindergarten to grade 12 curriculum-connected resource; and the assembly style presentation, Energy Champions, which is currently delivered in collaboration with the BC Lions.

FEI enjoys ongoing partnerships with post-secondary institutions and is supporting additional energy efficiency training for academic and trades training initiatives. This includes in-class programs, in-residence and on-campus education campaigns, and education campaigns delivered by energy specialists (or an energy manager). It also encompasses trades training and capacity building with specific initiatives for Indigenous students.

This program responds to meeting the adequacy requirements[14] of the DSM Regulation whereby a utilities' DSM portfolio is considered adequate if it includes an education program for students enrolled in [K-12] schools and post-secondary schools in the Company's service area.

## 7.1 Key Changes in New Plan

Compared with the previous DSM Plan, the 2023 DSM Plan has the following key updates:

- Digital Engagement Tool
- Heat Mapping
- Virtual Energy Audits
- Additional support for community-led energy efficiency education and awareness
- Additional support for behavioural-focused conservation initiatives
- Additional support for post-secondary support/trades training

[14] BC Utilities Commission Act, Demand Side Measures Regulation (BC Reg. 326/2008) Section 3.1(c)(d), amended March 24, 2017

## 7.2 Program Budget

Exhibit 55 shows the annual incentive, non-incentive, and total expenditures for the Conservation Education and Outreach program by activity.

**Exhibit 55 - Conservation Education and Outreach Expenditures by Activity ($000s)**

| Program Area | Incentives | Non-Incentives | Total Expenditures |
|---|---|---|---|
| Customer Engagement Tool | - | 3,039 | 3,039 |
| Residential Education Program | - | 3,887 | 3,887 |
| Commercial Education Program | - | 1,437 | 1,437 |
| School Education Program | - | 1,252 | 1,252 |
| Non-Program Specific Expenses | - | 98 | 98 |
| **Total ($000s)** | **-** | **9,713** | **9,713** |

## 7.1 Program Profiles

### 7.1.1 Customer Engagement Tool

**Exhibit 56 – Customer Engagement Tool Program Details**

| | |
|---|---|
| Program Description | This program will provide customers with an online portal and home energy reports where customers can access targeted energy conservation content. Other engagement measures may be included in future years to foster behaviour change. |
| Target Sub-Market | Residential |
| New vs. Retrofit | Both |
| Partners | FortisBC Inc. |

Exhibit 57 – Customer Engagement Tool Program Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | - |
| Admin | 2,570 |
| Communication | 175 |
| Evaluation | 72 |
| Labour | 221 |
| **Total** | **$3,039** |

### 7.1.2 Residential Education Program

Exhibit 58 – Residential Education Program Details

| | |
|---|---|
| Program Description | The program will provide information to Residential customers and the general public on natural gas conservation and energy literacy by seeking opportunities to engage with customers directly, online tools, and/or through marketing/advertising campaigns. Promotional undertakings will include a multimedia general rebates awareness campaign, engagement activities, educational seminars, and participation in home shows and community events. This audience will also include low income and multilingual customers.<br>In addition, continuing partnerships with Canadian Home Builders Associations and local sports organizations will expand outreach opportunities to engage with Residential customers. Our multilingual outreach continues to increase awareness among multilingual customers. Collaborations between internal departments and FortisBC Inc. will continue to be sought to achieve cost efficiencies in the budget, particularly for advertising and outreach events.<br>FEI will continue to focus on behavioural change opportunities that may result in energy savings. |
| Target Sub-Market | Residential, municipal and general public |
| New vs. Retrofit | New construction and retrofit |
| Partners | FortisBC Inc., municipalities |

**Exhibit 59 – Residential Education Program Expenditures by Type**

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | - |
| Admin | 678 |
| Communication | 2,660 |
| Evaluation | - |
| Labour | 549 |
| **Total** | **$3,887** |

### 7.1.3 Commercial Education Program

**Exhibit 60 – Commercial Education Program Details**

| | |
|---|---|
| Program Description | The Commercial sector is made up of small and larger businesses institutions in a variety of sub sectors such as retail, offices, multi-family residences, schools, hospitals, hospitality services and municipal governments. This program will provide ongoing communication and education about energy conservation initiatives, as well as encouraging behavioural changes to help Commercial customers reduce their energy consumption.<br>FEI will continue the Efficiency in Action Awards, which recognizes Commercial customers for their innovation in energy efficiency and achieved natural gas savings.<br>In addition, FEI will further partnerships with organizations such as Business Improvement Association BC and BC Non-Profit Housing Association, which work with small to medium-sized businesses and organizations.<br>Lastly, this area will also guide and support behaviour education campaigns delivered by energy specialists (or an energy manager) in their respective organizations. Collaborations between internal departments, FortisBC Inc., as well as other utilities, will be pursued to achieve cost efficiencies. An example of such a collaboration is the Energy Wise Network joint initiative with BC Hydro. |
| Target Sub-Market | Commercial customers, multi-family, energy specialists, energy management staff, municipalities |
| New vs. Retrofit | New construction and retrofit |
| Partners | BC Hydro, FortisBC Inc., municipalities |

Exhibit 61 – Commercial Education Program Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | - |
| Admin | 495 |
| Communication | 730 |
| Evaluation | - |
| Labour | 212 |
| **Total** | **$1,437** |

### 7.1.4 School Education Program

Exhibit 62 – School Education Program Details

| | |
|---|---|
| Program Description | Activities will include supporting FEI's school initiatives, including but not limited to Energy is Awesome and the kindergarten to grade 12 curriculum-connected resource, Energy Leaders. Additionally, the assembly style presentation, Energy Champions, which is currently partnering with the BC Lions, will continue.<br>Partnerships and funding support for post-secondary initiatives is expected to include in-class programs, in-residence and on-campus education campaigns, as well as supporting education campaigns delivered by energy specialists (or an energy manager).<br>This program responds to meeting the adequacy requirements[15] of the DSM Regulation whereby a utilities' DSM portfolio is considered adequate if it includes an education program for students enrolled in [K-12] schools and post-secondary schools in the Company's service area. |
| Target Sub-Market | Students and teachers |
| New vs. Retrofit | New construction and retrofits |
| Partners | FortisBC Inc. |

[15] BC Utilities Commission Act, Demand Side Measures Regulation (BC Reg. 326/2008) Section 3.1(c)(d), amended March 24, 2017

Exhibit 63 – School Education Program Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | - |
| Admin | 774 |
| Communication | 286 |
| Evaluation | - |
| Labour | 192 |
| **Total** | **$1,252** |

# 8 Innovative Technologies

The Innovative Technologies[16] Program Area evaluates both pre-commercial and commercially available technologies and conducts pilot studies to validate manufacturers' claims related to equipment and system performance. The program area also assesses actual savings and customer acceptance of these newer technologies or systems of technologies. Technologies that successfully emerge from the Innovative Technologies Program Area are considered for inclusion within the applicable sector programs within the larger C&EM portfolio.

Innovative Technologies are considered to be a specified demand-side measure, which means that the program and the technologies are only subject to the cost-benefit test at the program area level. As such, the expenditures are evaluated as part of the DSM portfolio as a whole. Furthermore, due to the preliminary and investigative nature of Innovative Technologies, it is challenging to effectively forecast energy savings from related pilot studies. As such, projected savings from the Innovative Technology program area have not been included in this DSM Plan. When results become available via evaluation activities, any energy savings will be reported in DSM Annual Reports.

In this DSM plan, the Innovative Technologies Program Area consists of three core activity areas:

- Technology Screening
- Pilot Projects
- Deep Retrofits

The **Technology Screening** activity area incorporates the assessment of new energy efficient technologies. Activities include conducting prefeasibility studies, small demonstrations or lab tests in order to understand the availability of the technology, applicable codes and testing standards, estimate the current adoption rate, evaluate any technical barriers, gather measure assumption data, determine the target customers and assess the market opportunity. The data is used to determine whether the technology meets the requirements of a technology innovation program as defined in the DSM Regulation Section 1. Candidate technologies that do not pass the DSM screen are rejected; those that do pass are considered further through the development of a pilot project if information gaps exist and are incorporated into a sector program if the information gaps are filled.

The Technology Screening activity also incorporates the administration of the Gas Technology Demonstration Program. This program is offered to FEI Energy Specialists to conduct technology studies, demonstrations and evaluation activities with funding support. Results of these activities are used to inform future DSM programs.

The **Pilot Projects** activity area is designed to gather actual field performance data of a technology in a customer's home or business to verify customer acceptance, installation challenges, costs and energy savings. This activity is supported by a third-party measurement and verification consultant who follows

[16] As defined in section 1 of the BC Utilities Commission Act, Demand Side Measures Regulation (BC Reg. 326/2008) amended March 24, 2017 technology innovation program

International Performance Measurement and Verification Protocols.  The development and implementation of a typical pilot project for technologies that pass Technology Screening takes approximately two to three years, depending on the complexities of the pilot design, program controls and participation requirements. Final results from pilot projects help support the feasibility of launching future DSM programs.

The **Deep Retrofits** activities aim to both assess and evaluate energy efficiency technologies, a system of technologies and or building designs that can reduce GHG emissions by 50% or greater in both residential and commercial buildings. Activities include conducting house-as-a-system technology research, executing small and large demonstrations, and partnering with industry stakeholders to educate the market.  Results of these activities will be used to inform energy savings and costing numbers, identify customer adoption barriers and establish recommendations to support future DSM program offerings.

## 8.1 Key Changes in New Plan

Compared to the previous DSM Plan, the 2023 DSM Plan has the following key updates in the Innovative Technologies program area:

Expenditures have expanded with incremental expenditures focused on screening and evaluating the following technologies:

- Residential hybrid heating systems and controls
- Residential and commercial gas heat pump technologies
- Deep retrofits
- Demand response natural gas solutions

## 8.2 Program Budget

Exhibit 64 shows the annual incentive, non-incentive, and total expenditures for the Innovative Technologies area by activity.

Exhibit 64 – Innovative Technology Expenditures by Activity ($000s)

| Program Area | Incentives | Non-Incentives | Total Expenditures |
|---|---|---|---|
| Pilot Projects - Deep Retrofits | 11,528 | 2,256 | 13,784 |
| Pilot Projects - Dual Fuel Hybrid Heating | 4,000 | 1,775 | 5,775 |
| Pilot Projects - Gas Heat Pumps | 2,860 | 492 | 3,352 |
| Pilot Projects - Other Technologies | 150 | 125 | 275 |
| Technology Screening Studies | 300 | 500 | 800 |
| Non-Program-Specific Expenses and Labour | - | 1,974 | 1,974 |
| **Total ($000s)** | **$18,838** | **$7,123** | **$25,960** |

## 8.3 Planned Activities

The following table provides a brief description of the technologies that are being evaluated for pilot projects over the period of 2023.

Exhibit 65 – Technologies Evaluated for 2023 Pilot Projects

| # | Technology | Description |
|---|---|---|
| 1 | Gas Heat Pumps | Gas heat pumps are used for space heating, water heating, ventilation and cooling for commercial and residential sectors. Technology manufacturers are developing three types of gas heat pump technologies: engine-driven vapor compression, sorption (absorption/adsorption), and thermal compression. Each type uses different refrigerants and pressurization methods to essentially move heat from an external heat source to a heat sink (indoors) using natural gas resulting in system efficiencies greater than 100%. |
| 2 | Hybrid Heating | A dual fuel hybrid heating system consists of a gas and electric heating system that is sequentially operated to meet heating needs to reduce costs and GHG emissions for building owners. Using hybrid heating systems claims to reduce the number of hours that electric heat pumps are required to operate at lower efficiencies during colder days, leading to reduced electric peak demand. The system also supports annual system efficiencies greater than 100% and resulting in less GHG emissions. |
| 4 | Demand Response natural gas solutions | Digital demand response technologies that can offer pathways to support events to reduce system capacity restraints with customers and reduce energy consumption and related GHG emissions. |
| 5 | Deep Retrofits | A deep energy retrofit or 'deep retrofit' of a home or building is a retrofit in which the envelope and energy systems are improved such that there is a reduction in overall energy consumption and GHG performance by at least 50% or more. Considering home as a system and improving the thermal performance of the envelope will reduce the heat demand and therefore creates better opportunity to downsize the required energy system. Across FEI's service territory, there is a significant base of buildings that are at least 25 years old and built before the adoption of the National Energy Code for buildings. The Conservation Potential Review study (CPR)[17], conducted by Posterity Group (an energy consultancy company) estimates an eligible market of 274 thousand dwellings and an annual energy savings potential of 890,000 GJ per year through leveraging comprehensive deep retrofit improvements. |

[17] 2021 Conservation Potential review, 12 July 2021, Posterity Group

| | | |
|---|---|---|
| 6 | Prefabricated panelized solutions | Prefabricated panelized solution is a methodology to reduce the construction time by integrating several thermal performance improvement measures together into a prefabricated wall or roof panel. These panels are fabricated in advance in a controlled environment inside a factory. These prefabricated panels will be attached to the existing building envelope onsite and in a short period of time. |
| 7 | AI-based energy performance evaluation | Artificial Intelligence based energy performance evaluation combines publicly available information with machine learning and provides home energy performance evaluation with current average of 80% accuracy. Leveraging this technology can improve scalability of deep retrofits while driving the cost down. |
| 8 | Building mapping solutions | Most older existing buildings do not have current architectural and mechanical plans. This can be a barrier for energy performance evaluation and deep retrofit implementation. Building mapping solutions provides dimensional and visual information for existing buildings and facilitates documenting the post retrofit condition. |
| 9 | Non-intrusive Air Sealing technologies | Improving airtightness is a deep retrofit measure that can provide significant impact on energy use reduction for a reasonable cost. Most often the destruction associated with improving the airtightness through conventional methods lowers the adoptability of this measure and non-intrusive Air Sealing technologies can remove such a barrier and improve market acceptance. |
| 10 | Thermal Bridging | Eliminating thermal bridging in existing buildings is one of the deep retrofit measures to improve thermal performance of the envelope. The improvement level depends on the archetype, construction assembly and current condition of the building. |
| 11 | Embodied Carbon | Embodied Carbon is a relatively newer consideration for lowering energy use and its associated GHG emissions in new and existing buildings. FortisBC will explore whether implementing a deep retrofit enhances the life of an existing building as well as the prevention of embodied carbon attached to its demolition. |
| 12 | Fault Detection and Diagnostics (FDD) | FDD supports buildings with identifying maintenance and design issues. The technology helps enhance operation sequencing and increasing awareness of building operators. This awareness can help optimize systems resulting in reduced consumption. |
| 13 | Automated Analytics | Advanced building automated analytics in conjunction with energy management information systems (EMIS) is used to increase the implementation of energy conservation measures. |

# 9 Enabling Activities

Enabling Activities are initiatives that support and supplement FEI's C&EM program development and delivery. These programs, activities and projects provide resources common to the support and delivery of all program area activities. Most of the activities listed are a continuation from 2018 or a re-application of a study previously conducted in order to gather up-to-date information. Note that the activities listed are not individually run through the DSM cost effectiveness tests and do not have energy savings directly associated with them. They are instead included on the portfolio level and reflected in the overall portfolio cost-effectiveness.

For the 2023 DSM plan, Enabling Activities are organized into the following:

- Trade Ally Network
- Codes and Standards
- Reporting Tool and Customer Application Portal
- Commercial Energy Specialist Program
- Community Energy Specialist Program
- Customer Research

## 9.1 Activity Profiles

### 9.1.1 Trade Ally Network

The **Trade Ally Network (TAN)** includes the expenditures related to maintaining FEI's program partners that help promote FEI's DSM programs and energy efficiency messaging. FEI relies on trade allies, such as contractors, distributors and Point of Sale Partners, to provide the qualifying products and installations of energy efficiency measures. FEI recognizes that other industry representatives, such as commercial service contractors, equipment manufacturers and architects play a role in influencing natural gas end-use and energy efficiency decisions, and that Energy Advisors and realtors play a role in influencing energy efficient upgrades in residential homes. As such incremental funding to support these industry representatives is planned. This program also supports funding energy efficiency training, a specified demand-side measure outlined in the DSM Regulation Section 1[18], and incremental funding to support additional measures and whole home retrofits is planned. Through the TAN, FEI provides sponsorships for training and support for several initiatives for the trades and trade organizations[19].

---

[18] BC Utilities Commission Act, Demand Side Measures Regulation (BC Reg. 326/2008) Section 1 amended March 24, 2017

[19] HPSC (Home Performance Stakeholder Council), MCABC (Mechanical Contractors Association of BC), etc.

Exhibit 66 – Trade Ally Network Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | - |
| Admin | 1,260 |
| Communication | 787 |
| Evaluation | 315 |
| Labour | 594 |
| **Total** | **$2,955** |

### 9.1.2 Codes and Standards

The **Codes and Standards** budget finances FEI's support for codes and standards policy development and research, through in-kind and financial co-funding arrangements.

In the residential sector, FEI will continue to provide support for energy compliance and testing of new homes through the provision of incentives for energy advisor services as required by the BC Energy Step Code. Incentives encourage builders to work with an energy advisor to validate the energy performance of their home through energy modelling, on-site airtightness testing, completion of the Step Code compliance reports and receipt of an EnerGuide label. Additional support will be provided to encourage early design activities such as mechanical design, building envelope design and integrated design process (IDP). These activities minimize time and risk when building to the upper tiers of the BC Energy Step Code.

The Codes and Standards area "supports the development of or compliance with specified standard or a measure respecting energy conservation or the efficient use of energy", as referred to in the definition of "specified demand-side measures" in the DSM Regulation Section 1 and supports implementation and adoption of such measures and aims to educate and provide training to the industry.

FEI also works with and supports several international, national, and provincial entities, such as:

- Canadian Standards Association
- Natural Resources Canada
- BC Ministry of Energy, Mines, and Low Carbon Innovation
- BC Building Safety & Standards Branch
- American Society of Heating, Refrigerating and Air-Conditioning Engineers
- Municipalities across BC

Compared to previous years, FEI will increase activity in this area to support development and advancement of provincial and federal energy efficiency building codes and appliance standards. Along with planned expansion of activities for codes and standards and in compliance with the DSM Regulation Section 3[20], investment equivalent to or more than 1% of the entire DSM portfolio expenditures has been included to be provided to a standards-making body, a regulator body and/or government to assist with the development of energy conservation standards or the efficient use of energy. The relevant financial investment planned to meet the 1% adequacy requirement[21] will be $1,411,000 in 2023. Included in the 1% planned adequacy funding is resources dedicated to standards making bodies which are advancing new testing and evaluation standards of natural gas fired equipment. Activities such as providing guidance and technical support for natural gas related energy efficiency initiatives are included to support provincial government. On a federal level, planned funding is included to support the development of national building codes or measures to enhance energy efficiency of natural gas heated homes.

Exhibit 67 – Codes and Standards Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | 2,308 |
| Admin | 502 |
| Communication | - |
| Evaluation | 60 |
| Labour | 152 |
| **Total** | **$3,022** |

### 9.1.3 Reporting Tool & Customer Application Portal

The **Reporting Tool & Customer Application Portal** includes expenditures related to the Demand-Side Management Tracking System ("DSMS"). This system manages DSM rebates from the application stage through to payment, including application review, approval, payment file exports, reporting, and customer communications. The budget consists of licensing and hosting fees and the labour required to operate and maintain the system and related customer portal.

[20] BC Utilities Commission Act, Demand Side Measures Regulation (BC Reg. 326/2008) Section 1(e)(i) and Section 3.1(e), amended March 24, 2017

[21] BC Utilities Commission Act, Demand Side Measures Regulation (BC Reg. 326/2008) Section 3.1(e), amended March 24, 2017

Exhibit 68 – Reporting Tool and Customer Application Portal Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | - |
| Admin | 1,157 |
| Communication | - |
| Evaluation | - |
| Labour | 413 |
| **Total** | **$1,570** |

### 9.1.4 Commercial Energy Specialist Program

The **Commercial Energy Specialist Program** funds Energy Specialist, Energy Analyst and Thermal Energy Manager positions in large commercial organizations including some that serve Indigenous housing. Funding ranges from $50,000 up to $80,000 per year based on position and an annual contract. A funded position's key priority is to identify and implement opportunities for their organization to participate in FEI's C&EM programs, while also identifying and implementing nonprogram specific opportunities to use natural gas more efficiently.

The estimated cost here includes an assumption of increasing to 47 participants including all positions. This program is funded as an enabling activity but claims natural gas savings for those projects completed by a funded position that are not claimed by another FEI DSM program. Although energy savings will be reported from this program, these energy savings come from unique ad hoc projects undertaken by energy specialists and therefore cannot be forecast. FEI considers this to be an energy management program, and hence a specified demand-side measure, as defined in Section 1 the DSM Regulation and subject to Section 4[22].

[22] BC Utilities Commission Act, Demand Side Measures Regulation (BC Reg. 326/2008) Section 4(4)(5), amended March 24, 2017

Exhibit 69 – Commercial Energy Specialist Program Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | 2,534 |
| Admin | 250 |
| Communication | - |
| Evaluation | 57 |
| Labour | 289 |
| **Total** | **$3,130** |

### 9.1.5 Community Energy Specialist Program

The **Community Energy Specialist Program** funds Senior Energy Specialist positions in municipalities, regional districts and Indigenous communities and organizations for up to $100,000 per year based on an annual contract. In the FEI service territory, C&EM contributes 60% of this funding amount, with the other 40% coming from FEI's External Relations department. In the FEI/FBC shared service territory, C&EM contributes 75% of this funding (split 50/50 between C&EM FEI and FBC), with the other 25% coming from FEI's External Relations department. Senior Energy Specialists lead policy development and implementation as communities develop or refresh their sustainability and energy plans, including BC Energy Step Code support where applicable and raise awareness of and participate in FEI's C&EM programs. 20 participants are expected in 2023. FEI considers this to be an energy management program, and hence a specified demand-side measure, as defined in Section 1 the DSM Regulation and subject to Section 4.

Exhibit 70 – Community Energy Specialist Program Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | 819 |
| Admin | 28 |
| Communication | - |
| Evaluation | 35 |
| Labour | 226 |
| **Total** | **$1,108** |

### 9.1.6 Customer Research

The **Customer Research** budget includes ongoing research to track the impact of C&EM communications, communications testing, digital user experience testing, and customer segmentation research.

Exhibit 71 – Customer Research Expenditures by Type

| Expenditures ($000s) - 2023 | |
|---|---|
| Incentives | - |
| Admin | 100 |
| Communication | - |
| Evaluation | 100 |
| Labour[23] | 25 |
| **Total** | **$225** |

[23] Labour is considered to be an administrative expenditure and has been listed separately throughout all program profiles in this DSM plan in order to clearly identify FEI's estimated labour expenditures.

## 9.2 Budget Overview

Exhibit  shows the annual incentive, non-incentive, and total expenditures for the Enabling Activities broken down by initiative.

Exhibit 72 – Enabling Activities Expenditures by Activity ($000s)

| Program Area | Incentives | Non-Incentives | Total Expenditures |
|---|---|---|---|
| Trade Ally Network | - | 2,955 | 2,955 |
| Codes & Standards | 2,308 | 714 | 3,022 |
| Reporting Tool & Customer Application Portal | - | 1,570 | 1,570 |
| Commercial Energy Specialist Program | 2,533 | 596 | 3,130 |
| Community Energy Specialist Program | 819 | 287 | 1,108 |
| Customer Research | - | 225 | 225 |
| **Total ($000s)** | **$5,662** | **$6,349** | **$12,010** |

# 10 Portfolio Level Activities

Portfolio Level Activities are those activities for which the costs cannot be assigned to individual DSM programs. These activities are distinct from Enabling Activities. These distinct Portfolio Level Activities include expenditures such as DSM support and portfolio level staff labour, staff training and conferences, facilities and equipment, industry association memberships, regulatory work and EECAG activities. Portfolio-level activities are required to properly plan and implement the proposed DSM programs and support efforts to meet the energy savings targets.

Exhibit 73 shows the annual expenditures for FEI's portfolio activities.

Exhibit 73 - Annual Portfolio DSM Expenditures by Activity ($000s)

| Activity | Total |
|---|---|
| Portfolio-Level Activities | 2,730 |
| **Total** | **$2,730** |

# 11 Summary

The information presented in this DSM Plan provides:

- A comprehensive suite of programs for each of the previously approved DSM activity areas
- Descriptions of each of the programs, including target markets, eligible measures, expected levels of participation, energy savings and forecast expenditures by administrative category
- A full reporting of the cost-effectiveness of those programs at the level of individual program, program area and total portfolio

The DSM plan illustrates that there remain significant cost-effective opportunities for energy efficiency within FEI's service territory, which is consistent with the results provided in FEI's BC Conservation Potential Review[24]. This remaining opportunity reflects, in part, how the continued technology cost and performance improvements have increased the availability of energy-efficiency options.

However, some markets are challenged. More specifically:

- The scope for program-induced natural gas savings in the Residential sector are challenged by the impacts of new space and water heating equipment performance standards, as well as those due to new residential construction standards. Consequently, the residential program portfolio has a TRC value of 0.4.

Overall, the portfolio of programs contained in the DSM Plan provide a TRC value of 0.7. Based on the DSM Regulation as amended on March 24, 2017 pursuant to B.C. Reg. 117/2017 (the March 2017 Amendment), the MTRC has been calculated for the measures with a TRC below 1.0. Section 4(1.5) of the DSM Regulation limits expenditures on measures that require the MTRC to be cost-effective to 40% of the total DSM portfolio expenditure. Based on the cost-effectiveness results presented herein, the expenditures for these programs total $43,161,000 in 2023, which represents 31% of the total DSM portfolio expenditures. Considering the MTRC adder only for the programs that require it, the portfolio cost-effectiveness was calculated to be 1.4.

[24] The annual energy savings reported in CPR 2021 include the cumulative effects of technologies implemented in prior years, which provides an accurate comparison with FEI's load forecast. However, the annual savings calculation method used for the purpose of this DSM Plan does not include the effects of those prior year technologies. Consequently, the reported savings from each approach are not directly comparable.

# *Appendix A-1* *Sources for Measure Assumptions*

## Residential Energy Efficiency Program Area

| Furnace | |
|---|---|
| Gas Savings per Participant | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on evaluation reports<br>Furnace Replacement Pilot Program – Preliminary Evaluation Results, Sampson Research, May 2014<br>Furnace Early Replacement Program – Preliminary Evaluation Year 1 Pilot, Habart & Associates Inc. May 2013 |
| Electricity Savings per Participant | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on evaluation report<br>Furnace Early Replacement Program – Preliminary Evaluation Year 1 Pilot, Habart & Associates Inc. May 2013 |
| Incremental Cost | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, April 2018 based on Program Participant data 2017 |
| Measure Life | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on reviews of Measure Life studies<br>MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING, Appendix C: Substantiation Sheets by Navigant Consulting, High Efficiency (Condensing) Furnace – Residential"<br>KEMA Measure Life Study: HVAC, 4.1697.190 Furnace (90% AFUE or greater) |
| Free Rider Rate | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018 based on Program Participant data 2017 |
| Spillover Rate | N/A |

| Communicating Thermostat | |
|---|---|
| Gas Savings per Participant | Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, ICF Consultants, July 2014 |
| Electricity Savings per Participant | Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, ICF Consultants, July 2014 |
| Incremental Cost | Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, ICF Consultants, July 2014 |
| Measure Life | Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, ICF Consultants, July 2014 |
| Free Rider Rate | Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, ICF Consultants, July 2014 |
| Spillover Rate | N/A |

| Boiler | |
|---|---|
| Gas Savings per Participant | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on evaluation reports<br>Furnace Replacement Pilot Program – Preliminary Evaluation Results, Sampson Research, May 2014<br>Furnace Early Replacement Program – Preliminary Evaluation Year 1 Pilot, Habart & Associates Inc. May 2013 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, April 2018 based on Program Participant data 2017 |
| Measure Life | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>based on reviews of Measure Life studies<br>MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING, Appendix C: Substantiation Sheets by Navigant Consulting, High Efficiency (Condensing) Furnace – Residential” |

| | |
|---|---|
| | KEMA Measure Life Study: HVAC, 4.1697.190 Furnace (90% AFUE or greater) |
| Free Rider Rate | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018 based on Program Participant data 2017 |
| Spillover Rate | N/A |

| Combination System | |
|---|---|
| Gas Savings per Participant | Combined Space and Water Heating Program Evaluation, Sampson Research, July 2017 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Review of 2015-16 Pilot Program Participation Costing Data, FEI, 2017 |
| Measure Life | Combination Unit Pre-Feasibility Study, Posterity Group, April 2014 |
| Free Rider Rate | Combined Space and Water Heating Program Evaluation, Sampson Research, July 2017 |
| Spillover Rate | Combined Space and Water Heating Program Evaluation, Sampson Research, July 2017 |

| EnerChoice Fireplace | |
|---|---|
| Gas Savings per Participant | 2010 Conservation Potential Review, ICF Marbek, 2010<br>Fireplace Impact Evaluation, Sampson Research, 2015,<br>AFER Study, Apartment Fireplace Efficiency Retrofit (AFER) Project, Building Energy Solutions, April 2017 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Regulatory Proposal (September 2016), Prepared by: Energy Efficiency Branch, BC Ministry of Energy and Mines |
| Measure Life | Regulatory Proposal (September 2016), Prepared by: Energy Efficiency Branch, BC Ministry of Energy and Mines |

| | |
|---|---|
| | Pre-Feasibility Study: Upgrades for Decorative Fireplaces-Ref: P132144JGW |
| Free Rider Rate | Analysis of 2017 Participant Data<br>Pre-Feasibility Study: Upgrades for Decorative Fireplaces-Ref: P132144JGW |
| Spillover Rate | John Sampson Analysis, February 2017 |

| Condensing Storage Tank Water Heater | |
|---|---|
| Gas Savings per Participant | Energy Savings Assumptions Review (of multiple energy savings data sources), FEI, November 2014, revisited February 2018 including<br>Deemed savings review of other jurisdictions<br>A Canadian High-Efficiency Natural Gas Water Heater Pilot Project, Natural Gas Technologies Centre, July 2014 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Review of program measure installations from 2017, FEI, April 2018 based on Program Participant data 2017 |
| Measure Life | Review of Technical Reference Manuals from other jurisdictions applied to actual program measure installation data from 2017. FEI, February 2018 including BC Hydro Powersmart F13 Effective Measure Life and Persistence |
| Free Rider Rate | Analysis of 2017 Participant Feedback, FEI, February 2018 |
| Spillover Rate | N/A |

| Condensing Tankless Water Heater | |
|---|---|
| Gas Savings per Participant | Energy Savings Assumptions Review (of multiple energy savings data sources), FEI, November 2014, revisited February 2018 including<br>Deemed savings review of other jurisdictions<br>A Canadian High-Efficiency Natural Gas Water Heater Pilot Project, Natural Gas Technologies Centre, July 2014 |

| | |
|---|---|
| Electricity Savings per Participant | N/A |
| Incremental Cost | Review of actual program measure installations from 2017, FEI, April 2018 based on Program Participant data 2017 |
| Measure Life | Review of Technical Reference Manuals from other jurisdictions applied to actual program measure installation data from 2017. FEI, February 2018 including<br>MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING, Appendix C: Substantiation Sheets by Navigant Consulting, page C-85 |
| Free Rider Rate | Analysis of 2017 Participant Feedback, FEI, February 2018 |
| Spillover Rate | N/A |

| Attic Insulation | |
|---|---|
| Gas Savings per Participant | Dunsky Energy Consulting analysis, 2013, 2015 – 2016 and 2018 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Dunsky Energy Consulting analysis update, 2018. |
| Measure Life | Dunsky Energy Consulting analysis update, 2018. |
| Free Rider Rate | Review of 2017 participant data and Analysis of Net-to-gross Survey Results for the ecoENERGY Retrofit for Homes program, Bronson Consulting Group, August 2010; |
| Spillover Rate | N/A |

| Wall Insulation | |
|---|---|
| Gas Savings per Participant | Dunsky Energy Consulting analysis, 2013, 2015 – 2016 and 2018 |
| Electricity Savings per Participant | N/A |

| | |
|---|---|
| Incremental Cost | Dunsky Energy Consulting analysis update, 2018. |
| Measure Life | Dunsky Energy Consulting analysis update, 2018. |
| Free Rider Rate | Review of 2017 participant data and Analysis of Net-to-gross Survey Results for the ecoENERGY Retrofit for Homes program, Bronson Consulting Group, August 2010; |
| Spillover Rate | N/A |

| **Crawlspace and Basement Insulation** | |
|---|---|
| Gas Savings per Participant | Dunsky Energy Consulting analysis, 2013, 2015 – 2016 and 2018 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Dunsky Energy Consulting analysis update, 2018. |
| Measure Life | Dunsky Energy Consulting analysis update, 2018. |
| Free Rider Rate | Review of 2017 participant data and Analysis of Net-to-gross Survey Results for the ecoENERGY Retrofit for Homes program, Bronson Consulting Group, August 2010; |
| Spillover Rate | N/A |

| **Other Insulation** | |
|---|---|
| Gas Savings per Participant | Dunsky Energy Consulting analysis, 2013, 2015 – 2016 and 2018 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Dunsky Energy Consulting analysis update, 2018. |
| Measure Life | Dunsky Energy Consulting analysis update, 2018. |
| Free Rider Rate | Review of 2017 participant data and Analysis of Net-to-gross Survey Results for the ecoENERGY Retrofit for Homes program, Bronson Consulting Group, August 2010; |

| | |
|---|---|
| Spillover Rate | N/A |

| Drain Water Heat Recovery | |
|---|---|
| Gas Savings per Participant | Pre-Feasibility Study – Drain Water Heat Recovery Systems, ICF Consultants, January 2016 |
| Electricity Savings per Participant | Pre-Feasibility Study – Drain Water Heat Recovery Systems, ICF Consultants, January 2016 |
| Incremental Cost | Pre-Feasibility Study – Drain Water Heat Recovery Systems, ICF Consultants, January 2016 |
| Measure Life | Pre-Feasibility Study – Drain Water Heat Recovery Systems, ICF Consultants, January 2016 |
| Free Rider Rate | Pre-Feasibility Study – Drain Water Heat Recovery Systems, ICF Consultants, January 2016 |
| Spillover Rate | N/A |

| Bonus Offers (Two Upgrade Bonus) | |
|---|---|
| Gas Savings per Participant | N/A - under development with program partners |
| Electricity Savings per Participant | N/A - under development with program partners |
| Incremental Cost | N/A - under development with program partners |
| Measure Life | N/A - under development with program partners |
| Free Rider Rate | N/A - under development with program partners |
| Spillover Rate | N/A - under development with program partners |

| Appliance Maintenance | |
|---|---|
| Gas Savings per Participant | N/A |

| | |
|---|---|
| Electricity Savings per Participant | N/A |
| Incremental Cost | N/A |
| Measure Life | N/A |
| Free Rider Rate | N/A |
| Spillover Rate | N/A |

| **Air Sealing – Contractor Incentive** | |
|---|---|
| Gas Savings per Participant | 2021 FEI CPR |
| Electricity Savings per Participant | 2021 FEI CPR |
| Incremental Cost | 2021 FEI CPR |
| Measure Life | 2021 FEI CPR |
| Free Rider Rate | 2021 FEI CPR |
| Spillover Rate | 2021 FEI CPR |

| **Draftproofing** | |
|---|---|
| Gas Savings per Participant | Innes Hood Oct 2010<br>Dunsky Energy Consulting analysis, 2013 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | N/A |
| Measure Life | Dunsky Energy Consulting analysis, 2013 |
| Free Rider Rate | 20191003: Review of Low Income Net-to-Gross, FRR by Ken Ross<br>Dunsky Energy Consulting analysis, 2013 |

| | |
|---|---|
| Spillover Rate | N/A |

| **EnergyStar Washer ($25)** | |
|---|---|
| Gas Savings per Participant | Review of Clothes Washer Technology Analysis, BC Hydro, 2010, 2010 Conservation Potential Review, ICF Marbek, 2010 and Technical Reference Manuals from other jurisdictions. |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Consultation with program partners |
| Measure Life | 2010 Conservation Potential Review, ICF Marbek, 2010 and Ontario Power Authority "2010 Prescriptive Measures and Assumptions: Release 1" |
| Free Rider Rate | BC Hydro and FortisBC based on market share of eligible washers. |
| Spillover Rate | N/A |

| **EnergyStar Dryer** | |
|---|---|
| Gas Savings per Participant | Market Review, ESource, December 2014 and High Efficiency Natural Gas Laundry Dryers, Posterity Group and Sampson Research, December 2014 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Market Review, ESource, December 2014 and High Efficiency Natural Gas Laundry Dryers, Posterity Group and Sampson Research, December 2014 |
| Measure Life | Market Review, ESource, December 2014 and High Efficiency Natural Gas Laundry Dryers, Posterity Group and Sampson Research, December 2014 |
| Free Rider Rate | Market Review, ESource, December 2014 and High Efficiency Natural Gas Laundry Dryers, Posterity Group and Sampson Research, December 2014 |
| Spillover Rate | N/A |

| Showerheads and Aerators | |
|---|---|
| Gas Savings per Participant | Terasen Gas TRC model RES, 3/4/2013, reviewed by FEI in February, 2017 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Analysis of actual installation costs, FEI, November 2016 |
| Measure Life | Terasen Gas TRC model RES, 3/4/2013, reviewed by FEI in February 2017 |
| Free Rider Rate | Dunsky Consulting analysis, 2013 |
| Spillover Rate | N/A |

| Bonus Offers (Three Upgrade Bonus) | |
|---|---|
| Gas Savings per Participant | N/A - under development with program partners |
| Electricity Savings per Participant | N/A - under development with program partners |
| Incremental Cost | N/A - under development with program partners |
| Measure Life | N/A - under development with program partners |
| Free Rider Rate | N/A - under development with program partners |
| Spillover Rate | N/A - under development with program partners |

| High Performance Windows and Doors | |
|---|---|
| Gas Savings per Participant | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Electricity Savings per Participant | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Incremental Cost | 2021 FEI CPR |

| | |
|---|---|
| | CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Measure Life | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Free Rider Rate | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Spillover Rate | N/A |

| STEP Code Measures | |
|---|---|
| Gas Savings per Participant | Preliminary Consulting Analysis, RDH Consultants – Understanding the BC Energy Step Code, 2017-2018<br>Preliminary Consulting Analysis, RDH Consultants, 2017-18 |
| Electricity Savings per Participant | Preliminary Consulting Analysis, RDH Consultants – Understanding the BC Energy Step Code, 2017-2018<br>Preliminary Consulting Analysis, RDH Consultants, 2017-18 |
| Incremental Cost | Preliminary Consulting Analysis, RDH Consultants – Understanding the BC Energy Step Code, 2017-2018<br>Preliminary Consulting Analysis, RDH Consultants, 2017-18 |
| Measure Life | Preliminary Consulting Analysis, RDH Consultants – Understanding the BC Energy Step Code, 2017-2018<br>Preliminary Consulting Analysis, RDH Consultants, 2017-18 |
| Free Rider Rate | New Home Program Analysis, ISE Consulting Group, 2014 and program experience<br>Estimation based on market assessment, FEI, February 2018 |
| Spillover Rate | N/A |

## Commercial Energy Efficiency Program Area

| Condensing Boiler Heating Plant Optimization | |
|---|---|
| Gas Savings per Participant | Condensing Boilers for Existing Buildings – Prism Engineering<br>Minnesota Department of Commerce – Division of Energy Resources – Commercial Condensing Boiler Optimization (December 2016)<br>Documentation of FortisBC Commercial Boiler Program (EBP) Data, 2018<br>FortisBC 2010 CPR |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Documentation of FortisBC Commercial Boiler Program (EBP) Data, 2018 |
| Measure Life | Documentation of FortisBC Commercial Boiler Program (EBP) Data, 2018<br>ICF Measure Lifetime analysis |
| Free Rider Rate | FortisBC 2010 CPR |
| Spillover Rate | N/A |

| Domestic Water Heater System Optimization | |
|---|---|
| Gas Savings per Participant | Condensing Boilers for Existing Buildings – Prism Engineering<br>Minnesota Department of Commerce – Division of Energy Resources – Commercial Condensing Boiler Optimization (December 2016)<br>Documentation of FortisBC Commercial Boiler Program (EBP) Data, 2018<br>FortisBC 2010 CPR |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Documentation of FortisBC Commercial Boiler Program (EBP) Data, 2018 |
| Measure Life | Documentation of FortisBC Commercial Boiler Program (EBP) Data, 2018<br>ICF Measure Lifetime analysis |
| Free Rider Rate | FortisBC 2010 CPR |

| | |
|---|---|
| Spillover Rate | N/A |

| Condensing Volume Boiler | |
|---|---|
| Gas Savings per Participant | Efficient Commercial Water Heater Evaluation – Final Report, Prism Engineering, February 2017 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Analysis of 2016 Program Participant Data, FEI, November 2017 for Efficient Boiler, and Vendor Costing Survey, FEI, 2016 for Base Efficiency Boiler |
| Measure Life | Review of Technical Reference Manuals from other jurisdictions, FEI, 2017 including<br>MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING, Appendix C: Substantiation Sheets by Navigant Consulting<br>KEMA Measure Life Study |
| Free Rider Rate | Efficient Commercial Water Heater Evaluation – Final Report, Prism Engineering, February 2017 |
| Spillover Rate | N/A |

| Condensing Tankless Water Heater | |
|---|---|
| Gas Savings per Participant | Efficient Commercial Water Heater Evaluation – Final Report, Prism Engineering, February 2017 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Analysis of 2016 Program Participant Data, FEI, November 2017 for Efficient Boiler, and Vendor Costing Survey, FEI, 2016 for Base Efficiency Boiler |
| Measure Life | Review of Technical Reference Manuals from other jurisdictions, FEI, 2017 including<br>MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING, Appendix C: Substantiation Sheets by Navigant Consulting |

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|---|---|
| | KEMA Measure Life Study |
| Free Rider Rate | Efficient Commercial Water Heater Evaluation – Final Report, Prism Engineering, February 2017 |
| Spillover Rate | N/A |

| Food Services Efficiency Measures | |
|---|---|
| Gas Savings per Participant | Commercial Food Service Incentive Program Evaluation, Final Report, Fish and River Consultants, February 2018 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Program Cost Data Review, FEI, 2017 and Vendor costing survey 2017 & 2018 |
| Measure Life | Review of TRMs from other jurisdictions, FEI, 2017 including KEMA Measure Life Study |
| Free Rider Rate | Commercial Food Service Incentive Program Evaluation, Final Report, Fish and River Consultants, February 2018 |
| Spillover Rate | N/A |

| Low Flow Spray Valves | |
|---|---|
| Gas Savings per Participant | Review of actual program data 2010 - 2016, FEI, February 2018 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Review of actual program data 2010 - 2016, FEI, February 2018 |
| Measure Life | Ontario Energy Board: OEB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge |
| Free Rider Rate | Commercial Food Service Incentive Program Evaluation, Final Report, Fish and River Consultants, February 2018 |
| Spillover Rate | N/A |

| Condensing Make Up Air Unit | |
|---|---|
| Gas Savings per Participant | Condensing Gas-Fired Ventilation Unit Pilot Program, FortisBC, SES Consulting Inc. and FRESCo Ltd., November 2015 and Ontario Energy Board: OEB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge |
| Electricity Savings per Participant | Condensing Gas-Fired Ventilation Unit Pilot Program, FortisBC, SES Consulting Inc. and FRESCo Ltd., November 2015 and Ontario Energy Board: OEB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge |
| Incremental Cost | Ontario Energy Board: OEB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge |
| Measure Life | Ontario Energy Board: OEB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge |
| Free Rider Rate | Ontario Energy Board: OEB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge, Pre-Feasibility Study, Condensing Rooftop Units, Prism Engineering, January 2012 |
| Spillover Rate | N/A |

| Furnace | |
|---|---|
| Gas Savings per Participant | Residential Furnace Early replacement methodology applied using commercial sector GJ savings estimation from Ontario Energy Board: OEB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge, adjusted to BC climate conditions by FEI, February 2018 |
| Electricity Savings per Participant | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on evaluation report<br>Furnace Early Replacement Program – Preliminary Evaluation Year 1 Pilot, Habart & Associates Inc. May 2013 |
| Incremental Cost | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018 based on Program Participant data 2017 |

| | |
|---|---|
| Measure Life | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on reviews of Measure Life studies<br>MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING, Appendix C: Substantiation Sheets by Navigant Consulting, High Efficiency (Condensing) Furnace – Residential"<br>KEMA Measure Life Study: HVAC, 4.1697.190 Furnace (90% AFUE or greater) |
| Free Rider Rate | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018 based on Program Participant data 2017 |
| Spillover Rate | N/A |

| **HVAC Controls – Kitchen DCV** | |
|---|---|
| Gas Savings per Participant | Review of actual custom program data 2013-2017, FEI, January 2018 |
| Electricity Savings per Participant | Review of actual custom program data 2013-2017, FEI, January 2018 |
| Incremental Cost | Review of actual custom program data 2013-2017, FEI, January 2018 |
| Measure Life | Review of TRM and Measure Life Study references including<br>BC Hydro F13 Measure Life and Persistency: 2.6.4 - Exhaust hood demand ventilation controls<br>KEMA: 14.6000.085 - Kitchen Exhaust Hood Demand Control Ventilation |
| Free Rider Rate | Ontario Energy Board: EB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge, adjusted to BC climate conditions by FEI, February 2018 |
| Spillover Rate | N/A |

| **Condensing Unit Heaters** | |
|---|---|
| Gas Savings per Participant | Pre-Feasibility Study – Condensing Unit & Infrared Radiant Tube Heating, ICF Marbek, November 2013 |

| | |
|---|---|
| Electricity Savings per Participant | Pre-Feasibility Study – Condensing Unit & Infrared Radiant Tube Heating, ICF Marbek, November 2013 |
| Incremental Cost | Pre-Feasibility Study – Condensing Unit & Infrared Radiant Tube Heating, ICF Marbek, November 2013 |
| Measure Life | Pre-Feasibility Study – Condensing Unit & Infrared Radiant Tube Heating, ICF Marbek, November 2013 |
| Free Rider Rate | Ontario Energy Board: EB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge, adjusted to BC climate conditions by FEI, February 2018, and Pre-Feasibility Study – Condensing Unit & Infrared Radiant Tube Heating, ICF Marbek, November 2013 |
| Spillover Rate | N/A |

| Vortex DeAerators | |
|---|---|
| Gas Savings per Participant | Ice Rink Resurfacing Efficiency Pilot Measurement and Verification Result, FEI, June 2014 and discussions from product vendor |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Pilot data |
| Measure Life | BC Hydro F13 Measure Life and Persistency: 2.3.10 Water Distribution Piping Retrofit |
| Free Rider Rate | Ice Rink Resurfacing Efficiency Pilot Measurement and Verification Result, FEI, June 2014 and discussions from product vendor |
| Spillover Rate | N/A |

| Gas Underfired Boilers | |
|---|---|
| Gas Savings per Participant | Ontario Energy Board: EB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge |
| Electricity Savings per Participant | Ontario Energy Board: EB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge |

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|---|---|
| Incremental Cost | Ontario Energy Board: EB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge |
| Measure Life | Ontario Energy Board: EB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge |
| Free Rider Rate | Ontario Energy Board: EB-2015-0344 New and Updated DSM Measures - Joint Submission from Union Gas Ltd. and Enbridge |
| Spillover Rate | N/A |

| **Air Curtains** | |
|---|---|
| Gas Savings per Participant | IPP Measures Documentation - Phase I & Phase II, 2018<br>Posterity Group Industrial Measures Analysis (2017)<br>Enbridge Gas Distribution (2016), Updated DSM Measures and the Technical Resource Manual (TRM), EB-2016-0246, Exhibit B. |
| Electricity Savings per Participant | IPP Measures Documentation - Phase I, 2018<br>Enbridge Gas Distribution (2016), Updated DSM Measures and the Technical Resource Manual (TRM), EB-2016-0246, Exhibit B.<br>Environment and Climate Change Canada (2017), Canadian Weather Year for Energy Calculation [online datasets]<br>Illinois Energy Efficiency Stakeholder Advisory Group (2017), Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 6.0, Volume 2<br>Posterity Group Industrial Measures Analysis (2017) |
| Incremental Cost | IPP Measures Documentation - Phase I, 2018<br>Enbridge Gas Distribution (2016), Updated DSM Measures and the Technical Resource Manual (TRM), EB-2016-0246, Exhibit B.<br>Illinois Energy Efficiency Stakeholder Advisory Group (2017), Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 6.0, Volume 2<br>Posterity Group Industrial Measures Analysis (2017) |
| Measure Life | Enbridge Gas Distribution (2016), Updated DSM Measures and the Technical Resource Manual (TRM), EB-2016-0246, Exhibit B. Filed: 2016-12-21. page 21 |

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|---|---|
| Free Rider Rate | FRR- 18% - Ken Ross Feb 25/20 email<br>IPP Measures Documentation - Phase I, 2018 |
| Spillover Rate | FRR- 18% - Ken Ross Feb 25/20 email<br>IPP Measures Documentation - Phase I, 2018 |

| Pipe and Tank Insulation | |
|---|---|
| Gas Savings per Participant | IPP Measures Documentation - Phase I & Phase II, 2018<br>Posterity Group Industrial Measures Analysis (2017)<br>Pacific Gas &Electric Company (2014), Work Paper PGECORPRO103 Tank Insulation, Revision 5.<br>Southern California Gas Company (2014). Pipe Insulation (Non-Space Conditioning) Workpaper SCGWP 110812A, Revision 3.<br>Pipe Insulation Source Documentation - from Kalie McGratten 11/21/2018 |
| Electricity Savings per Participant | IPP Measures Documentation - Phase I, 2018 |
| Incremental Cost | IPP Measures Documentation - Phase I & Phase II, 2018<br>Posterity Group Industrial Measures Analysis (2017)<br>Pacific Gas &Electric Company (2014), Work Paper PGECORPRO103 Tank Insulation, Revision 5.<br>McMaster-Carr Website (2018)<br>Southern California Gas Company (2014). Pipe Insulation (Non-Space Conditioning) Workpaper SCGWP 110812A, Revision 3. |
| Measure Life | IPP Measures Documentation - Phase I & Phase II, 2018<br>Enbridge Gas Distribution (2016), Updated DSM Measures and the Technical Resource Manual (TRM), EB-2016-0246, Exhibit B. Filed: 2016-12-21. page 21<br>Pacific Gas &Electric Company (2014), Work Paper PGECORPRO103 Tank Insulation, Revision 5. |
| Free Rider Rate | FRR- 18% - Ken Ross Feb 25/20 email<br>IPP Measures Documentation - Phase I & Phase II, 2018 |
| Spillover Rate | FRR- 18% - Ken Ross Feb 25/20 email |

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|---|---|
| | IPP Measures Documentation - Phase I & Phase II, 2018 |

| **Steam Boilers** | |
|---|---|
| Gas Savings per Participant | CLEAResult, Steam Boiler Measure Study Report, Rev.1, February 28, 2019 |
| Electricity Savings per Participant | CLEAResult, Steam Boiler Measure Study Report, Rev.1, February 28, 2019 |
| Incremental Cost | Cannepp and Raven Supply Workshop - Jermin Hsieh, Nov. 26/2019<br>CLEAResult, Steam Boiler Measure Study Report, Rev.1, February 28, 2019 |
| Measure Life | CLEAResult, Steam Boiler Measure Study Report, Rev.1, February 28, 2019 |
| Free Rider Rate | FRR- 18% - Ken Ross Feb 25/20 email<br>Habart & Associates -Efficient Boiler Program Impact Evaluation (June 12, 2003), Page 3 |
| Spillover Rate | FRR- 18% - Ken Ross Feb 25/20 email<br>Habart & Associates -Efficient Boiler Program Impact Evaluation (June 12, 2003), Page 3 |

| **Hybrid Systems** | |
|---|---|
| Gas Savings per Participant | FEI and FBC 2021 CPR |
| Electricity Savings per Participant | FEI and FBC 2021 CPR |
| Incremental Cost | FEI and FBC 2021 CPR |
| Measure Life | FEI and FBC 2021 CPR |
| Free Rider Rate | FEI and FBC 2021 CPR |
| Spillover Rate | FEI and FBC 2021 CPR |

| Gas Heat Pump | |
|---|---|
| Gas Savings per Participant | Posterity Group Measure Library (commercial gas heat pump)<br>Based on findings from FEI pilot projects |
| Electricity Savings per Participant | Posterity Group Measure Library (commercial gas heat pump)<br>Based on findings from FEI pilot projects |
| Incremental Cost | Posterity Group Measure Library (commercial gas heat pump)<br>Based on findings from FEI pilot projects |
| Measure Life | Posterity Group Measure Library (commercial gas heat pump)<br>Based on findings from FEI pilot projects |
| Free Rider Rate | Posterity Group Measure Library (commercial gas heat pump)<br>Based on findings from FEI pilot projects |
| Spillover Rate | N/A |

| Connected Thermostats | |
|---|---|
| Gas Savings per Participant | APEX Analytics LLC and Demand Side Analytics, FortisBC Smart Learning Thermostat Pilot - Evaluation Final, April 29,2 019, page 51<br>ECAP Measure Characterization_rev3_FINAL_Dunsky, Dec. 5/19<br>ICF Marbek: Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, DRAFT ICF Consultants, July 2014, page 122 |
| Electricity Savings per Participant | ICF Marbek: Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, DRAFT ICF Consultants, July 2014, page 123 |
| Incremental Cost | ICF Marbek: Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, DRAFT ICF Consultants, July 2014, page 123 |
| Measure Life | ECAP Measure Characterization_rev3_FINAL_Dunsky, Dec. 5/19. from NB Power TRM - September 2017 |
| Free Rider Rate | 20191003: Review of Low Income Net-to-Gross, FRR by Ken Ross<br>APEX Analytics LLC and Demand Side Analytics, FortisBC Smart Learning Thermostat Pilot - Evaluation Final, April 29,2 019, page 45 |

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|---|---|
| | ICF Marbek: Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, DRAFT ICF Consultants, July 2014, page 63 |
| Spillover Rate | APEX Analytics LLC and Demand Side Analytics, FortisBC Smart Learning Thermostat Pilot - Evaluation Final, April 29, 2019, page 44<br>ICF Marbek: Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, DRAFT ICF Consultants, July 2014, page 124 |

| Boiler Additives | |
|---|---|
| Gas Savings per Participant | Based on data from FortisBC Pilot project, 2020 |
| Electricity Savings per Participant | Based on data from FortisBC Pilot project, 2020 |
| Incremental Cost | Based on data from FortisBC Pilot project, 2020 |
| Measure Life | Based on data from FortisBC Pilot project, 2020 |
| Free Rider Rate | Based on data from FortisBC Pilot project, 2020 |
| Spillover Rate | Based on data from FortisBC Pilot project, 2020 |

| Studies - Retrofit | |
|---|---|
| Gas Savings per Participant | N/A - no savings attributed to study |
| Electricity Savings per Participant | N/A - no savings attributed to study |
| Incremental Cost | Review of past program data 2013-2018, FEI, February 2018 |
| Measure Life | N/A |
| Free Rider Rate | Review of Technical Reference Manuals from other jurisdictions, FEI, January 2010. Updated on a project-by-project basis for actual projects. |
| Spillover Rate | N/A |

| Capital Upgrades - Retrofit | |
|---|---|
| Gas Savings per Participant | Review of actual program measure implementation 2011 – 2017, FEI, February 2018 |
| Electricity Savings per Participant | Review of actual program measure implementation 2011 – 2017, FEI, February 2018 |
| Incremental Cost | Review of actual program measure implementation 2011 – 2017, FEI, February 2018 |
| Measure Life | Review of actual program measure implementation 2011 – 2017, FEI, February 2018 |
| Free Rider Rate | Review of Technical Reference Manuals from other jurisdictions, FEI, January 2010. Updated on a project-by-project basis for actual projects. |
| Spillover Rate | N/A |

| Recommissioning (Studies & O&M) | |
|---|---|
| Gas Savings per Participant | Review of Continuous Optimization Program Data provided by BC Hydro as contained in Continuous Optimization Business Case, FEI, 2016 |
| Electricity Savings per Participant | Review of Continuous Optimization Program Data provided by BC Hydro as contained in Continuous Optimization Business Case, FEI, 2016 |
| Incremental Cost | Review of Continuous Optimization Program Data provided by BC Hydro as contained in Continuous Optimization Business Case, FEI, 2016 |
| Measure Life | Review of Continuous Optimization Program Data provided by BC Hydro as contained in Continuous Optimization Business Case, FEI, 2016 |
| Free Rider Rate | Review of Continuous Optimization Program Data provided by BC Hydro as contained in Continuous Optimization Business Case, FEI, 2016 |
| Spillover Rate | N/A |

| Commercial Energy Assessments | |
|---|---|
| Gas Savings per Participant | Energy Assessment Program Evaluations, 2008 and 2010 Friuch Consulting adjusted for current conditions by Program Manager, September2017 |

| | |
|---|---|
| Electricity Savings per Participant | Review of Actual Program Data for 2014 – 2017, FEI, September 2017 |
| Incremental Cost | Review of Actual Program Data for 2014 – 2017, FEI, September 2017 |
| Measure Life | Review of Actual Program Data for 2014 – 2017, FEI, September 2017 |
| Free Rider Rate | Energy Assessment Program Evaluations, 2008 and 2010 Friuch Consulting |
| Spillover Rate | N/A |

| STEP Code – Whole Building | |
|---|---|
| Gas Savings per Participant | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Electricity Savings per Participant | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Incremental Cost | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Measure Life | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Free Rider Rate | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Spillover Rate | N/A |

| Non-STEP Code – Whole Building | |
|---|---|
| Gas Savings per Participant | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Electricity Savings per Participant | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Incremental Cost | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Measure Life | Preliminary program design work, Dunsky Energy Consulting, February 2018 |

| | |
|---|---|
| Free Rider Rate | Review of Technical Reference Manuals from other jurisdictions and other relevant publications, FEI, January 2010. |
| Spillover Rate | N/A |

| Early Engagement | |
|---|---|
| Gas Savings per Participant | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Electricity Savings per Participant | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Incremental Cost | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Measure Life | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Free Rider Rate | Review of Technical Reference Manuals from other jurisdictions and other relevant publications, FEI, January 2010. |
| Spillover Rate | N/A |

| Small Commercial New Construction | |
|---|---|
| Gas Savings per Participant | Focal Engineering Commercial New Construction Part 3 and Part 9 Analysis, 2021 |
| Electricity Savings per Participant | Focal Engineering Commercial New Construction Part 3 and Part 9 Analysis, 2021 |
| Incremental Cost | Focal Engineering Commercial New Construction Part 3 and Part 9 Analysis, 2021 |
| Measure Life | Focal Engineering Commercial New Construction Part 3 and Part 9 Analysis, 2021 |
| Free Rider Rate | Focal Engineering Commercial New Construction Part 3 and Part 9 Analysis, 2021 |

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|---|---|
| Spillover Rate | Focal Engineering Commercial New Construction Part 3 and Part 9 Analysis, 2021 |

| STEP Code Capacity Building - Charettes | |
|---|---|
| Gas Savings per Participant | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Electricity Savings per Participant | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Incremental Cost | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Measure Life | Preliminary program design work, Dunsky Energy Consulting, February 2018 |
| Free Rider Rate | Review of Technical Reference Manuals from other jurisdictions and other relevant publications, FEI, January 2010. |
| Spillover Rate | N/A |

| RAP – Energy Assessments (Common Area) | |
|---|---|
| Gas Savings per Participant | 2020 Commercial Energy Assessment - Business Case, by Jermin Hsieh, July 14, 2020 – FINAL<br>Commercial Energy Assessments:  2019 Actuals TrakSmart/SAP Adj File<br>Commercial RAP Energy Assessments: The costs are based on the actual costs invoiced from the Vendor.<br>2018 Actuals TrakSmart/SAP Adj File<br>Terasen Gas EAP Review 2010<br>Energy Assessment Program Evaluations, 2008 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Review of actual program data 2014-2017 |
| Measure Life | Review of actual program data 2014-2017 |

| | |
|---|---|
| Free Rider Rate | Commercial Energy Assessment Program Evaluation, Friuch Consulting Energy Assessment Program Evaluations, 2008 |
| Spillover Rate | N/A |

| RAP – Implementation Support Partial (Common Area) | |
|---|---|
| Gas Savings per Participant | N/A |
| Electricity Savings per Participant | N/A |
| Incremental Cost | N/A |
| Measure Life | N/A |
| Free Rider Rate | N/A |
| Spillover Rate | N/A |

| RAP – Implementation Support Full (Common Area) | |
|---|---|
| Gas Savings per Participant | N/A |
| Electricity Savings per Participant | N/A |
| Incremental Cost | N/A |
| Measure Life | N/A |
| Free Rider Rate | N/A |
| Spillover Rate | N/A |

| RAP – Condensing Boilers (Common Area) |
|---|

| | |
|---|---|
| Gas Savings per Participant | Based on 2018-2019 analysis of actuals<br>Update of Energy Savings Analysis from FortisBC Efficient Boiler Program – Final Report 2013, Prism Engineering. |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Based on 2018-2019 analysis of actuals |
| Measure Life | KEMA: Boilers & Burners 1.2796.040 High Efficiency Modulating Hot Water Boiler<br>ASHRAE Equipment Life Tables |
| Free Rider Rate | Efficient Boiler Program Impact Evaluation, June 12, 2003, page 51 |
| Spillover Rate | Efficient Boiler Program Impact Evaluation, June 12, 2003, page 51 |

| RAP – Water Heaters (Common Area) | |
|---|---|
| Gas Savings per Participant | Based on analysis of 2018-2019 actuals<br>Efficient Commercial Water Heater Evaluation – Final Report, Prism Engineering, February 2017 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Based on analysis of 2018-2019 actuals |
| Measure Life | MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING, Appendix C: Substantiation Sheets by Navigant Consulting<br>KEMA Measure Life Study |
| Free Rider Rate | Efficient Commercial Water Heater Evaluation – Final Report, Prism Engineering, February 2017 |
| Spillover Rate | N/A |

| RAP – Recirculation Controls (Common Area) | |
|---|---|
| Gas Savings per Participant | Based on FortisBC Pilot project data, 2016 |

| | |
|---|---|
| Electricity Savings per Participant | Based on FortisBC Pilot project data, 2016 |
| Incremental Cost | Based on FortisBC Pilot project data, 2016 |
| Measure Life | Based on FortisBC Pilot project data, 2016 |
| Free Rider Rate | Based on FortisBC Pilot project data, 2016 |
| Spillover Rate | Based on FortisBC Pilot project data, 2016 |

| 1.5GPM Showerheads (Gas) (Unit) | |
|---|---|
| Gas Savings per Participant | ECAP Measure Characterization_rev3_FINAL_Dunsky, Dec. 5/19<br>RAP Business Case, Source is Dunsky Consulting, 20150713, Page 34<br>Terasen Gas TRC model RES, 3/4/2013, reviewed by FEI in February, 2017 (Resi)<br>Low Flow Numbers for ECAP & ESK v1 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Based on actuals |
| Measure Life | Dunsky Energy Consulting analysis, 2019<br>RAP Business Case, Source is Dunsky Consulting, 20150713, Page 34<br>2012 BC Hydro Persistence Standard<br>Terasen Gas TRC model RES, 3/4/2013, reviewed by FEI in February, 2017 |
| Free Rider Rate | RAP Business Case, Source is Dunsky Consulting, 20150713, page 34<br>Dunsky Consulting analysis, 2013 |
| Spillover Rate | N/A |

| 1.5GPM Handheld Showerhead (Gas) (Unit) | |
|---|---|
| Gas Savings per Participant | Dunsky Energy Consulting analysis, 2019<br>RAP Business Case, Source is Dunsky Consulting, 20150713, Page 34 |

| | |
|---|---|
| | Terasen Gas TRC model RES, 3/4/2013, reviewed by FEI in February 2017<br>Low Flow Numbers for ECAP & ESK v1 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Based on actuals |
| Measure Life | Dunskey Energy Consulting analysis, 2019<br>RAP Business Case, Source is Dunsky Consulting, 20150713, Page 34<br>2012 BC Hydro Persistence Standard<br>Terasen Gas TRC model RES, 3/4/2013, reviewed by FEI in February 2017 |
| Free Rider Rate | RAP Business Case, Source is Dunsky Consulting, 20150713, page 34<br>Dunsky Consulting analysis, 2013 |
| Spillover Rate | N/A |

| 1.5GPM Bathroom Aerators (Gas) (Unit) | |
|---|---|
| Gas Savings per Participant | Dunskey Energy Consulting analysis, 2019<br>RAP Business Case, Source is Dunsky Consulting, 20150713, Page 34<br>Terasen Gas TRC model RES, 3/4/2013, reviewed by FEI in February 2017<br>Low Flow Numbers for ECAP & ESK |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Analysis of actual installation costs, FEI, November 2016 |
| Measure Life | Dunskey Energy Consulting analysis, 2019<br>RAP Business Case, Source is Dunsky Consulting, 20150713, Page 34<br>2012 BC Hydro Persistence Standard<br>Terasen Gas TRC model RES, 3/4/2013, reviewed by FEI in February, 2017 |
| Free Rider Rate | Low Income FRR Revision Dec 8,2017<br>RAP Business Case, Source is Dunsky Consulting, 20150713, Page 34 |
| Spillover Rate | N/A |

| 1.5GPM Kitchen Aerators (Gas) (Unit) | |
|---|---|
| Gas Savings per Participant | Dunskey Energy Consulting analysis, 2019<br>RAP Business Case, Source is Dunsky Consulting, 20150713, Page 34<br>Terasen Gas TRC model RES, 3/4/2013, reviewed by FEI in February 2017<br>Low Flow Numbers for ECAP & ESK |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Analysis of actual installation costs, FEI, November 2016 |
| Measure Life | Dunskey Energy Consulting analysis, 2019<br>RAP Business Case, Source is Dunsky Consulting, 20150713, Page 34<br>2012 BC Hydro Persistence Standard<br>Terasen Gas TRC model RES, 3/4/2013, reviewed by FEI in February 2017 |
| Free Rider Rate | Low Income FRR Revision Dec 8,2017<br>RAP Business Case, Source is Dunsky Consulting, 20150713, Page 34 |
| Spillover Rate | N/A |

## Industrial Energy Efficiency Program Area

| Process Boiler (Hot Water and Steam) | |
|---|---|
| Gas Savings per Participant | FEI (2018), Analysis of Prism Engineering (2013), Update of Energy Savings Analysis from FortisBC Efficient Boiler Program. |
| Electricity Savings per Participant | N/A |
| Incremental Cost | FEI (2017), Analysis of 2016 Efficient Boiler Program participants; FEI (2017), Vendor Costing Survey. |
| Measure Life | FEI (2017), Review of Technical Reference Manuals from other jurisdictions. |
| Free Rider Rate | Efficient Boiler Program Impact Evaluation (2003). |
| Spillover Rate | N/A |

| Air Curtains | |
|---|---|
| Gas Savings per Participant | Posterity Group (2017), Analysis of: Enbridge Gas Distribution (2016), Updated DSM Measures and the Technical Resource Manual (TRM), EB-2016-0246, Exhibit B. |
| Electricity Savings per Participant | Posterity Group (2017), Analysis of: Enbridge Gas Distribution (2016), Updated DSM Measures and the Technical Resource Manual (TRM), EB-2016-0246, Exhibit B; Environment and Climate Change Canada (2017), Canadian Weather Year for Energy Calculation [online datasets]; Illinois Energy Efficiency Stakeholder Advisory Group (2017), Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 6.0, Volume 2. |
| Incremental Cost | Posterity Group (2017), Analysis of: Enbridge Gas Distribution (2016), Updated DSM Measures and the Technical Resource Manual (TRM), EB-2016-0246, Exhibit B; Illinois Energy Efficiency Stakeholder Advisory Group (2017), Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 6.0, Volume 2. |
| Measure Life | Enbridge Gas Distribution (2016), Updated DSM Measures and the Technical Resource Manual (TRM), EB-2016-0246, Exhibit B. |

| | |
|---|---|
| Free Rider Rate | Preliminary determination based on Commercial Prescriptive Program (to be formalized in 2018). |
| Spillover Rate | N/A |

| Direct Contact Water Heater | |
|---|---|
| Gas Savings per Participant | Posterity Group (2017), Analysis of: Pacific Gas &Electric Company (2016), Work Paper PGECORPRO106 Direct Contact Water Heater, Revision 4. |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Posterity Group (2017), Analysis of: Pacific Gas &Electric Company (2016), Work Paper PGECORPRO106 Direct Contact Water Heater, Revision 4. |
| Measure Life | Michigan Public Service Commission (2017), 2017 Michigan Energy Measures Database. |
| Free Rider Rate | Preliminary determination based on Commercial Prescriptive Program (to be formalized in 2018). |
| Spillover Rate | N/A |

| Steam Traps Survey | |
|---|---|
| Gas Savings per Participant | N/A |
| Electricity Savings per Participant | N/A |
| Incremental Cost | CLEAResult (2016), Market Characterization of Stream Trap Maintenance Practices. |
| Measure Life | N/A |
| Free Rider Rate | Preliminary determination based on Commercial Prescriptive Program (to be formalized in 2018). |
| Spillover Rate | N/A |

| Steam Traps Replacement | |
|---|---|
| Gas Savings per Participant | CLEAResult (2016), Market Characterization of Stream Trap Maintenance Practices. |
| Electricity Savings per Participant | N/A |
| Incremental Cost | CLEAResult (2016), Market Characterization of Stream Trap Maintenance Practices. |
| Measure Life | CLEAResult (2016), Market Characterization of Stream Trap Maintenance Practices. |
| Free Rider Rate | Preliminary determination based on Commercial Prescriptive Program (to be formalized in 2018). |
| Spillover Rate | N/A |

| Tank Insulation | |
|---|---|
| Gas Savings per Participant | Posterity Group (2017), Analysis of: Pacific Gas &Electric Company (2014), Work Paper PGECORPRO103 Tank Insulation, Revision 5. |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Posterity Group (2017), Analysis of: Pacific Gas &Electric Company (2014), Work Paper PGECORPRO103 Tank Insulation, Revision 5; McMaster-Carr Website (2018), https://www.mcmaster.com/. |
| Measure Life | Pacific Gas &Electric Company (2014), Work Paper PGECORPRO103 Tank Insulation, Revision 5. |
| Free Rider Rate | Preliminary determination based on Commercial Prescriptive Program (to be formalized in 2018). |
| Spillover Rate | N/A |

| Other Prescriptive Measures | |
|---|---|
| Gas Savings per Participant | Preliminary engineering estimate, FEI, (to be studied further in 2018) |
| Electricity Savings per Participant | Preliminary engineering estimate, FEI, (to be studied further in 2018) |
| Incremental Cost | Preliminary engineering estimate, FEI, (to be studied further in 2018) |
| Measure Life | Preliminary engineering estimate, FEI, (to be studied further in 2018) |
| Free Rider Rate | Preliminary determination based on Commercial Prescriptive Program (to be formalized in 2018). |
| Spillover Rate | N/A |

| Thermal Curtains | |
|---|---|
| Gas Savings per Participant | Business Case of Greenhouse Thermal Curtains Prescriptive Measure-Conservation & Energy Management, July 2018, Page 3<br>Posterity Group Industrial Measures Analysis (2017) |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Business Case of Greenhouse Thermal Curtains Prescriptive Measure-Conservation & Energy Management, July 2018, Page 3<br>IOP FS Results<br>MCS Review |
| Measure Life | Business Case of Greenhouse Thermal Curtains Prescriptive Measure-Conservation & Energy Management, July 2018, Page 3<br>Greenhouse Measures Energy Trust of Oregon<br>PG&E-Work Paper<br>Focus on Energy Wisconsin 2015 |
| Free Rider Rate | Business Case of Greenhouse Thermal Curtains Prescriptive Measure-Conservation & Energy Management, July 2018, Page 3<br>PG&E Agricultural and Food Processing: Greenhouse Heat Curtain and Infrared Film Measures |

| | |
|---|---|
| Spillover Rate | Business Case of Greenhouse Thermal Curtains Prescriptive Measure-Conservation & Energy Management, July 2018, Page 3 |

| Infrared Heater | |
|---|---|
| Gas Savings per Participant | Posterity Group Industrial Measures Analysis (2017) |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Posterity Group Industrial Measures Analysis (2017) |
| Measure Life | Posterity Group Industrial Measures Analysis (2017) |
| Free Rider Rate | FRR- 18% - Ken Ross Feb 25/20 email<br>IPP Measures Documentation - Phase I, 2018 |
| Spillover Rate | FRR- 18% - Ken Ross Feb 25/20 email<br>IPP Measures Documentation - Phase I, 2018 |

| Technology Implementation | |
|---|---|
| Gas Savings per Participant | FEI (2017), Analysis of 2015-2017 program participants. |
| Electricity Savings per Participant | FEI (2017), Analysis of 2015-2017 program participants. |
| Incremental Cost | FEI (2017), Analysis of 2015-2017 program participants. |
| Measure Life | FEI (2017), Analysis of 2015-2017 program participants. |
| Free Rider Rate | Preliminary determination based on Commercial Performance Program: FEI (2010), Review of Technical Reference Manuals from Other Jurisdictions (Updated on a Project by Project Basis). |
| Spillover Rate | N/A |

| Feasibility Study |
|---|

| | |
|---|---|
| Gas Savings per Participant | N/A |
| Electricity Savings per Participant | N/A |
| Incremental Cost | FEI (2017), Analysis of 2016-2017 study participants |
| Measure Life | N/A |
| Free Rider Rate | N/A |
| Spillover Rate | N/A |

| **Plant Wide Audit** | |
|---|---|
| Gas Savings per Participant | N/A |
| Electricity Savings per Participant | N/A |
| Incremental Cost | FEI (2017), Analysis of 2016-2017 study participants |
| Measure Life | N/A |
| Free Rider Rate | N/A |
| Spillover Rate | N/A |

| **Individual, Large Customer** | |
|---|---|
| Gas Savings per Participant | Preliminary engineering estimate |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Estimate based on BC Hydro program planning |
| Measure Life | Estimate based on BC Hydro program planning |

| | |
|---|---|
| Free Rider Rate | Preliminary determination based on Commercial Performance Program (to be formalized during program design and evaluation): FEI (2010), Review of Technical Reference Manuals from other jurisdictions. |
| Spillover Rate | N/A |

| Cohort, Medium Customers | |
|---|---|
| Gas Savings per Participant | Preliminary engineering estimate |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Estimate based on BC Hydro program planning |
| Measure Life | Estimate based on BC Hydro program planning |
| Free Rider Rate | Preliminary determination based on Commercial Performance Program (to be formalized during program design and evaluation): FEI (2010), Review of Technical Reference Manuals from other jurisdictions. |
| Spillover Rate | N/A |

## Low Income Energy Efficiency Program Area

| **Energy Savings Kit (ESK)** | |
|---|---|
| Gas Savings per Participant | ECAP Measure Characterization_rev3_FINAL_Dunsky, Dec. 5/19<br>Discounted Savings Based on BC Hydro Evaluation of Installation Rates & 2013 Tech Review (SFD) & (MURB) |
| Electricity Savings per Participant | ECAP Measure Characterization_rev3_FINAL_Dunsky, Dec. 5/19 |
| Incremental Cost | Average based on the full cost of the gas measures included in the ESK |
| Measure Life | ECAP Measure Characterization_rev3_FINAL_Dunsky, Dec. 5/19<br>Average based on the individual gas measures included in the Energy Saving Kit, 2017 |
| Free Rider Rate | 20191003: Review of Low Income Net-to-Gross, FRR by Ken Ross<br>Esource: Low-income, Income Assisted Customers or Charitable Programs Oct. 30, 2017; BC Hydro, Oct. 30, 2017 |
| Spillover Rate | 20200226:  Low Income Spillover, 2019, Ken Ross email |

| **Re-engagement Kit** | |
|---|---|
| Gas Savings per Participant | Based on 2019-2020 annual report data |
| Electricity Savings per Participant | Based on 2019-2020 annual report data |
| Incremental Cost | Based on 2019-2020 annual report data |
| Measure Life | Based on 2019-2020 annual report data |
| Free Rider Rate | Based on 2019-2020 annual report data |
| Spillover Rate | Based on 2019-2020 annual report data |

| Energy Conservation Assistance Program (ECAP) | |
|---|---|
| Gas Savings per Participant | Dunsky Energy Consultants analysis, 2019<br>Based on analysis of 2017-2020 actuals |
| Electricity Savings per Participant | Dunsky Energy Consultants analysis, 2019 |
| Incremental Cost | Based on average cost of the customized bundle of measures installed, includes the full cost of the gas measures installed in gas heated homes. |
| Measure Life | Dunsky Energy Consultants analysis, 2019<br>Average based on the individual gas measures installed |
| Free Rider Rate | 20191003: Review of Low Income Net-to-Gross, FRR by Ken Ross<br>Esource: Low-income, Income Assisted Customers or Charitable Programs Oct. 30, 2017; BC Hydro, Oct. 30, 2017 |
| Spillover Rate | 20200226: Low Income Spillover, 2019, Ken Ross email |

| Furnace | |
|---|---|
| Gas Savings per Participant | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on evaluation reports<br>Furnace Replacement Pilot Program – Preliminary Evaluation Results, Sampson Research, May 2014<br>Furnace Early Replacement Program – Preliminary Evaluation Year 1 Pilot, Habart & Associates Inc. May 2013 |
| Electricity Savings per Participant | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on evaluation report<br>Furnace Early Replacement Program – Preliminary Evaluation Year 1 Pilot, Habart & Associates Inc. May 2013 |
| Incremental Cost | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, April 2018 based on Program Participant data 2017 |
| Measure Life | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018 |

| | |
|---|---|
| | Based on reviews of Measure Life studies<br>MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING, Appendix C: Substantiation Sheets by Navigant Consulting, High Efficiency (Condensing) Furnace – Residential"<br>KEMA Measure Life Study: HVAC, 4.1697.190 Furnace (90% AFUE or greater) |
| Free Rider Rate | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018 based on Program Participant data 2017 |
| Spillover Rate | N/A |

| Boiler (94% or Higher AFUE) | |
|---|---|
| Gas Savings per Participant | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on evaluation reports<br>Furnace Replacement Pilot Program – Preliminary Evaluation Results, Sampson Research, May 2014<br>Furnace Early Replacement Program – Preliminary Evaluation Year 1 Pilot, Habart & Associates Inc. May 2013 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, April 2018 based on Program Participant data 2017 |
| Measure Life | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>based on reviews of Measure Life studies<br>MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING, Appendix C: Substantiation Sheets by Navigant Consulting, High Efficiency (Condensing) Furnace – Residential"<br>KEMA Measure Life Study: HVAC, 4.1697.190 Furnace (90% AFUE or greater) |
| Free Rider Rate | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018 based on Program Participant data 2017 |
| Spillover Rate | N/A |

| Connected Thermostat | |
|---|---|
| Gas Savings per Participant | Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, ICF Consultants, July 2014 |
| Electricity Savings per Participant | Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, ICF Consultants, July 2014 |
| Incremental Cost | Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, ICF Consultants, July 2014 |
| Measure Life | Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, ICF Consultants, July 2014 |
| Free Rider Rate | Inventory and Energy Savings Estimates for Residential Self-programmable Thermostats, ICF Consultants, July 2014 |
| Spillover Rate | N/A |

| Water Heater Condensing Tankless | |
|---|---|
| Gas Savings per Participant | Energy Savings Assumptions Review (of multiple energy savings data sources), FEI, November 2014, revisited February 2018 including<br>Deemed savings review of other jurisdictions<br>A Canadian High-Efficiency Natural Gas Water Heater Pilot Project, Natural Gas Technologies Centre, July 2014 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Review of actual program measure installations from 2017, FEI, April 2018 based on Program Participant data 2017 |
| Measure Life | Review of Technical Reference Manuals from other jurisdictions applied to actual program measure installation data from 2017. FEI, February 2018 including<br>MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING, Appendix C: Substantiation Sheets by Navigant Consulting, page C-85 |
| Free Rider Rate | Analysis of 2017 Participant Feedback, FEI, February 2018 |
| Spillover Rate | N/A |

| Water Heater Condensing Storage Tank | |
|---|---|
| Gas Savings per Participant | Energy Savings Assumptions Review (of multiple energy savings data sources), FEI, November 2014, revisited February 2018 including<br>Deemed savings review of other jurisdictions<br>A Canadian High-Efficiency Natural Gas Water Heater Pilot Project, Natural Gas Technologies Centre, July 2014 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Review of program measure installations from 2017, FEI, April 2018 based on Program Participant data 2017 |
| Measure Life | Review of Technical Reference Manuals from other jurisdictions applied to actual program measure installation data from 2017. FEI, February 2018 including BC Hydro Powersmart F13 Effective Measure Life and Persistence |
| Free Rider Rate | Analysis of 2017 Participant Feedback, FEI, February 2018 |
| Spillover Rate | N/A |

| Two Upgrade Bonus | |
|---|---|
| Gas Savings per Participant | N/A - under development with program partners |
| Electricity Savings per Participant | N/A - under development with program partners |
| Incremental Cost | N/A - under development with program partners |
| Measure Life | N/A - under development with program partners |
| Free Rider Rate | N/A - under development with program partners |
| Spillover Rate | N/A - under development with program partners |

| Attic Insulation | |
|---|---|
| Gas Savings per Participant | Dunsky Energy Consulting analysis, 2013, 2015 – 2016 and 2018 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Dunsky Energy Consulting analysis update, 2018. |
| Measure Life | Dunsky Energy Consulting analysis update, 2018. |
| Free Rider Rate | Review of 2017 participant data and Analysis of Net-to-gross Survey Results for the ecoENERGY Retrofit for Homes program, Bronson Consulting Group, August 2010; |
| Spillover Rate | N/A |

| Wall Insulation | |
|---|---|
| Gas Savings per Participant | Dunsky Energy Consulting analysis, 2013, 2015 – 2016 and 2018 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Dunsky Energy Consulting analysis update, 2018. |
| Measure Life | Dunsky Energy Consulting analysis update, 2018. |
| Free Rider Rate | Review of 2017 participant data and Analysis of Net-to-gross Survey Results for the ecoENERGY Retrofit for Homes program, Bronson Consulting Group, August 2010; |
| Spillover Rate | N/A |

| Ventilation | |
|---|---|
| Gas Savings per Participant | (HRR) HERO Measure Savings-Dunsky Energy Consulting analysis, Apr 4, 2018<br>Dunsky Consulting, 2013-2016 |

| | |
|---|---|
| Electricity Savings per Participant | N/A |
| Incremental Cost | HERO Measure Savings-Dunsky Energy Consulting analysis |
| Measure Life | HERO Measure Savings-Dunsky Energy Consulting analysis |
| Free Rider Rate | Review of actual 2017 data<br>Analysis of Net-to-gross Survey Results for the ecoENERGY Retrofit for Homes program, Bronson Consulting Group, August 2010 |
| Spillover Rate | N/A |

| **Crawlspace and Basement Insulation** | |
|---|---|
| Gas Savings per Participant | Dunsky Energy Consulting analysis, 2013, 2015 – 2016 and 2018 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Dunsky Energy Consulting analysis update, 2018. |
| Measure Life | Dunsky Energy Consulting analysis update, 2018. |
| Free Rider Rate | Review of 2017 participant data and Analysis of Net-to-gross Survey Results for the ecoENERGY Retrofit for Homes program, Bronson Consulting Group, August 2010; |
| Spillover Rate | N/A |

| **Other Insulation** | |
|---|---|
| Gas Savings per Participant | Dunsky Energy Consulting analysis, 2013, 2015 – 2016 and 2018 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Dunsky Energy Consulting analysis update, 2018. |
| Measure Life | Dunsky Energy Consulting analysis update, 2018. |

| | |
|---|---|
| Free Rider Rate | Review of 2017 participant data and Analysis of Net-to-gross Survey Results for the ecoENERGY Retrofit for Homes program, Bronson Consulting Group, August 2010; |
| Spillover Rate | N/A |

| | |
|---|---|
| **Fireplace** | |
| Gas Savings per Participant | 2010 Conservation Potential Review, ICF Marbek, 2010<br>Fireplace Impact Evaluation, Sampson Research, 2015,<br>AFER Study, Apartment Fireplace Efficiency Retrofit (AFER) Project, Building Energy Solutions, April 2017 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Regulatory Proposal (September 2016), Prepared by: Energy Efficiency Branch, BC Ministry of Energy and Mines |
| Measure Life | Regulatory Proposal (September 2016), Prepared by: Energy Efficiency Branch, BC Ministry of Energy and Mines,<br>Pre-Feasibility Study: Upgrades for Decorative Fireplaces-Ref: P132144JGW |
| Free Rider Rate | Analysis of 2017 Participant Data<br>Pre-Feasibility Study: Upgrades for Decorative Fireplaces-Ref: P132144JGW |
| Spillover Rate | John Sampson Analysis, February 2017 |

| | |
|---|---|
| **Combination System** | |
| Gas Savings per Participant | Combined Space and Water Heating Program Evaluation, Sampson Research, July 2017 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Review of 2015-16 Pilot Program Participation Costing Data, FEI, 2017 |
| Measure Life | Combination Unit Pre-Feasibility Study, Posterity Group, April 2014 |

| | |
|---|---|
| Free Rider Rate | Combined Space and Water Heating Program Evaluation, Sampson Research, July 2017 |
| Spillover Rate | Combined Space and Water Heating Program Evaluation, Sampson Research, July 2017 |

| Appliance Maintenance | |
|---|---|
| Gas Savings per Participant | N/A |
| Electricity Savings per Participant | N/A |
| Incremental Cost | N/A |
| Measure Life | N/A |
| Free Rider Rate | N/A |
| Spillover Rate | N/A |

| Commercial – Non-Profit Bundled Measures | |
|---|---|
| Gas Savings per Participant | Review of actual program measure implementation, FEI |
| Electricity Savings per Participant | Review of actual program measure implementation, FEI |
| Incremental Cost | Review of actual program measure implementation, FEI |
| Measure Life | Review of actual program measure implementation, FEI |
| Free Rider Rate | Review of actual program measure implementation, FEI |
| Spillover Rate | Review of actual program measure implementation, FEI |

| Commercial – Boiler | |
|---|---|
| Gas Savings per Participant | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on evaluation reports<br>Furnace Replacement Pilot Program – Preliminary Evaluation Results, Sampson Research, May 2014<br>Furnace Early Replacement Program – Preliminary Evaluation Year 1 Pilot, Habart & Associates Inc. May 2013 |
| Electricity Savings per Participant | N/A |
| Incremental Cost | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, April 2018 based on Program Participant data 2017 |
| Measure Life | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>based on reviews of Measure Life studies<br>MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING, Appendix C: Substantiation Sheets by Navigant Consulting, High Efficiency (Condensing) Furnace – Residential"<br>KEMA Measure Life Study: HVAC, 4.1697.190 Furnace (90% AFUE or greater) |
| Free Rider Rate | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018 based on Program Participant data 2017 |
| Spillover Rate | N/A |

| Commercial – Water Heater | |
|---|---|
| Gas Savings per Participant | Review of actual program measure implementation, FEI |
| Electricity Savings per Participant | Review of actual program measure implementation, FEI |
| Incremental Cost | Review of actual program measure implementation, FEI |
| Measure Life | Review of actual program measure implementation, FEI |

| | |
|---|---|
| Free Rider Rate | Review of actual program measure implementation, FEI |
| Spillover Rate | Review of actual program measure implementation, FEI |

| **Commercial – Gas Heat Pump** | |
|---|---|
| Gas Savings per Participant | Review of actual program measure implementation, FEI |
| Electricity Savings per Participant | Review of actual program measure implementation, FEI |
| Incremental Cost | Review of actual program measure implementation, FEI |
| Measure Life | Review of actual program measure implementation, FEI |
| Free Rider Rate | Review of actual program measure implementation, FEI |
| Spillover Rate | Review of actual program measure implementation, FEI |

| **Commercial – Furnace** | |
|---|---|
| Gas Savings per Participant | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on evaluation reports<br>Furnace Replacement Pilot Program – Preliminary Evaluation Results, Sampson Research, May 2014<br>Furnace Early Replacement Program – Preliminary Evaluation Year 1 Pilot, Habart & Associates Inc. May 2013 |
| Electricity Savings per Participant | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on evaluation report<br>Furnace Early Replacement Program – Preliminary Evaluation Year 1 Pilot, Habart & Associates Inc. May 2013 |
| Incremental Cost | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, April 2018 based on Program Participant data 2017 |

| | |
|---|---|
| Measure Life | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018<br>Based on reviews of Measure Life studies<br>MEASURES AND ASSUMPTIONS FOR DEMAND SIDE MANAGEMENT (DSM) PLANNING, Appendix C: Substantiation Sheets by Navigant Consulting, High Efficiency (Condensing) Furnace – Residential"<br>KEMA Measure Life Study: HVAC, 4.1697.190 Furnace (90% AFUE or greater) |
| Free Rider Rate | Documentation of FortisBC Furnace and Boiler Early Replacement Program, FEI, February 2018 based on Program Participant data 2017 |
| Spillover Rate | N/A |

| Windows and Doors Tier 1 | |
|---|---|
| Gas Savings per Participant | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Electricity Savings per Participant | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Incremental Cost | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Measure Life | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Free Rider Rate | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Spillover Rate | N/A |

| Windows and Doors Tier 2 | |
|---|---|
| Gas Savings per Participant | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |

| | |
|---|---|
| Electricity Savings per Participant | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Incremental Cost | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Measure Life | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Free Rider Rate | 2021 FEI CPR<br>CleanBC Windows and Doors Replacement Rebate – Better Homes BC |
| Spillover Rate | N/A |

| Health and Safety | |
|---|---|
| Gas Savings per Participant | Review of actual program measure implementation, FEI |
| Electricity Savings per Participant | Review of actual program measure implementation, FEI |
| Incremental Cost | Review of actual program measure implementation, FEI |
| Measure Life | Review of actual program measure implementation, FEI |
| Free Rider Rate | Review of actual program measure implementation, FEI |
| Spillover Rate | Review of actual program measure implementation, FEI |

| Commercial – Small Commercial New Construction (SCNC) | |
|---|---|
| Gas Savings per Participant | Review of actual program measure implementation, FEI |
| Electricity Savings per Participant | Review of actual program measure implementation, FEI |
| Incremental Cost | Review of actual program measure implementation, FEI |
| Measure Life | Review of actual program measure implementation, FEI |

| | |
|---|---|
| Free Rider Rate | Review of actual program measure implementation, FEI |
| Spillover Rate | Review of actual program measure implementation, FEI |

| **STEP Code Measures** | |
|---|---|
| Gas Savings per Participant | Preliminary Consulting Analysis, RDH Consultants – Understanding the BC Energy Step Code, 2017-2018<br>Preliminary Consulting Analysis, RDH Consultants, 2017-18 |
| Electricity Savings per Participant | Preliminary Consulting Analysis, RDH Consultants – Understanding the BC Energy Step Code, 2017-2018<br>Preliminary Consulting Analysis, RDH Consultants, 2017-18 |
| Incremental Cost | Preliminary Consulting Analysis, RDH Consultants – Understanding the BC Energy Step Code, 2017-2018<br>Preliminary Consulting Analysis, RDH Consultants, 2017-18 |
| Measure Life | Preliminary Consulting Analysis, RDH Consultants – Understanding the BC Energy Step Code, 2017-2018<br>Preliminary Consulting Analysis, RDH Consultants, 2017-18 |
| Free Rider Rate | New Home Program Analysis, ISE Consulting Group, 2014 and program experience<br>Estimation based on market assessment, FEI, February 2018 |
| Spillover Rate | N/A |

| **Bundled Residential New Home Measures** | |
|---|---|
| Gas Savings per Participant | Review of actual program measure implementation, FEI |
| Electricity Savings per Participant | Review of actual program measure implementation, FEI |
| Incremental Cost | Review of actual program measure implementation, FEI |
| Measure Life | Review of actual program measure implementation, FEI |

| | |
|---|---|
| Free Rider Rate | Review of actual program measure implementation, FEI |
| Spillover Rate | Review of actual program measure implementation, FEI |

| **Residential Energy Efficiency Works (REnEW)** | |
|---|---|
| Gas Savings per Participant | N/A |
| Electricity Savings per Participant | N/A |
| Incremental Cost | N/A |
| Measure Life | N/A |
| Free Rider Rate | 20191003: Review of Low Income Net-to-Gross, FRR by Ken Ross<br>Esource: Low-income, Income Assisted Customers or Charitable Programs Oct. 30, 2017; BC Hydro, Oct. 30, 2017 |
| Spillover Rate | 20200226: Low Income Spillover, 2019, Ken Ross email |

# Appendix B

# FEI 2021 ANNUAL DSM REPORT

FORTIS BC™

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March 31, 2022

British Columbia Utilities Commission
Suite 410, 900 Howe Street
Vancouver, BC
V6Z 2N3

Attention: Mr. Patrick Wruck, Commission Secretary

Dear Mr. Wruck:

**Re: FortisBC Energy Inc. (FEI)**
**Natural Gas Demand-Side Management (DSM) – 2021 Annual Report**

Attached please find the Natural Gas DSM Program 2021 Annual Report for FEI.

If further information is required, please contact Sarah Wagner, Regulatory Projects Manager at (250) 469-6081.

Sincerely,

**FORTISBC ENERGY INC.**

***Original signed:***

Diane Roy

Attachment

# FortisBC Energy Inc.

# Natural Gas
# Demand-Side Management Programs
# 2021 Annual Report

March 31, 2022

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# 1. REPORT OVERVIEW

FortisBC Energy Inc. (FEI or the Company), is committed to delivering a broad portfolio of cost-effective natural gas Demand-side Management[1] (DSM) measures that address the expectations of customers while meeting the requirements for public utilities to pursue cost-effective DSM. In 2021, the Company achieved a combined portfolio Modified Total Resource Cost (MTRC)[2] of 1.4 on expenditures of $106.844 million, meeting FEI's goal of cost-effective program delivery.

The FEI DSM Annual Report (the Report) outlines the Company's actual results and expenditures for 2021 as compared to the Company's 2019-2022 DSM Plan approved by the BCUC in its Decision and Order G-10-19 (the Decision) and subsequent amendments approved by BCUC Orders G-135-21, G-301-21 and G-345-21. The Report compares 2021 actual activity and results to these approved DSM Plan values for 2021. Where the details of individual programs vary substantially from the 2019-2022 DSM Plan, explanations are provided in the applicable Program Area sections of the Report.

## 1.1 PURPOSE OF REPORT: TRANSPARENCY, ACCOUNTABILITY AND UPDATE ON PROGRESS

The Report details the Company's activities for the overall DSM Portfolio and in each Program Area. Incentive and non-incentive expenditures are reported at the level of each program or measure, as well as at the Program Area and Portfolio levels. Results for the following cost effectiveness tests are provided for the overall Portfolio and each Program Area in Section 2, and for each program as appropriate in the respective Program Area sections:

- Total Resource Cost (TRC);
- Ratepayer Impact Measure (RIM);
- Participant Cost Test (PCT);
- Utility Cost Test (UCT); and
- Modified Total Resource Cost (MTRC). In accordance with British Columbia's Demand-Side Measures Regulation (DSM Regulation), results of the MTRC calculations are also provided where appropriate (see Section 2.1).

The Report also demonstrates that the Company is meeting the accountability mechanisms directed by the BCUC in Order G-10-19, which carries over a number of requirements from prior

[1] Throughout this Report the use of the term Demand-Side Management or "DSM" is intended to refer to demand-side measures in BC as defined in the BC Demand-Side Measures Regulation (DSM Regulation).

[2] Pursuant to the BC Demand-side Measures Regulation, the Portfolio level MTRC is calculated based on costs and benefits of all programs in the Portfolio as well as any Program Area and Portfolio level administration costs, and including the benefit adders for those programs for which the MTRC is relied upon to determine cost effectiveness on an individual program basis (i.e. those programs that have been designated as being under the MTRC Cap as presented in Section 2.1 of this report).

orders regarding DSM expenditures. One such mechanism contained in Order G-36-09 was the requirement to file DSM Annual Reports, which states:

> A requirement that Terasen [now FEI] submit annually to the BCUC, by the end of the first quarter following year-end, for each year of the funding period, a report on all [DSM] initiatives and activities, expenditures and results…

This report shows that FEI's DSM portfolio meets the cost-effectiveness calculations and adequacy requirements set out in the DSM Regulation, as amended in March 2017.

## 1.2 *ORGANIZATION OF THE DSM ANNUAL REPORT*

The following describes how each section of the Report presents the results of 2021 DSM activities:

**Section 1: Report Overview**

- Provides a high-level background for the Report.

**Section 2: Portfolio Overview**

- Provides detail regarding the overall actual 2021 expenditures for DSM activities.
- Section 2.5 discusses any new requirements from the BCUC concerning information to be included in the 2021 DSM Annual Report.

**Section 3: Funding Transfers and Carryover**

- Provides a discussion on funding transfers between Program Areas and amounts unspent in 2021 in each Program Area that are rolled over to 2020 planned expenditures.

**Section 4: Advisory Group Activities**

- Provides information regarding Energy Efficiency and Conservation Advisory Group (EECAG) activities in 2021.

**Sections 5 - 9 provide information on:**

- Residential, Low Income, Commercial, Innovative Technologies, and Industrial Energy Efficiency Program Areas, respectively;
- Each section contains a table summarizing the planned and actual expenditures for the respective Program Area in 2021, including incentive and non-incentive expenditures, annual and NPV gas savings, as well as TRC and other cost-effectiveness test results. Additional tables outline the individual 2021 programs, including program and measure descriptions, program assumptions and sources for these assumptions, and a breakdown of incentive and non-incentive expenditures.

**Section 10: Conservation Education and Outreach Initiatives**

- Provides both a summary and details regarding actual 2021 expenditures for the Conservation Education and Outreach (CEO) Program Area.

**Section 11: Enabling Activities**

- Provides both summary and detail regarding actual 2021 expenditures for the Enabling Activities that support the work of the DSM Portfolio as a whole.

**Section 12: Evaluation**

- Provides detail regarding pending and actual expenditures for 2021 program evaluation activities, as well as summary results from evaluations and studies completed in 2021.

**Section 13: Data Gathering, Reporting and Internal Control Processes**

- Provides a summary of the Company's data tracking, process control, and reporting for 2021 DSM activities, and a high-level description of the Company's internal approval process for programs.

**Section 14: 2021 DSM Annual Report Summary**

- Provides a summary conclusion for the Report and FEI's 2021 DSM activity.

# 2. PORTFOLIO OVERVIEW

In this Section, FEI provides its DSM energy savings, expenditures and cost-effectiveness test results at an overall Portfolio level and Program Area level for 2021. A summary of the overall Portfolio results is provided in Table 2-1, demonstrating that the Company achieved a combined Portfolio MTRC of 1.4. FEI achieved DSM expenditures of $106.844 million and recorded annual natural gas savings of 1.15 million GJ in 2021. These energy savings resulted in carbon emission reductions of almost 69,000 tonnes of CO2e in 2021 and total reductions of almost 736,000[3] tonnes of CO2e over the life of all measures installed or undertaken in 2021. Expenditures and savings have increased over 2020 results by approximately $31 million and approximately 116,000 GJ respectively.

**Table 2-1: Overall DSM Portfolio Results for 2021**

| Indicator - 2021 Results | | Total |
|---|---|---|
| Utility Expenditures, Incentives ($000s) | | 86,129 |
| Utility Expenditures, Non-Incentives ($000s) | | 20,715 |
| Utility Expenditures, Total ($000s) | | 106,844 |
| Net Incremental Annual Gas Savings (GJ/yr.) | | 1,142,533 |
| Annual GHG Emission Reductions* (tonnes CO2e/yr) | | 68,323 |
| NPV of Annual Gas Savings (GJ/yr.) | | 12,303,687 |
| Measure Lifetime GHG Emission Reductions* (tonnes CO2e) | | 735,761 |
| Benefit/Cost Ratios | TRC | **0.9** |
| | MTRC | **1.4** |
| | UCT | **0.8** |
| | PCT | **2.3** |
| | RIM | **0.4** |

Tables 2-2 and 2-3 below provide the expenditures and cost-effectiveness test results by Program Area for the overall DSM Portfolio.

[3] Emission reduction value based on life cycle (well to burner tip) emission factor of 0.0598 tonnes CO2e/GJ for natural gas. Annual emission reductions are just those attributed to the first year following measure implementation. Lifetime reductions are the total reductions that occur over the life of all measures implemented (based on NPV of gas savings).

**Table 2-2: Overall DSM Portfolio Level Results by Program Area 2021 – Expenditures[4]**

| Program Area | Utility Expenditures ($000s) | | | | | |
|---|---|---|---|---|---|---|
| | Incentives | | Non-Incentives | | Total Expenditures | |
| | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual |
| Residential | 46,570 | 48,910 | 3,551 | 2,574 | 50,121 | 51,484 |
| Commercial | 16,900 | 18,479 | 3,835 | 2,830 | 20,735 | 21,309 |
| Industrial | 7,137 | 5,438 | 776 | 658 | 7,913 | 6,095 |
| Low Income | 8,043 | 7,467 | 2,279 | 1,575 | 10,322 | 9,043 |
| Conservation Education and Outreach | 0 | 0 | 8,578 | 4,517 | 8,578 | 4,517 |
| Innovative Technologies | 1,900 | 1,707 | 3,164 | 2,014 | 5,064 | 3,721 |
| Enabling Activities | 3,673 | 4,128 | 5,049 | 5,071 | 8,722 | 9,199 |
| Portfolio Level Activities | 0 | 0 | 943 | 1,477 | 943 | 1,477 |
| **ALL PROGRAMS** | **84,223** | **86,129** | **28,175** | **20,715** | **112,398** | **106,844** |

**Table 2-3: Overall DSM Portfolio Level Results by Program Area 2021 – Savings**

| Program Area | Incremental Annual Gas Savings, Net (GJ) | | Benefit/Cost Ratios | | | | |
|---|---|---|---|---|---|---|---|
| | 2021 Plan | 2021 Actual | TRC | MTRC | UCT | PCT | RIM |
| Residential | 272,112 | 299,709 | 0.4 | 1.4 | 0.5 | 1.6 | 0.4 |
| Commercial | 388,041 | 413,589 | 1.3 | 1.3 | 1.6 | 2.8 | 0.5 |
| Industrial | 458,768 | 297,760 | 2.7 | 2.7 | 3.9 | 4.9 | 0.8 |
| Low Income | 57,547 | 50,660 | 3.0 | 3.0 | 0.4 | 2.6 | 0.3 |
| Conservation Education and Outreach | 0 | 58,204 | 0.2 | 1.3 | 0.2 | 2.2 | 0.2 |
| Innovative Technologies | Savings Not Estimated | | Savings Not Estimated | | | | |
| Enabling Activities | 0 | 22,612 | Calculated at Portfolio Level | | | | |
| Portfolio Level Activities | Savings Not Estimated | | Savings Not Estimated | | | | |
| **ALL PROGRAMS** | **1,176,468** | **1,142,533** | **0.9** | **1.4** | **0.8** | **2.3** | **0.4** |

Portfolio Level Activities, shown in the tables above, are those activities for which the costs cannot be assigned to individual DSM programs. These activities are distinct from the Enabling Activities specifically listed in Section 11 of the 2019-2022 DSM Plan. These distinct Portfolio Level Activities include expenditures such as stakeholder engagement activities, portfolio level staff labour, staff training and conferences, research and association memberships, portfolio level research studies, and regulatory work including consulting fees.

Throughout the Report, the following general notes also apply to all the Program Areas:

- In the above table, and in tables throughout the Report, any difference in the totals between the Portfolio Overview, Program Area, and individual program tables is due to

[4] Carryover from the prior year is added to the current year plan. Information in Table 2-2 is net of such adjustments. Since FEI experienced a small over-spend in 2020, a negative carryover resulted as approved by Commission Order G-345-21. That negative carryover was allocated to the Enabling Activities and Portfolio Level Activities Areas in order that Program Areas with energy saving incentives not be impacted.

rounding. Where “zero” values occur, they may be a reflection of rounding to the nearest $000 expenditure level when expenditures were under $500.

- A “Non-Program Specific Expense” line item has been included for each Program Area in Sections 5 through 11. These expenditures support multiple programs within that Program Area and therefore, are not specific to only one program. Generally, these expenditures represent items such as training, travel, marketing collateral and consulting services that support the overall Program Area.

The expenditures, energy savings and cost effectiveness results presented in the Report are exclusive of third party funding such as CleanBC funding from the British Columbia Ministry of Energy, Mines and Low Carbon Innovation (EMLI). For measures that also receive third party incentive funding, attribution of energy savings among the parties has been accounted for in both the FEI claimed savings and cost test results.

## 2.1 PORTFOLIO LEVEL MTRC CALCULATION AND RESULTS

The DSM Regulation specifies that utilities can implement DSM with TRC values less than 1.0 but that meet an MTRC threshold of 1.0 provided expenditures on these activities do not exceed 40 percent of the total Portfolio expenditure. FEI refers to this 40 percent as the “MTRC Cap”. Table 2-3 above shows that in 2021, FEI met the conditions of the DSM Regulation, achieving a Portfolio MTRC value of 1.5. Table 2.4 below shows that 33.1 percent of the Portfolio was enabled by the MTRC cost-effectiveness test.

**Table 2-4: Programs Subject to MTRC and the Relative Proportion of 2021 Portfolio Expenditures**

| Program | Program TRC | Program MTRC | Expenditure ($000s) subject to cap | % of Portfolio Spending |
|---|---|---|---|---|
| Home Renovation Rebate Program | 0.4 | 1.5 | $29,966 | 28.0% |
| New Home Program | 0.3 | 1.0 | $4,597 | 4.3% |
| Commercial Prescriptive Program | 1.9 | 1.9 | $214 | 0.2% |
| Residential Customer Engagement Tool Program | 0.2 | 1.3 | $575 | 0.5% |
| **Total** | | | **$35,352** | **33.1%** |

While FEI strives for TRC test results that approach or exceed 1.0 within each program and across all programs, there are benefits to implementing programs that do not meet this threshold. Some of these benefits include making programs available to those customers that would otherwise be underserved (such as Low Income and Residential customers), water savings, increased human health and comfort, and economic benefits such as job creation. These benefits are recognized in the DSM Regulation, which enables use of an MTRC in determining program and Portfolio cost effectiveness. The MTRC uses the long-run marginal cost of acquiring electricity generated from clean or renewable resources in British Columbia (referred to as the Zero Emission Energy

Alternative, or ZEEA) as a proxy for the avoided cost of natural gas and allows for the inclusion of non-energy benefits (NEBs).[5]

## 2.2 MEETING APPROVED EXPENDITURE LEVELS

FEI's 2021 DSM expenditure budget of $112.398 million includes the original expenditure approval of $88.803 million, accepted on January 17, 2019 pursuant to the Decision on FEI's 2019-2022 DSM Plan[6], as well an increase of $24.982 million as approved by BCUC Order G-301-21 and a carryover amount from 2020 of $(1.388) million as approved by Commission Order G-345-21. This Annual Report also includes a reallocation of 2021 funding amounts for Residential and Low Income Program Areas as approved by BCUC Order G-135-21. 2021 DSM Plan amounts for Program Areas and the Portfolio as a whole shown in tables throughout this report reflect these approved amendments to the DSM Plan. FEI's actual 2021 expenditures of $106.844 million for the total DSM portfolio shows that FEI's efforts to achieve the overall approved spending plan were successful. Incentive expenditures exceeded non-incentive expenditures by greater than a 3:1 margin[7] in 2021.

Section 3 discusses funding transfers between Program Areas in 2021 within the overall DSM funding envelope and within the rules for transferring funds between Program Areas as set out in the 2019-22 DSM Plan and approved in the Decision. Section 3 also reports 2021 carryover amounts for each Program Area.

## 2.3 MEETING ADEQUACY REQUIREMENTS OF THE DSM REGULATION

The adequacy requirements set out in the DSM Regulation are as follows:

> A public utility's plan portfolio is adequate for the purposes of Section 44.1 (8) c of the Act only if the plan portfolio includes all the following:
>
> a) A demand-side measure intended specifically to assist:
>
> i. residents of low-income households to reduce their energy consumption; or
>
> ii. to reduce energy consumption in housing owned or operated by
>
> (A) a housing provider that is a local government, a society as defined in section 1 of the *Societies Act*, other than a member-funded society as defined in section 190 of that Act, or an

[5] As the DSM Regulation stipulates, the updated value that FEI has used for the ZEEA in 2020 in the MTRC calculation is $106/MWh, or $29.45/GJ.
[6] BCUC Order G-10-19.
[7] This ratio is temporarily higher than in previous years, largely as a result of the time-limited increase in incentives in 2021 that were supporting COVID-19 recovery efforts in the province.

association as defined in section 1 (1) of the *Cooperative Association Act*, or

(B) the governing body of a first nation,

if the benefits of the reduction primarily accrue to

(C) the low-income households occupying the housing,

(D) a housing provider referred to in clause (A), or

(E) a governing body referred to in clause (B) if the households in the governing body's housing are primarily low-income households;

b) If the plan portfolio is introduced on or after June 1, 2009, a demand-side measure intended specifically to improve the energy efficiency of rental accommodations;

c) An education program for students enrolled in schools in the public utility’s service area;

d) If the plan portfolio is submitted on or after June 1, 2009, an education program for students enrolled in post-secondary institutions in the public utility’s service area.

e) one or more demand-side measures to provide resources as set out in paragraph (e) of the definition of "specified demand-side measure", representing no less than

(i) an average of 1% of the public utility's plan portfolio's expenditures per year over the portfolio's period of expenditures, or

(ii) an average of $2 million per year over the portfolio's period of expenditures;

f) one or more demand-side measures intended to result in the adoption by local governments and first nations of a step code or more stringent requirements within a step code.

Section 6 provides details regarding FEI’s DSM programs for Low Income customers. FEI also continues to deliver the Rental Apartment Efficiency Program (RAP) through its Residential and Commercial programs as discussed in each of the respective Program Area sections (Sections 5 and 7). Sections 6 and 7 of the Report also provide details on a number of other Low Income and Commercial energy efficiency programs that are available for use by owners of rental buildings, including the Energy Specialist Program. In terms of education programs, FEI’s School Education Program, Commercial and Residential customer education programs, and other energy conservation and education outreach initiatives are presented in Section 10.

FEI's DSM activities related to the codes and standards specified demand-side measure that are the subject of paragraph e) above are considered enabling activities by FEI and are discussed in Section 11. Finally, FEI's portfolio has supported the adoption of step codes in the Province in a number of ways, particularly through the Residential and Commercial Program Areas as discussed in Sections 5 and 7 respectively.

## 2.4 *COLLABORATION & INTEGRATION*

The Company continues to collaborate and integrate DSM programming among BC's largest energy utilities, as well as with other entities such as governments and industry associations. The Company recognizes that doing so will maximize program efficiency and effectiveness. Discussion of collaborative activity is captured in the individual Program Area sections and program descriptions found in Sections 5 through 11.

FEI, FortisBC Inc. (FBC) and BC Hydro and Power Authority (BC Hydro) (the BC Utilities) continued to collaborate on various programs and projects through their voluntary Memorandum of Understanding (MOU), the purpose of which is to develop enhanced utility integration in support of government legislation, policy and direction. The BC Utilities also continue to experience cost efficiencies from their collaboration efforts, including streamlined application processes for customers, extended program reach and consistent and unified messaging intended to improve energy literacy.

FEI, FBC and EMLI continued to collaborate in 2021. FEI's collaboration with EMLI on CleanBC programs includes administering incentives and enabling applications for CleanBC rebates through FEI's application processes to provide a streamlined customer experience. The tables contained throughout this Annual Report include only expenditure and savings information for FEI's expenditure portfolio. They do not include the CleanBC expenditures nor the savings attributed to the CleanBC incentives. In 2021, CleanBC incentives were administered alongside FEI incentives in the Residential Home Renovation Rebate Program, the Low Income Prescriptive and Support Programs, and the Commercial Existing Building Performance Program as noted in Sections 5, 6 and 7 respectively.

## 2.5 *SUMMARY*

The Company's DSM Portfolio met the goal of cost effectiveness with a Portfolio MTRC value of 1.4 in 2021. The Company is of the view that both energy savings accounted for in the Portfolio and the resulting TRC remain conservative. Benefits from non-incentive expenditures such as those activities in the CEO and Enabling Program Areas play a very important role in supporting the development and delivery of programs, while creating a culture of conservation in British Columbia. FEI continues to develop and maintain strong, collaborative relationships with other BC utilities and government partners, as well as key market players in providing its portfolio of DSM programs.

# 3. FUNDING TRANSFERS

The practice of transferring expenditure amounts within FEI's DSM portfolio applies to the tracking of actual versus approved spending amounts for each of the Program Areas. It acknowledges that the approved expenditure amount is a forecast and that actual spending in each Program Area will inevitably vary from the forecast to some degree. A Program Area in which annual expenditures are somewhat less than plan has availability within its approved program expenditure envelope to balance against a Program Area that might spend somewhat more than its approved amount. This balancing or 'transfer' allows FEI to maximize the use of its total approved portfolio expenditure amount while managing the uncertainties and external factors that can impact program development and delivery. The Decision approved the continuation of rules that allow FEI to transfer amounts equal to or less than 25 percent of the approved Program Area funding limit without further approval from the BCUC. Throughout the remainder of this report, expenditure tables that show 2021 Plan values report such values prior to consideration of the 2021 transfers discussed in this Section.

Carryover refers to any approved Program Area expenditure amount that was not spent in a given year (after accounting for funding transfers) and can therefore be spent in the following year within the approved DSM Plan timeframe. These amounts are 'rolled over' to the next years' annual approved spending limit. The ability to roll funds over from one year to the next also provides flexibility for FEI to manage uncertainties and external factors that can impact program development and delivery – in this case by making unspent expenditure amounts in one year available to benefit customers in the next year. The Decision approved FEI's request to carryover unspent Program Area amounts during the 2019-2022 DSM Plan.

Table 3-1 presents the transfers and carryover for 2021. This table identifies a transfer of greater than 25 percent into the Portfolio Level Activities Program Area. This transfer was caused by a negative carryover amount from 2020 in this category rather than spending above the original approval amount for Portfolio Level Activities. FEI is requesting approval of this funding transfer in a separate application filed concurrently with this Report.

**Table 3-1: Funding Transfers for 2021 and Calculation of Carryover Expenditures to 2022**

| Program Area | 2021 Plan Expenditures (incl. 2020 Carryover*) | 2021 Actual Expenditures ($000) | 2021 Actual less Plan ($000) | 2021 Funding Transfer Amount In (Out) ($000) | Plan Amount Carried Over to 2022 ($000s) | Transfer as a percent of Approved |
|---|---|---|---|---|---|---|
| Residential | 50,121 | 51,484 | 1,363 | 1,363 | 0 | 3% |
| Commercial | 20,735 | 21,309 | 574 | 574 | 0 | 3% |
| Industrial | 7,913 | 6,095 | -1,818 | -803 | 1,015 | -10% |
| Low Income | 10,322 | 9,043 | -1,279 | 0 | 1,279 | 0% |
| Conservation Education and Outreach | 8,578 | 4,517 | -4,061 | -2,144 | 1,917 | -25% |
| Innovative Technologies | 5,064 | 3,721 | -1,343 | 0 | 1,343 | 0% |
| Enabling Activities | 8,722 | 9,199 | 476 | 476 | 0 | 5% |
| Portfolio Level Activities | 943 | 1,477 | 534 | 534 | 0 | 57% |
| **ALL PROGRAMS** | **112,398** | **106,844** | **-5,554** | | **5,554** | |

* See Table 2-2 for 2020 Carryover amounts

# 4. ADVISORY GROUP ACTIVITIES

The Energy Efficiency and Conservation Advisory Group (EECAG) provides insight and feedback on FEI's Portfolio of DSM activities and related issues. While EECAG provides input on both the electric and natural gas portfolios for FBC and FEI (together, FortisBC), this section describes those 2021 activities that mainly pertain to the FEI portfolio.

EECAG members may be invited based on their relevant subject matter expertise, representation of a common interest shared by stakeholders, or representation of a particular organization/group and/or interest. Examples include governments, regions, Indigenous communities, customers, suppliers, industries, non-governmental organizations, research institutes and other groups that have historically intervened in FEI's regulatory proceedings. Since the formation of the EECAG in 2009, FEI has gained valuable insight on DSM program design and implementation and developed positive working relationships with stakeholders. EECAG input continues to be instrumental as FEI moves forward with DSM activities, helping to ensure that efforts are aligned with the interests and suggestions of stakeholders.

In 2021, FEI sought EECAG input on three key topics for which four partial day engagement sessions were hosted in June, September and December. Due to the COVID-19 pandemic and associated protocols, these sessions were hosted virtually and reduced to a few hours in length from the typical full-day workshops hosted in previous years. The first topic was a request for feedback on FEI's proposal for increased expenditure amounts into the Industrial, Residential and Innovative Technologies Program Areas. The expenditure application that followed this proposal was ultimately approved by the BCUC in Fall 2021. The second topic was a presentation and discussion on proposed new concepts for upcoming FBC and FEI DSM expenditure plans. FEI also took the opportunity to present and discuss opportunities in renewable gases that FortisBC is pursuing. EECAG members provided feedback on new concepts and generally supported the areas being considered for the upcoming expenditure plan. The third topic was a presentation and discussion on the proposed draft FBC DSM expenditure plan. This information was well received by members and their feedback was being taken into account in drafting the expenditure plan.

# 5. RESIDENTIAL ENERGY EFFICIENCY PROGRAM AREA

## 5.1 *OVERVIEW*

The Residential Energy Efficiency Program Area reduced annual natural gas consumption by 299,709 GJs, achieving an overall MTRC of 1.4. $51.484 million was invested in Residential Energy Efficiency programs in 2021, and 95 percent of this investment was incentive spending[8]. Tables 5-1 and 5-2 summarize the expenditures for the Residential Energy Efficiency Program Area, including incentive and non-incentive spending and annual gas savings, as well as TRC/MTRC and other cost-effectiveness test results.

Residential programs serve over 954 thousand customers[9] in the FEI service territories. For DSM purposes, these customers predominantly include those living in single-family homes, row houses, townhomes or mobile homes[10]. Some in-suite measures, such as low flow fixtures and a small number of fireplaces and water heaters in multi-unit residential buildings are also included in this funding envelope.

For the 2019-2022 DSM Plan, the customer offerings for the Residential Energy Efficiency Program Area consist of consolidating measures within three overarching programs: Home Renovation, New Home and Rental Apartment Efficiency. These programs enable FEI customers to reduce their energy consumption and support industry in improving overall home performance. The combination of rebates, policy support, customer and industry engagement is instrumental in driving a culture of conservation and fostering market transformation in the residential sector.

**Table 5-1: Residential Energy Efficiency Program Area Results Summary - Expenditures**

| Program Area | Utility Expenditures ($000s) | | | | | |
|---|---|---|---|---|---|---|
| | Incentives | | Non-Incentives | | Total Expenditures | |
| | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual |
| Home Renovation Program | 39,162 | 40,390 | 2,226 | 1,465 | 41,388 | 41,856 |
| New Home Program | 7,158 | 8,430 | 844 | 856 | 8,002 | 9,285 |
| Rental Apartment Efficiency Program | 250 | 90 | 181 | 86 | 431 | 175 |
| Non-Program Specific Expenses | 0 | 0 | 300 | 167 | 300 | 167 |
| **ALL PROGRAMS** | **46,570** | **48,910** | **3,551** | **2,574** | **50,121** | **51,484** |

[8] Since actual expenditures were greater than plan, a funding transfer into the Residential Program Areas was required in 2021. Section 3 of this Annual Report discusses 2021 funding transfers.
[9] FEI Annual Review for 2020 and 2021 Rates, BCUC Order G-319-20 Compliance Filing.
[10] Programs for Multifamily Dwellings served under Rate Schedule 2 or 3 are included in the Commercial Energy Efficiency Program Area (please refer to Section 7) with a few exceptions as noted.

**Table 5-2: Residential Energy Efficiency Program Area Results Summary – Savings**

| Program Area | Incremental Annual Gas Savings, Net (GJ) | | Benefit/Cost Ratios | | | | |
|---|---|---|---|---|---|---|---|
| | 2021 Plan | 2021 Actual | TRC | MTRC | UCT | PCT | RIM |
| Home Renovation Program | 221,854 | 259,835 | 0.4 | 1.5 | 0.6 | 1.6 | 0.4 |
| New Home Program | 26,323 | 31,587 | 0.3 | 1.0 | 0.4 | 1.6 | 0.3 |
| Rental Apartment Efficiency Program | 23,935 | 8,287 | 2.7 | 2.7 | 2.5 | 12.2 | 0.6 |
| Non-Program Specific Expenses | Savings Not Estimated | | Savings Not Estimated | | | | |
| **ALL PROGRAMS** | **272,112** | **299,709** | **0.4** | **1.4** | **0.5** | **1.6** | **0.4** |

Notes:

- The 2019-2022 DSM Plan figures were adjusted in 2021. The 2021 Plan figures shown in Table 5-2 are the figures approved pursuant to Order G-301-21.
- Non-incentive expenditures consist of rebate administration, communications, evaluation and labour expenditures.

## 5.2 *2021 RESIDENTIAL ENERGY EFFICIENCY PROGRAMS*

This section outlines the specific Residential Energy Efficiency initiatives undertaken in 2021, including program and measure descriptions and a breakdown of non-incentive expenditures for each of the Home Renovations Rebate Program, the New Home Program, and the Rental Apartment Efficiency Program.

### Home Renovation Rebate Program

| | |
|---|---|
| **Program Description** | The program promotes energy-efficiency home retrofits in collaboration with Utility Partners, EMLI, as well as federal and municipal governments. In addition to rebates, initiatives include capacity building for trades, ensuring high quality installations and providing opportunities to promote home labeling through EnerGuide home evaluations. |
| **Target Sub-Market** | Residential |
| **New vs. Retrofit** | Retrofit |
| **Partners** | BC Hydro, FortisBC Inc., EMLI, Municipal, and Federal Governments |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Home Renovation Rebate Program** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **39,162** | **720** | **280** | **226** | **1,000** | **41,388** |
| **2021 Actual** | 40,390 | 400 | 10 | 154 | 901 | **41,856** |

| Participation | | |
|---|---|---|
| **Measure** | **2021 Plan** | **2021 Actual** |
| **Space Heating** | | |
| Furnace | 16,393 | 17,225 |
| Boiler | 400 | 410 |
| Combination System | 1,533 | 1,776 |
| **Secondary Heating** | | |
| EnerChoice Fireplace | 5,810 | 6,110 |
| Direct Vent Wall Furnace | 0 | 0 |

| | | |
|---|---|---|
| **Water Heating** | | |
| 0.67 EF Storage Tank Water Heater | 1,500 | 1,513 |
| Condensing Tankless Water Heater | 6,000 | 6,038 |
| Condensing Storage Tank Water Heater | 100 | 72 |
| **Building Envelope** | | |
| Attic Insulation | 1,500 | 1,912 |
| Wall Insulation | 250 | 328 |
| Crawlspace and Basement Insulation | 250 | 416 |
| Other Insulation | 100 | 132 |
| Bonus Offers | 5,640 | 5,791 |
| **Water Conservation and Retail measures** | | |
| Aerators & Showerheads | 3,500 | 6,313 |
| Draftproofing | 20,000 | 47,757 |
| ENERGY STAR Washer | 2,000 | 2,445 |
| ENERGY STAR Dryer | 100 | 149 |
| **Other** | | |
| Drain Water Heat Recovery | 0 | 0 |
| Communicating Thermostat | 8,557 | 9,174 |
| HVAC Zone Controls | 0 | 0 |
| Appliance Maintenance services | 0 | 1,645 |
| **Total** | **73, 633** | **109,206** |

Notes:

- The Home Renovation Rebate program encourages customers to take a whole home approach to their energy efficiency upgrades by consolidating space heating, water heating and building envelope measures into an overarching program. In 2021, this program was a collaboration between the BC Utilities and the EMLI CleanBC Better Homes program.
- As part of the Double Rebates offer which launched in fall of 2020, the deadline for double rebate eligible installations occurred on June 30, 2021. The deadline was previously extended from March 31, 2021 to enable higher quality installations, as well as to respond to equipment shortages related to high customer demand and COVID-19 supply chain interruptions.
- Emphasis continued to be placed on Furnace Quality Installation. Rebate eligibility requirements include the installation of a two-pipe direct vent system and the completion of a commissioning sheet. An ENERGY STAR Verified Installation pilot (ESVI), launched in late 2019, which provides homeowners with a label that informs them that their installation conformed to best practices[11]. Due to COVID-19 implications and the desire to limit additional contractor time in the customers' homes, this pilot activity slowed. This provided the opportunity to launch the application software for ESVI and work with contractors to gain feedback and improve the software further. FEI is continuing to evaluate energy savings associated with Quality Installation. Virtual and onsite furnace inspections were conducted through the program to continue to support quality installation and contractor education.

[11] Please refer to Section 11, Enabling Activities for more information.

- Working with program partners, the Home Performance Stakeholder Council, and FEI's Trade Ally Network, FEI continues to promote the Home Performance industry through trades outreach, training, development of accredited contractor directories, site visits for program compliance quality installation and contractor accreditation initiatives. These activities provide value to customers through increased performance and longevity of installed equipment and improved comfort of their homes. Funding for these activities is outlined in Enabling Activities Section 11.2.

## New Home Program

| | |
|---|---|
| **Program Description** | The New Home Program provides financial incentives in support of energy-efficient building practices for the Residential sector. The program supports the BC Energy Step Code, and educates builders and consumers about the benefits of high performance new homes. |
| **Target Sub-Market** | Residential |
| **New vs. Retrofit** | New |
| **Partners** | BC Hydro, FortisBC Inc., Municipal, Provincial and Federal Governments |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **New Home Program** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **7,158** | **130** | **45** | **84** | **585** | **8,002** |
| **2021 Actual** | 8,430 | 76 | 122 | 100 | 557 | **9,285** |

| Participation | | |
|---|---|---|
| **Measure** | **2021 Plan** | **2021 Actual** |
| **BC Energy Step Code - Whole Home** | | |
| STEP 2 (Single Family Dwelling) | 350 | 206 |
| STEP 2 (Townhome/Rowhome) | 110 | 70 |
| STEP 3 (Single Family Dwelling) | 960 | 646 |
| STEP 3 (Townhome/Rowhome) | 410 | 383 |
| STEP 4 (Single Family Dwelling) | 115 | 134 |
| STEP 4 (Townhome/Rowhome) | 50 | 70 |
| **Space and Water Heating Systems** | | |
| 0.67 EF Storage Tank Water Heater | 210 | 126 |
| Tankless Water Heater | 860 | 1021 |
| Condensing Storage Tank Water Heater | 290 | 119 |
| Combination System | 700 | 483 |
| **Secondary Heating** | | |
| EnerChoice Fireplace | 1,850 | 937 |
| Direct Vent Wall Furnace | 150 | 0 |
| **Other** | | |
| Drain Water Heat Recovery | 200 | 15 |
| Communicating Thermostat | 750 | 591 |
| HVAC Zone Controls | 50 | 0 |
| ENERGY STAR Dryer | 50 | 452 |
| **TOTAL** | **7,105** | **4,506** |

Notes:

- FEI, in collaboration with FBC, provides whole home incentives to align with the five tiers of the BC Energy Step Code for Part 9 buildings, as directed in the 2017 Amendment to the DSM Regulation. The amendment supports utilities' ability to provide incentives for builders who adopt the Energy Step Code in municipalities across BC.

- In fall 2020, the New Home program provided enhanced incentives of $2,000 per Step Code level which will remain in market until the end of 2022 allowing for builders to plan for the incorporation of energy efficient measures and execute plans over the life of the project.
- Step Code incentives were distributed to 1,509 units for a total of $6.1 million.
- Natural gas high efficiency equipment incentives were distributed for 3,819 measures for a total of $2.3 million.
- FEI's Design Offer is available to builder's pursuing Step 3, 4 or 5 and is intended to educate and encourage higher performance construction and reduce builder time and risk. The Design Offer helps to offset the costs of engaging mechanical and building envelope designers and for pursuing an integrated design process (IDP). This offer assists in building the capacity and education of these service providers. This offer is funded through the Codes and Standards budget (Table 11.1).
- FEI collaborates with FBC, BC Hydro, EMLI and BC Housing to provide education to builders and energy advisors, and support policy regarding high performance homes in BC. These funds are discussed further in Section 11, and shown in Table 11.1 in the Codes and Standards budget.

**Rental Apartment Efficiency Program**

| | |
|---|---|
| **Program Description** | There are three components to this program. To start, participants are provided with direct install of in-suite energy efficiency upgrades completed by an agent of FortisBC. Next, participants are provided with energy assessments, which may recommend building-level energy efficiency upgrades such as condensing boilers, high efficiency water heaters and control upgrades. Lastly, participants are provided with support in implementing the energy efficiency recommendations and applying for rebates. All of the in-suite related expenses are included in the Residential Program Area, while the common area related expenses, including the energy assessment, implementation support, and common area upgrades, are included in the Commercial Program Area. |
| **Target Sub-Market** | Rental Apartment Buildings |
| **New vs. Retrofit** | Retrofit |
| **Partners** | N/A |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Rental Apartment Efficiency Program** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **250** | **106** | **45** | **14** | **16** | **432** |
| **2021 Actual** | 90 | 82 | 0 | 2 | 1 | **175** |

| Participation | | |
|---|---|---|
| **Measure** | **2021 Plan** | **2021 Actual** |
| **Aerators & Showerheads** | 24,450 | 16,064 |

Notes:

- 2021 was another challenging year for the Rental Apartment Efficiency Program with the COVID-19 pandemic continuing to dampen participation in this program.

## 5.3 *SUMMARY*

Residential Energy Efficiency Program Area activity in 2021 resulted in over 299,709 GJ/year of natural gas savings. These programs enabled customers to increase their home's performance while reducing their energy consumption. The program area continues to expand relationships with the trades and builders for education on energy efficiency and quality installation. The combination of financial incentives, policy support, contractor outreach, and customer education is instrumental to the ongoing success of these programs in generating natural gas savings and fostering market transformation in the residential sector.

# 6. LOW INCOME ENERGY EFFICIENCY PROGRAM AREA

## 6.1 *OVERVIEW*

The Low Income Program Area serves Low Income customers, Indigenous housing, co-operative housing, non-profit housing, and charities that aid Low Income customers. In 2021, DSM investments in the Low Income Program Area were $9 million and annual gas savings were 50,660 GJ/yr. Tables 6-1 and 6-2 summarize the planned and actual expenditures for the Low Income Program Area in 2021, including incentive and non-incentive expenditures and annual gas savings, as well as the cost-effectiveness test results. The TRC for Low Income programs uses the same inputs as the MTRC without impacting the MTRC Cap in accordance with the DSM Regulation.

Key milestones in 2021 include:

- The Program Area experienced higher than expected investments in the Direct Install Program and the Prescriptive Program which led to the filing and subsequent approval from the BCUC through Order G-301-21 to increase the Program Area budget for 2021 and 2022. The planned figures in the tables below reflect the recently approved expenditures and savings.

- In spite of the COVID-19 pandemic and extreme weather impacts on programming and customer priorities, the Low Income Program Area performed well and exceeded 2020 expenditures of $7.2 million. With additional safety protocols in place, the Direct Install Program was in market all year.

- FEI continued developing energy efficiency retrofit opportunities for manufactured homes through the Direct Install Program and increased the number of measure installations completed.

- As part of the Double Rebates offer which launched in fall of 2020, the deadline for double rebate eligible installations occurred on June 30, 2021. The deadline was previously extended from March 31, 2021 to enable higher quality installations, as well as to respond to equipment shortages related to high customer demand and COVID-19 pandemic supply chain interruptions. This contributed to the Prescriptive Program gaining momentum in 2021.

- The Prescriptive Program was expanded as we introduced new incentives for Indigenous communities building high-performance homes and for small buildings.

**Table 6-1: 2021 Low Income Program Results Summary – Expenditures**

| Program Area | Utility Expenditures ($000s) | | | | | |
|---|---|---|---|---|---|---|
| | Incentives | | Non-Incentives | | Total Expenditures | |
| | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual |
| Direct Install Program | 3,386 | 4,133 | 1,613 | 928 | 4,999 | 5,061 |
| Self Install Program | 491 | 381 | 66 | 81 | 557 | 462 |
| Prescriptive Program | 3,939 | 2,778 | 316 | 315 | 4,255 | 3,093 |
| Support Program | 227 | 176 | 22 | 12 | 249 | 188 |
| Non-Program Specific Expenses | 0 | 0 | 262 | 239 | 262 | 239 |
| **ALL PROGRAMS** | **8,043** | **7,467** | **2,279** | **1,575** | **10,322** | **9,043** |

**Table 6-2: 2021 Low Income Program Area Results Summary – Savings**

| Program Area | Incremental Annual Gas Savings, Net (GJ) | | Benefit/Cost Ratios | | | | |
|---|---|---|---|---|---|---|---|
| | 2021 Plan | 2021 Actual | TRC | MTRC | UCT | PCT | RIM |
| Direct Install Program | 8,553 | 10,907 | 1.4 | 1.4 | 0.1 | 2.6 | 0.2 |
| Self Install Program | 26,568 | 20,295 | 17.7 | 17.7 | 2.5 | 8.3 | 0.6 |
| Prescriptive Program | 22,426 | 19,457 | 3.2 | 3.2 | 0.6 | 2.2 | 0.4 |
| Support Program | Savings Not Estimated | | Savings Not Estimated | | | | |
| Non-Program Specific Expenses | Savings Not Estimated | | Savings Not Estimated | | | | |
| **ALL PROGRAMS** | **57,547** | **50,660** | **3.0** | **3.0** | **0.4** | **2.6** | **0.3** |

Notes:

- EMLI also contributed funds through their CleanBC programs towards some Low Income programs as noted in the partnership details in Section 6.2. EMLI funding is excluded from the above financials and energy savings.

More details for each of the programs within the Low Income Program Area follow.

## 6.2 *2021 LOW INCOME PROGRAMS*

This section outlines the specific Low Income programs undertaken in 2021, including program and measure descriptions and a breakdown of non-incentive expenditures for each of the Direct Install Program, Self Install Program, Prescriptive Program and Support Program.

### Direct Install Program

| | |
|---|---|
| **Program Description** | Recognizing that some Low Income customers do not have the expertise and/or physical capabilities to install energy efficient measures, this program aims to remove that barrier by having a program delivery agent/contractor perform the installation |
| **Target Sub-Market** | Low Income single family dwellings, row homes, manufactured homes and apartments |
| **New vs. Retrofit** | Retrofit |
| **Partners** | BC Hydro, FBC, EMLI |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| Direct Install Program | Incentives | Administration | Communication | Evaluation | Labour | TOTAL |
| 2021 Plan | 3,386 | 415 | 726 | 151 | 321 | 4,999 |
| 2021 Actual | 4,133 | 133 | 287 | 204 | 303 | 5,061 |

| Participation | | |
|---|---|---|
| Measure | 2021 Plan | 2021 Actual |
| Energy Conservation Assistance | 1,793 | 1,544 |

Notes:

- The Direct Install Program achieved 101 percent of the expenditure target. Expenditures were driven by an increase in the installation of more impactful measures such as insulation and furnaces as well as the work completed in manufactured homes. This also resulted in achieving 128 percent of planned energy savings in 2021.
- Participation increased slightly from 1,391 in 2020 but remained lower than pre-pandemic levels.

## Self Install Program

| | |
|---|---|
| Program Description | Participants that have the capability to perform basic installations on their own can receive a bundle of basic energy efficiency measures to install themselves |
| Target Sub-Market | Low income home owners and renters |
| New vs. Retrofit | Retrofit |
| Partners | BC Hydro, FBC |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| Self Install Program | Incentives | Administration | Communication | Evaluation | Labour | TOTAL |
| 2021 Plan | 491 | 7 | 45 | 4 | 12 | 558 |
| 2021 Actual | 381 | 0 | 52 | 0 | 29 | 462 |

| Participation | | |
|---|---|---|
| Measure | 2021 Plan | 2021 Actual |
| Energy Savings Kit | 12,300 | 14,084 |

Notes:

- The Self Install Program achieved 115 percent of the participation target. This is partially due to a re-engagement campaign for previous participants to receive additional energy measures.

## Prescriptive Program

| | |
|---|---|
| **Program Description** | Enable a straight-forward path towards a rebate for specific residential or commercial energy efficiency measure |
| **Target Sub-Market** | Residential Low Income customers, Indigenous housing providers, non-profit housing providers, charities |
| **New vs. Retrofit** | New construction and retrofit |
| **Partners** | EMLI |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Prescriptive Program** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **3,939** | **11** | **16** | **0** | **290** | **4,255** |
| **2021 Actual** | 2,778 | 8 | 9 | 0 | 298 | **3,093** |

| Participation | | |
|---|---|---|
| **Measure** | **2021 Plan** | **2021 Actual** |
| **Residential Retrofit** | | |
| **Boiler** | 55 | 39 |
| **Furnace** | 758 | 578 |
| **Health and Safety** | 46 | 141 |
| **Insulation (Attic, Wall, and Other)** | 65 | 7 |
| **Thermostat** | 261 | 156 |
| **Ventilation** | 3 | 5 |
| **Water Heater** | 277 | 185 |
| **Windows and Doors** | 77 | 0 |
| **Residential New Construction** | | |
| **STEP 2** | 6 | 0 |
| **STEP 3** | 20 | 6 |
| **STEP 4** | 0 | 0 |
| **Commercial** | | |
| **Boiler** | 12 | 20 |
| **Bundled Measures** | 42 | 46 |
| **Furnace** | 36 | 24 |
| **Water Heater** | 20 | 20 |
| **TOTAL** | **1,678** | **1,227** |

Notes:

- The Prescriptive Program achieved 73 percent of planned participation. Participation was aided by the time-limited Bigger Rebates offer on select measures as well as the continued uptake of residential rebates in Indigenous communities. While these offers have continued to build momentum within Indigenous communities, COVID-19 continued to impact many communities, which in turn affected project completion and program participation.
- Additional rebates were introduced in 2021 to support the building of energy efficient homes in Indigenous communities and small buildings.

### Support Program

| | |
|---|---|
| **Program Description** | Seek to enhance energy efficiency retrofit skills, provide direction to non-profit housing providers looking at enhancing the energy efficiency of their housing stock and motivate behavioural change through education and engagement |
| **Target Sub-Market** | Low Income customers and non-profit housing providers |
| **New vs. Retrofit** | New construction and retrofit |
| **Partners** | BC Hydro, FBC, EMLI |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Support Program** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **227** | **0** | **0** | **0** | **22** | **249** |
| **2021 Actual** | 176 | 0 | 0 | 0 | 12 | **188** |

| Participation | | |
|---|---|---|
| **Measure** | **2021 Plan** | **2021 Actuals** |
| **Residential Energy Efficiency Works** | 0 | 0 |
| **Non-Profit Custom Studies and Implementation Support** | 67 | 50 |
| **TOTAL** | **67** | **50** |

Notes:

- The Residential Energy Efficiency Works (REnEW), a training program geared towards people facing barriers to employment, involves several weeks of in-class training for participants. Due to COVID-19 concerns, this program was out of market in 2021.
- Although there were a greater number of energy studies performed in non-profit housing than was planned, there was less uptake than expected for implementation support.

## 6.3 *SUMMARY*

In spite of the COVID-19 pandemic and extreme weather events having some negative impact on programs, the strong performance in the Direct Install Program and the momentum built in the Prescriptive Program lead to the highest ever investment to date in the Low Income Program Area with $9 million in expenditures and 50,660 GJ/yr gas savings.

# 7. COMMERCIAL ENERGY EFFICIENCY PROGRAM AREA

## 7.1 OVERVIEW

In 2021, Commercial Energy Efficiency programs continued to encourage commercial customers to reduce their overall consumption of natural gas and associated energy costs. The Commercial Energy Efficiency Program Area reduced annual natural gas consumption by approximately 413,600 GJs annually and achieved an overall TRC of 1.3. $21.309 million was invested in Commercial Energy Efficiency, of which 87 percent was incentive spending.

Key highlights include:

- Changes to the Commercial Energy Assessment offer following customer feedback received positive response from small and medium business customers, including higher than expected participation.

- In 2020, FortisBC introduced COVID-19 recovery offers to the market which included increased incentives for some of the programs or an accelerated payment structure to support capital upgrades in an economic downturn. In May 2021, C&EM phased out the COVID-19 recovery offers, which accelerated the project completions prior to the end date and resulted in increased participation in some of our offers, most notably in the Performance Program – Existing Buildings.

**Table 7-1: 2021 Commercial Energy Efficiency Program Results Summary - Expenditures**

| Program Area | Utility Expenditures ($000s) | | | | | |
|---|---|---|---|---|---|---|
| | Incentives | | Non-Incentives | | Total Expenditures | |
| | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual |
| Prescriptive Program | 7,100 | 8,298 | 1,277 | 1,324 | 8,377 | 9,622 |
| Performance - Existing Buildings | 6,200 | 8,959 | 916 | 499 | 7,116 | 9,458 |
| Performance - New Buildings | 3,000 | 709 | 501 | 354 | 3,501 | 1,063 |
| Rental Apartment Efficiency Program | 600 | 513 | 340 | 174 | 940 | 687 |
| Non-Program Specific Expenses | 0 | 0 | 800 | 478 | 800 | 478 |
| **ALL PROGRAMS** | **16,900** | **18,479** | **3,835** | **2,830** | **20,735** | **21,309** |

**Table 7-2: 2021 Commercial Energy Efficiency Program Results Summary – Savings**

| Program Area | Incremental Annual Gas Savings, Net (GJ) | | Benefit/Cost Ratios | | | | |
|---|---|---|---|---|---|---|---|
| | 2021 Plan | 2021 Actual | TRC | MTRC | UCT | PCT | RIM |
| Prescriptive Program | 188,100 | 182,109 | 1.9 | 1.9 | 1.7 | 4.5 | 0.6 |
| Performance - Existing Buildings | 110,000 | 200,215 | 1.1 | 1.1 | 1.7 | 2.2 | 0.5 |
| Performance - New Buildings | 60,341 | 7,929 | 1.0 | 1.0 | 1.1 | 1.2 | 0.3 |
| Rental Apartment Efficiency Program | 29,600 | 23,336 | 1.0 | 1.0 | 1.0 | 3.0 | 0.6 |
| Non-Program Specific Expenses | Savings Not Estimated | | Savings Not Estimated | | | | |
| **ALL PROGRAMS** | **388,041** | **413,589** | **1.3** | **1.3** | **1.6** | **2.8** | **0.5** |

## 7.2 2021 COMMERCIAL ENERGY EFFICIENCY PROGRAMS

This section outlines the specific Commercial Energy Efficiency programs undertaken in 2021, including program and measure descriptions and a breakdown of non-incentive expenditures for each of the Prescriptive Program, Performance Programs (Existing and New Buildings) and Rental Apartment Efficiency Program.

### Prescriptive Program

| | |
|---|---|
| **Program Description** | This program provides rebates for the installation of high efficiency natural gas burning equipment, heat-loss reduction items and controls. Simple rebates are provided for equipment and products that meet specific performance standards. The program makes use of midstream and downstream rebate delivery approaches, as warranted by the particularities of each appliance type and the market it is intended to serve. |
| **Target Sub-Market** | All commercial sub-sectors |
| **New vs. Retrofit** | New construction and retrofit |
| **Partners** | FBC |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| Prescriptive Program | Incentives | Administration | Communication | Evaluation | Labour | TOTAL |
| **2021 Plan** | **7,100** | **591** | **244** | **32** | **411** | **8,377** |
| **2021 Actual** | 8,298 | 50 | 280 | 0 | 994 | **9,622** |

| Participation | | |
|---|---|---|
| **Measure** | **2021 Plan** | **2021 Actual** |
| **Condensing Boiler** | 280 | 231 |
| **Mid Efficiency Boiler** | 15 | 4 |
| **Water Heater** | 371 | 258 |
| **Deep Fryer** | 121 | 46 |
| **Large Vat Deep Fryer** | 14 | 7 |
| **Griddle** | 51 | 5 |
| **Combination Oven** | 17 | 36 |
| **Convection Oven** | 90 | 33 |
| **Rack Oven** | 6 | 2 |
| **Conveyor Oven** | 14 | 16 |
| **Steam Cooker** | 10 | 0 |
| **Low Flow Spray Valve** | 100 | 0 |
| **Condensing Make Up Air Unit** | 200 | 20 |
| **Furnace Replacement (Baseline: Std.)** | 1,300 | 43 |
| **Furnace Replacement (Baseline: Mid)** | 1,300 | 85 |
| **Connected Thermostat** | 0 | 1 |

| | | |
|---|---|---|
| **Roof Insulation** | 200 | 0 |
| **HVAC Controls** | 40 | 30 |
| **Condensing Unit Heaters** | 187 | 45 |
| **Vortex Deaerators** | 28 | 13 |
| **Gas Underfired Broilers** | 85 | 0 |
| **Air curtains** | 0 | 5 |
| **Pipe and Tank Insulation** | 0 | 36 |
| **Steam Boilers** | 0 | 7 |
| **Steam Traps** | 0 | 5 |
| **Steam Trap Survey** | 0 | 2 |
| **Contractor SPIFF** | 0 | 37 |
| **TOTAL** | **4,429** | **967** |

Notes:

The measures with the most significant deviation from the plan are the following:

- Furnace measures achieved increased participation compared to 2020 as the rebate offer has now been in market for several years and customers and contractors are aware of the rebate.
- The Roof Insulation measure continues to perform below plan, as FEI has not yet identified a practical approach to engage the market players and deliver this offer as a prescriptive rebate.
- Condensing Make Up Air Units and Condensing Unit Heaters measures continue to underperform compared to plan and FortisBC identified the opportunity for promotion and marketing in increase awareness of the rebate offer.
- Commercial kitchen/restaurant measures continued to have mixed performances. While measures such as Combination Oven and Conveyor Ovens over performed, Griddle and Convection Oven measures underperformed in 2021. Underfired Broilers are not yet included in the Energy Star certification program, as a qualifying requirement for the program. As such, FEI did not provide rebates for Underfired Broilers in 2021.

## Performance Program – Existing Buildings

| | |
|---|---|
| **Program Description** | The program provides incentives to encourage participants to pursue a performance based approach to achieving natural gas savings in existing buildings. The program encourages detailed analysis of integrated energy saving measures to help identify all technically feasible and cost effective energy savings, and then follows up by providing support for the implementation of those measures. |
| **Target Sub-Market** | Medium to large commercial, institutional and multifamily residential |
| **New vs. Retrofit** | Retrofit |
| **Partners** | FBC |
| **Notes** | |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Performance - Existing Buildings** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **6,200** | **526** | **18** | **82** | **290** | **7,116** |
| **2021 Actual** | 8,959 | 4 | 1 | 147 | 347 | **9,458** |

| Participation | | |
|---|---|---|
| **Measure** | **2021 Plan** | **2021 Actual** |
| **Studies - Retrofit** | 35 | 64 |
| **Capital Upgrades - Retrofit** | 18 | 37 |
| **Recommissioning - Studies** | 26 | 16 |
| **Recommissioning - O&M** | 13 | 8 |
| **Commercial Energy Assessments** | 35 | 113 |
| **TOTAL** | **127** | **238** |

Notes:

- FEI administered CleanBC incentives supporting non-cost effective commercial natural gas energy efficiency projects, not eligible for existing FEI programs. The cost for administering additional CleanBC offers are administered separately and are not included in the program reporting herein.
- Both, “Studies – Retrofit” and “Capital Upgrades – Retrofit”, experienced an increased uptake due to increased demand in the market. We also experienced accelerated project completions by our customers due to the deadline for the COVID-19 recovery offer.
- The Commercial Energy Assessment offer, which was re-introduced to the market in 2020 after customer feedback, received higher than expected participation. FEI’s changes to the offer received positive feedback from small and medium business customers. Implementation support was also introduced as an additional service, which is one of the reasons for increased interest in the program.

## Performance Program – New Buildings

| | |
|---|---|
| **Program Description** | The program provides incentives to encourage participants in pursuing a performance based approach to achieving natural gas savings in new buildings. The program encourages detailed analysis of integrated energy saving measures to help identify technically feasible and cost effective energy savings, and then follows up by providing support for the implementation of those measures. The program provides pathways for both buildings subject and not subject to the BC Energy Step Code. |
| **Target Sub-Market** | Medium to large commercial, institutional, and multifamily residential |
| **New vs. Retrofit** | New construction |
| **Partners** | FortisBC Inc. |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Performance - New Buildings*** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **3,000** | **298** | **10** | **28** | **165** | **3,500** |
| **2021 Actual** | 709 | 14 | 7 | 120 | 214 | **1,063** |

| Participation | | |
|---|---|---|
| **Measure** | **2021 Plan** | **2021 Actual** |
| BC Energy Step Code - Whole Building | 11 | 5 |
| Non-BC Energy Step Code - Whole Building | 5 | 5 |
| Early Engagement | 20 | 0 |
| Non-BC Energy Step Code - Engineered | 45 | 0 |
| BC Energy Step Code Capacity Building - Charrettes | 2 | 0 |
| Existing Program Participants | 0 | 4 |
| **TOTAL** | **83** | **14** |

Notes:

- The Performance Program – New Buildings underperformed in 2021 in incentives and savings. However, beginning in mid-2021, this program experienced an increased intake of projects for which agreements have been issued for the customers to proceed with energy modelling. Some of these projects progressed into the Capital Incentive agreement issuance stage in 2021, while other projects needed more time to reach that stage and therefore, will receive their Capital Incentive Agreements from FEI in 2022. Increase in incentives and savings is expected for 2022 and the years to come due to the longer lifecycle of the New Construction sector.
- FEI continued with the outreach activities to architects, engineers, developers and energy modellers in 2021 and the increased intake of projects in 2021 is a result of these outreach activities.
- Legacy participants in the now out-of-market joint BC Hydro and FortisBC New Construction Program continued to receive incentives from existing rebate commitments.

### Rental Apartment Efficiency Program (RAP)

| | |
|---|---|
| **Program Description** | There are three components to this program. To start, participants are provided with direct install of in-suite energy efficiency upgrades completed by an agent of FortisBC. Next, participants are provided with energy assessments, which may recommend building-level energy efficiency upgrades such as condensing boilers, high efficiency water heaters and control upgrades. Lastly, participants are provided with support in implementing the energy efficiency recommendations and applying for rebates. All in-suite related expenses are included in the Residential Program Area, while the common area related expenses, including the energy assessment, implementation support, and common area upgrades, are included in the Commercial Program Area. |
| **Target Sub-Market** | Rental Apartment Buildings |
| **New vs. Retrofit** | Retrofit |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Rental Apartment Efficiency Program** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **600** | **204** | **75** | **31** | **31** | **941** |
| **2021 Actual** | 513 | 113 | 34 | 1 | 26 | **687** |

| Participation | | |
|---|---|---|
| **Measure** | **2021 Plan** | **2021 Actual** |
| Energy Assessments | 120 | 135 |

| | | |
|---|---|---|
| **Implementation Support Partial** | 5 | 5 |
| **Implementation Support Full** | 25 | 11 |
| **Condensing Boilers** | 25 | 19 |
| **Water Heaters** | 5 | 5 |
| **Recirculation Controls** | 100 | 0 |
| **TOTAL** | **280** | **175** |

Notes:

- 2021 was another challenging year for the Rental Apartment Efficiency Program with COVID-19 continuing to dampen participation in this program.

## 7.3 *SUMMARY*

Commercial Energy Efficiency Program Area activity in 2021 resulted in approximately 413,600 GJ/year of natural gas savings. These programs enabled commercial and institutional customers to conduct both simple and comprehensive energy efficiency upgrades at their buildings. The combination of financial incentives, consultant and contractor outreach, and effective marketing in these programs is instrumental to the ongoing success of these programs in generating natural gas savings and fostering market transformation in the commercial sector.

# 8. INNOVATIVE TECHNOLOGIES PROGRAM AREA

## 8.1 *OVERVIEW*

A primary objective of the Innovative Technologies Program Area is to identify technologies that are not yet widely adopted in British Columbia, and that are suitable for inclusion in the Portfolio of ongoing DSM programs in other Program Areas. This is accomplished through pilot and demonstration projects, pre-feasibility studies and the use of Industry Standard Evaluation, Measurement and Verification (EM&V) protocols to validate manufacturers' claims related to equipment and system performance. Results from Innovative Technologies activities are used in making future DSM programming decisions and technology inclusions.

All 2021 activities undertaken in this Program Area meet the definition of technology innovation programs as set out in the DSM Regulation. It should be noted that Innovative Technologies are considered a "specified demand-side measure", meaning that the Program Area or the measures therein are not subject individually to a cost-effectiveness test. Instead the cost effectiveness of these expenditures is evaluated as part of the DSM Portfolio as a whole. Innovative Technologies expenditures are also not subject to the MTRC cap set out in subsection 4(4) of the DSM Regulation according to Request for Clarification of Order G-44.

Table 8-1 summarizes expenditures for the Innovative Technologies Program Area in 2021, including incentive and non-incentive expenditures.

**Table 8-1: 2021 Innovative Technologies Program Area Results Summary – Expenditures[12]**

| Program Area | Utility Expenditures ($000s) | | | | | |
|---|---|---|---|---|---|---|
| | Incentives | | Non-Incentives | | Total Expenditures | |
| | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual |
| Technology Screening | 0 | 0 | 838 | 178 | 838 | 178 |
| Pilot Project Expenditures | 1,700 | 1,554 | 882 | 862 | 2,582 | 2,416 |
| **Deep Retrofits - Residential (New)** | N/A | 0 | N/A | 42 | 1,072 | 42 |
| **Deep Retrofits - Commercial (New** | N/A | 153 | N/A | 324 | 387 | 477 |
| Non-Program Specific Expenses | 0 | 0 | 185 | 608 | 185 | 608 |
| **ALL PROGRAMS** | **1,700** | **1,707** | **1,905** | **2,014** | **5,064** | **3,721** |

## 8.2 *2021 INNOVATIVE TECHNOLOGIES ACTIVITIES*

This section outlines the specific Innovative Technologies Screening, Pilot Projects and Deep Energy Retrofit activities undertaken in 2021, including program and measure descriptions and a breakdown of non-incentive expenditures for each area.

12 In 2021, the Innovative Technologies Program Area received approval from the BCUC to increase the total budget to $5.064 million to explore deep energy retrofits and gas heat pump technologies.

# Technology Screening

| | |
|---|---|
| **Program Description** | Technology screening activities includes conducting prefeasibility studies, small field demonstrations or lab tests in order to understand the availability of the technology, applicable codes and testing standards, current adoption rate, technical barriers, measure assumption data and to determine the market opportunity. The data is used to determine whether the technology meets the requirements of a technology innovation program as defined in the DSM Regulation and used determine the feasibility of launching a pilot or to make future Program Area inclusion decisions. |
| **Target Market** | Variable |
| **New vs. Retrofit** | Variable |
| **Burner Management Controls** | The objective of this prefeasibility study is to assess the energy and non-energy benefits of innovative burner management technologies (burners and controls) for commercial applications. The study will recommend different pathways to evaluating and providing a future prescriptive rebate for this technology category. Study results were handed off in Q1 2021 to the C&I program team. With the positive TRC/MTRCs and applicability of a prescriptive program, commercial is moving forward with introducing this measure as a rebate program. They will continue to work with the vendor to develop a program. |
| **Envelope and Duct Sealing** | The objective of this prefeasibility study is to identify the energy savings and non-energy benefits of Air Barrier and Duct Sealing for residential and small commercial buildings. Study results were handed off in Q4 2021. The results of the study concluded that the air barrier measure would be difficult to implement in a retrofit scenario unless the building was emptied for full renovation or between occupants. Duct sealing had a more positive result. Air Barrier will be piloted in 2022 with the City of Vancouver and both measures will be included in the deep energy retrofit pilot program. |
| **Hybrid Heating System Controls** | The objective of this prefeasibility study is to identify the energy savings and non-energy benefits of residential hybrid heating controls. The results of the study identified opportunities to reduce energy consumption and to validate performance of the controls through conducting pilot measurement and verification activities. Study results were handed off in Q4 2021 to the Residential program team. |
| **Connected Homes** | The objective of this prefeasibility study is to update the 2018 connected homes study and to identify new or improved energy savings and non-energy benefits. Study results were handed off in Q3 2021. The study reviewed stand along technologies as well as home energy management systems. The results did not present net new technologies or significant improvements in energy savings or cost reductions for connected devices. Although the results we not cost effective further work may be required to assess non-energy benefits. |
| **Gas Heat Pump Lab Testing: Thermal Compression Heat Pump** | FortisBC provided funding for a European gas heat pump manufacturer in partnership with the Natural Gas Innovation Fund to conduct efficiency and performance lab testing for a residential gas heat pump to support the business case for expansion into the North American market. This project was put on hold due to a manufacturer decision to revisit research and development efforts and will be revisited in 2022. |
| **Gas Heat Pump Lab Testing: Residential Gas Absorption Heat Pump** | FortisBC is providing funding to the Gas Technology Institute to test and verify system performance for both a residential and commercial gas absorption heat pump manufacturer to support the business case for expansion into the North American market. Results expected Q3 2022. |
| **Gas Heat Pump Combi Characterization Report** | FortisBC is a founding member of the North American Gas Heat Pump Collaborative. In 2021, FortisBC co-funded a gas heat pump combi market characterization report to identify opportunities to advance gas heat pumps in the residential sector. The results of the report will be used to inform strategic communication and education strategies for contractors and customers to adopt gas heat pump combi units. Study results were handed off in Q4 2021 to the Residential program team. |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Technology Screening** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **0** | **348** | **393** | **0** | **97** | **838** |
| **2021 Actual** | 0 | 153 | 0 | 0 | 25 | **178** |

## 1 Pilot Project Expenditures

| | |
|---|---|
| **Program Description** | The Pilot Program focused on conducting field demonstrations to gather data and validate manufacturer's claims about measure system performance and energy savings. The data from pilots can also be used to help improve the quality and installation of future systems, and to understand and reduce market barriers. Technologies that successfully emerge from Innovative Technologies Program will be considered for inclusion in the various Program Areas within the larger C&EM portfolio. |
| **Target Market** | Variable |
| **New vs. Retrofit** | Variable |
| **Carbon Capture Pilot** | FortisBC partnered with Clean02 to test and demonstrate energy efficiency and GHG reduction for 10 carbon capture and conversion technology installations in the Lower Mainland and Vancouver Island. The pilot will test if the Clean02 Carbon Capture Technology can meet the energy conservation and greenhouse gas (GHG) reduction objectives of commercial and small business clients. In 2021, FortisBC provided incentives for one customer site. Pilot results are expected Q4 2023. |
| | 2021 Participants<br>Total 1 |
| **New Construction Combo Unit Demo Pilot** | FortisBC previously conducted a pilot program for the retrofit specific market on Combination systems. Although the pilot results were promising, they were only indicative of the retrofit market. The New Construction Combination Pilot was conducted to assess the technical characteristics, market opportunity and projected energy savings of combination systems in the new construction market. The project targeted two townhome development projects located in FortisBC service territories. Survey results revealed a need for education and awareness for engineering firms and contractors to better understand the integration, costs and value of adding combination systems into new construction developments. Results were handed off in Q2 2020 to the Residential program area to inform program decisions. Final participant rebates were delivered in 2021. |
| | 2021 Participants<br>Total 6 |
| **Commercial Gas Absorption Heat Pump Pilot** | FortisBC further investigated two existing participant sites to identify system performance enhancements for both domestic hot water and space heating applications. Pilot results are summarized in Table 12.2: Summary of Key Findings and Methodology for 2021 Completed C&EM Program Evaluation Studies. |
| | 2021 Participants<br>Total 2 |
| **Gas Technology Institute: Residential Gas Absorption Heat Pump Water Heater Pilot** | FortisBC is funding Gas Technology Institute's North American Residential Gas Heat Pump Water Heat Pilot ("GHPWH") evaluating a GHPWH prototype for residential applications. The GHPWH will be an 80 gallon tank with efficiencies greater than 100%. Collectively, the pilot project will install 61 GHPWH across North America with 10 units being installed in FortisBC's service territory. The overall end goal is to provide evaluation results to support DSM program development and commercialization of gas heat pump water heaters. Due to manufacturing delays this pilot was put on hold for 2021 and will be reassessed in Q1 2022. |
| | 2021 Participants<br>Total 0 |
| **Residential Gas Absorption Heat Pump Pilot ("RGAHP")** | FortisBC is evaluating the energy savings, installation and customer acceptance of a pre-production residential gas absorption heat pump unit for residential space and water heating applications. Installations across 10 sites is expected to be complete by Q2 2022, with monitoring and evaluation taking place from Q2 2022 to Q2 2023. Post evaluation of the pre-production unit, the Manufacturer will be responsible to replace the unit with a certified market ready product. In 2021, FortisBC incented the manufacturer for parts and materials to produce 10 certified pre-production units. |
| | 2021 Participants<br>Total 10 |

| | |
|---|---|
| **Step 5 Homes Pilot** | The objectives of the pilot is to evaluate incremental costs and customer acceptance of achieving Step 5 of the BC Energy Step Code utilizing natural gas energy efficiency measures to support the Residential New Construction program development. In 2021, there were thirty three Step 5 applicants. |
| | 2021 Participants<br>Total 33 |
| **Thermal Compression Heat Pump Pilot ("TCHP")** | FortisBC is evaluating the energy savings, installation and customer acceptance of a thermal compression heat pump (TCHP) prototype for residential space and water heating applications. Installations of up to 10 sites is expected to be complete by Q4 2022, with monitoring and evaluation taking place from Q4 2022 to Q4 2023. Post evaluation of the TCHP prototype, the Manufacturer will be responsible to replace the prototype with a certified product which be further evaluated from Q4 2023 to Q4 2024 for quality assurance. Prototype results are expected in Q1 2024. Final results of the certified product expected in Q1 2025. In 2021, FortisBC incented two installations. |
| | 2021 Participants<br>Total 2 |
| **Commercial Gas Heat Pump Pilot: Heritage Gas** | FortisBC is funding a commercial gas absorption heat pump pilot with Heritage Gas to identify the energy savings, installation and customer acceptance of a pre-commercial gas absorption heat pump technology. Results expected Q2 2023. |
| | 2021 Participants<br>Total 1 |
| **Gas Technology Demonstration Pilot ("GTD")** | The Gas Technology Demonstration ("GTD") pilot provides funding to FortisBC Energy Specialists and Climate Action Partners to explore innovative technologies through three main program offerings: Technology Feasibility Study, Technology Demonstration, Technology Measurement and Verification. In 2021, GTD provided funding for LUX laundry, integrated fault detection and diagnostic systems, and feasibility assessment for innovative building envelopes.<br>2021 Participants<br>Total 5 |
| **Participants** | 2021 Projected Actual<br>Total n/a 60 |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Pilot Project Expenditures** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **1,700** | **225** | **0** | **157** | **500** | **2,582** |
| **2021 Actual** | 1,554 | 499 | 0 | 324 | 39 | **2,416** |

## Deep Energy Retrofits

| | |
|---|---|
| **Deep Retrofit Demonstration – Commercial** | FortisBC in partnership with the City of Vancouver, BC Housing and BC Non-profit Housing Association are identifying the feasibility of reducing up to 80 per cent greenhouse gas emissions in an existing multi-unit residential building by undergoing a comprehensive deep energy retrofit utilizing natural gas energy efficiency. In 2021, FortisBC completed several project milestones including the selection of both a pilot participant and a prime consultant to initiate detailed design. A building condition assessment was completed to identify the building's current state and highlight the greatest opportunities for energy and non-energy upgrades. In addition, FortisBC conducted measurement and verification analysis to establish baseline energy consumption, occupant comfort and indoor air quality metrics. Furthermore, FortisBC supported the development of a tenant communications strategy including funding support of a tenant liaison position to lead building logistics and tenant communications efforts during the project. In 2022, the project is targeting to complete detailed design and will focus on procurement of a general contractor to support |

| | |
|---|---|
| | construction activities throughout 2022-2024. Completion of the retrofit construction and evaluation results is expected by Q4 2025. |
| **Drone Assisted Thermographic Study** | The objective of this study is to identify the efficiency opportunities of utilizing innovative thermal imaging drone technologies compared to standard thermal imagining equipment. Study results provided insights into the advantages and limitations for thermal drones and were handed off in Q4 2021 to inform future deep energy retrofit assessments. |
| **Deep Retrofit Implementation Approaches Study** | The objective of this study is to understand the various design and construction methods of which a retrofit building project could be delivered and how these methods could impact a project to optimize the customer experience through a pilot program. Study results expected Q1 2022. |
| **Deep Energy Retrofit Energy and Cost Modelling Study** | The two objectives of this study were to identify and evaluate all industry accepted energy modelling platforms as well understand the potential cost of the deep energy retrofit for both Single Family Dwelling (SFD) and Multi-Unit Residential Buildings (MURB). The result of this study was used in developing the business case for deep energy retrofit pilot program. |
| **Deep Energy Retrofit Pilot- Part 3 Commercial and Part 9 Residential buildings** | FortisBC is evaluating the potential energy savings, GHG emission reduction, customer and industry acceptance and implementation challenges of deep energy retrofits within its natural gas based customer based. This pilot focuses on two streams. The first stream is Part 3 Multi-Unit Residential Buildings (MURB) and the second stream is Part 9 Single Family Dwellings (SFD), all located in BC Climate Zone 4, 5 and 6. The business case for this pilot program was developed and approved and the contract with two individual implementation contractors was awarded during 2021. A deep energy retrofit costing and energy modelling study was also conducted in 2021 to provide information to define the estimated budget and methodology. In December 2021, a separate study was also conducted to develop educational collateral about deep energy retrofits in both Part 3 and Part 9 buildings. The main purpose of the collateral is to raise awareness and encourage participation. The balance of activities in the pilot program are planned for 2022 through the end of 2025. |
| **Reframed Initiative Partnerships** | FortisBC has entered into a partnership with Pembina Institute to promote a natural gas based deep energy retrofit pathway with Pembina Institute's reframed Initiative. Reframed Initiative is a partnership between Pembina Institute, City of Vancouver, BC Housing and BC Non-profit Housing Association. The main objective of Reframed Initiative is to create a business case around scalable deep energy retrofit of the existing building stock in BC and including a natural gas based solution is an important step for FortisBC as one of the leaders in the future of BC's deep energy retrofit industry. |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Deep Retrofits** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **200** | **686** | **0** | **157** | **416** | **1,459** |
| **2021 Actual** | 153 | 304 | 4 | 49 | 9 | **519** |

*The Variance is attributed to the time required to develop and approve the deep energy retrofit pilot program business case and the selection of implementation contractors.

Notes:

- In 2021, the Innovative Technologies program area received additional expenditures in order to expand technology research and evaluation for gas heat pumps and deep energy retrofits. However, expenditures were impacted by supply chain delays and resource constraints due to the COVID-19 pandemic, postponing installation schedules and pilot activities for 2021 to 2022.

## 8.3 *SUMMARY*

Innovative Technologies represent a key component of FEI's overall commitment to DSM activities by identifying viable technologies and projects that have the potential to support the development of new programs within the larger DSM Portfolio. Overall, the Innovative Technologies initiatives achieved results in evaluating the feasibility of new technologies and providing insights used towards the design of future DSM programs. The Innovative Technologies Program Area continues to use consistent criteria to ensure the greatest potential for screening technologies for further development as full programs in other areas of the DSM Portfolio.

The Innovative Technologies Program Area conducted several technology screening, pilot projects and deep energy retrofit activities as noted in section 8.2 above, to investigate innovative solutions to reduce emissions in existing buildings by over 50 percent and to support the commercialization of natural gas heat pumps whereby the technologies can achieve system efficiencies greater than 100 percent.

The completed research from the Innovative Technologies Program Area helped transition commercial gas absorption heat pumps into FortisBC's first commercial gas heat pump rebate program. Furthermore, the team was recognized for their leadership in the evaluation and advancement of gas heat pumps across the Pacific Northwest and was the recipient of the North West Efficiency Alliance's 2021 Leadership in Energy Efficiency Award for Innovation.

# 9. INDUSTRIAL ENERGY EFFICIENCY PROGRAM AREA

## 9.1 OVERVIEW

In 2021, the Industrial Energy Efficiency Program Area continued to encourage industrial customers to use natural gas more efficiently, achieving an overall TRC of 2.7. As a result, net natural gas savings of approximately 297,800 GJ/yr were achieved. Table 9-1 summarizes expenditures for the Industrial Energy Efficiency Program Area in 2021, including incentive and non-incentive spending, annual and NPV gas savings, as well as all cost-effectiveness test results.

During 2021, the Industrial Energy Efficiency Area experienced a continuation of the increased 2020 participation levels in all industrial program offerings. In 2020, FortisBC introduced COVID-19 recovery offers to the market which included time-limited increased incentives for some of the programs and an accelerated payment structure to support capital upgrades in an economic downturn. In May 2021, the COVID-19 recovery offers for FEI's industrial customers were phased out, which led to accelerated completion of some of the projects in the Performance Program, since the participants wanted to benefit from those temporary offers before their expiry. Some of the projects (Performance and Prescriptive Programs) did not complete and this only became evident very late in 2021. The most common reasons were supply chain issues and events that were outside of the participant's control. Hence, the Industrial expenditure was below plan in 2021.

**Table 9-1: 2021 Industrial Energy Efficiency Program Results Summary**

| Program Area | Utility Expenditures ($000s) | | | | | |
|---|---|---|---|---|---|---|
| | Incentives | | Non-Incentives | | Total Expenditures | |
| | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual |
| Performance Program | 4,297 | 2,982 | 351 | 408 | 4,648 | 3,390 |
| Prescriptive Program | 2,500 | 2,122 | 90 | 166 | 2,590 | 2,288 |
| Strategic Energy Management Program | 340 | 333 | 145 | 49 | 485 | 382 |
| Non-Program Specific Expenses | 0 | 0 | 190 | 35 | 190 | 35 |
| **ALL PROGRAMS** | **7,137** | **5,438** | **776** | **658** | **7,913** | **6,095** |

**Table 9-2: 2021 Industrial Program Results Summary – Savings**

| Program Area | Incremental Annual Gas Savings, Net (GJ) | | Benefit/Cost Ratios | | | | |
|---|---|---|---|---|---|---|---|
| | 2021 Plan | 2021 Actual | TRC | MTRC | UCT | PCT | RIM |
| Performance Program | 282,656 | 181,539 | 3.2 | 3.2 | 4.8 | 5.7 | 0.8 |
| Prescriptive Program | 120,112 | 78,718 | 2.1 | 2.1 | 2.7 | 3.7 | 0.8 |
| Strategic Energy Management Program | 56,000 | 37,503 | 3.7 | 3.7 | 3.0 | 6.5 | 0.9 |
| Non-Program Specific Expenses | Savings Not Estimated | | Savings Not Estimated | | | | |
| **ALL PROGRAMS** | **458,768** | **297,760** | **2.7** | **2.7** | **3.9** | **4.9** | **0.8** |

## 9.2 2021 INDUSTRIAL ENERGY EFFICIENCY PROGRAMS

### Performance Program

| | |
|---|---|
| **Program Description** | The Performance Program is a custom program to help industrial customers use natural gas more efficiently for process-related activities. The program provides funding for walkthrough-level plant wide audits, detailed engineering feasibility studies and custom capital incentives to implement cost effective energy conservation measures (ECMs). Formerly submitted as the Industrial Optimization Program. |
| **Target Sub-Market** | Industrial Customers |
| **New vs. Retrofit** | New construction and retrofit |
| **Partners** | FortisBC Inc. |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| Performance Program | Incentives | Administration | Communication | Evaluation | Labour | TOTAL |
| 2021 Plan | 4,297 | 61 | 20 | 50 | 220 | 4,648 |
| 2021 Actual | 2,982 | 2 | 0 | 112 | 294 | 3,390 |

| Participation | | |
|---|---|---|
| Measure | 2021 Plan | 2021 Actual |
| Technology Implementation | 9 | 8 |
| Feasibility Study | 11 | 16 |
| Plant Wide Audit | 8 | 3 |
| TOTAL | 28 | 27 |

Notes:

- The Performance Program continues to experience solid participation, owing to present market demands and referrals from the Strategic Energy Management (SEM) program.
- Towards year-end, a number of customers informed FEI that the completion of their projects were delayed due to supply chain issues, triggered by the COVID-19 pandemic, and that they would not complete their projects in 2021 as planned.

### Prescriptive Program

| | |
|---|---|
| **Program Description** | Prescriptive initiatives to encourage the implementation of technologies for specific industrial processes using natural gas as an energy source. |
| **Target Sub-Market** | Large, medium and small industrial facilities |
| **New vs. Retrofit** | All measures available for both new construction and retrofit, except for the steam trap surveys and steam trap replacement (retrofit only) |
| **Partners** | FortisBC Inc. |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| Prescriptive Program | Incentives | Administration | Communication | Evaluation | Labour | TOTAL |
| 2021 Plan | 2,500 | 3 | 3 | 41 | 43 | 2,590 |
| 2021 Actual | 2,122 | 27 | 0 | 0 | 139 | 2,288 |

| Participation | | |
|---|---|---|
| **Measure** | **2021 Plan** | **2021 Actual** |
| **Process Boiler (Hot Water and Steam)** | 12 | 6 |
| **Air Curtains - Small Door** | 2 | 0 |
| **Air Curtains - Medium Door** | 2 | 0 |
| **Air Curtains - Large Door** | 2 | 0 |
| **Direct Contact Water Heater** | 5 | 0 |
| **Steam Traps Survey** | 13 | 0 |
| **Steam Traps Replacement** | 13 | 1 |
| **1" insulation 0.5-1" HW pipe** | 3 | 2 |
| **1" insulation ≥ 1" HW pipe** | 3 | 2 |
| **1" insulation 0.5-1" LPS pipe** | 3 | 0 |
| **1" insulation ≥ 1" LPS pipe** | 3 | 2 |
| **1" insulation 0.5-1" HPS pipe** | 3 | 0 |
| **1" insulation ≥ 1" HPS pipe** | 3 | 0 |
| **Tank Insulation 1" Low Temp** | 1 | 0 |
| **Tank Insulation 1" High Temp** | 1 | 0 |
| **Tank Insulation 2" High Temp** | 1 | 0 |
| **Thermal Curtains** | 0 | 9 |
| **Single Stage Infrared Heater** | 0 | 3 |
| **Two Stage Infrared Heater** | 0 | 37 |
| **Condensing Unit Heater** | 0 | 4 |
| **Other Prescriptive Measures** | 5 | 18 |
| **SPIFF** | 0 | 42 |
| **TOTAL** | **75** | **130** |

Notes:

- The 2021 participation for the industrial prescriptive rebate offer was similar to the participation in this program for 2020. Towards year-end, a number of customers informed FEI that the completion of their projects were delayed to due to the flooding the province experienced in November 2021.

### Strategic Energy Management Program

| | |
|---|---|
| **Program Description** | A comprehensive approach to energy management to achieve sustainable energy and cost savings over the long term for larger FEI natural gas industrial customers. Components include operation energy analytics, energy expert expertise and support, assistance with applications for other program offers, industry collaboration and support for conservation initiatives. Includes pay-for-performance aspect for verified energy savings at the end of the program period or for achieving identified milestones. |
| **Target Sub-Market** | Large and medium industrial facilities |
| **New vs. Retrofit** | Retrofit |
| **Partners** | BC Hydro |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Strategic Energy Management Program** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **340** | **13** | **13** | **50** | **70** | **486** |
| **2021 Actual** | 333 | 15 | 0 | 0 | 35 | **382** |

| Participation | | |
|---|---|---|
| **Measure** | **2021 Plan** | **2021 Actual** |
| **Individual, Large Customer** | 5 | 6 |
| **Cohort, Medium Customers** | 10 | 23 |
| **TOTAL** | **15** | **29** |

Notes:

- FEI offers Strategic Energy Management (SEM) as a supplementary offer to the Strategic Energy Management program offered by BC Hydro. FEI's SEM support is focused on natural gas efficiency for participants who are already enrolled in BC Hydro's SEM program and consume significant volumes of natural gas.
- FEI offered natural gas efficiency support to five cohorts (BC Hydro Cohort 1, 2, 3, 5 and the Industrial Energy Manager cohort)
- Non-incentive spending in the SEM program was lower than the DSM Plan due to easier than anticipated participant recruitment in the Cohort and the Industrial Energy Manager offers.

## 9.3 *SUMMARY*

Industrial Energy Efficiency Program Area activity in 2021 resulted in approximately 297,800 GJ/year of natural gas savings. These programs enabled industrial customers to conduct both simple and comprehensive energy efficiency upgrades at their facilities. The combination of financial incentives, increased Point-of-Sale trade ally partners, Strategic Energy Management program, and effective marketing in these programs is instrumental to the ongoing success of these programs in generating natural gas savings and fostering market transformation in the industrial sector.

# 10. CONSERVATION EDUCATION AND OUTREACH INITIATIVES

## 10.1 *OVERVIEW*

The CEO Program Area continues to support the DSM Portfolio goals of energy conservation in a variety of ways. In order to foster a culture of conservation, several initiatives and campaigns were undertaken/continued in 2021, providing information about behaviour change and customer attitudes on energy efficiency. Educating all types of customers and students (who are future customers) remains a strong priority and FEI is continuing to ensure steps are taken to make the information provided relevant and timely. Adjustments made to CEO initiatives addressing COVID-19 pandemic restrictions and related customer response are described in this section. Table 10-1 presents the CEO expenditures for 2021.

**Table 10-1: 2021 CEO Initiative Results Summary – Expenditures**

| Program Area | Utility Expenditures ($000s) | | | | | |
|---|---|---|---|---|---|---|
| | Incentives | | Non-Incentives | | Total Expenditures | |
| | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual |
| General Residential Education Program | 0 | 0 | 3,145 | 1,497 | 3,145 | 1,497 |
| Residential Customer Engagement Tool | 0 | 0 | 3,144 | 1,542 | 3,144 | 1,542 |
| Commercial Education Program | 0 | 0 | 891 | 754 | 891 | 754 |
| School Education Program | 0 | 0 | 1,294 | 679 | 1,294 | 679 |
| Non-Program Specific Expenses | 0 | 0 | 105 | 45 | 105 | 45 |
| **ALL PROGRAMS** | **0** | **0** | **8,578** | **4,517** | **8,578** | **4,517** |

**Table 10-2: 2021 CEO Initiative Results Summary- Savings**

| Program Area | Incremental Annual Gas Savings, Net (GJ) | | Benefit/Cost Ratios | | | | |
|---|---|---|---|---|---|---|---|
| | 2021 Plan | 2021 Actual | TRC | MTRC | UCT | PCT | RIM |
| General Residential Education Program | Savings Not Estimated | | Savings Not Estimated | | | | |
| Residential Customer Engagement Tool | 0 | 58,204 | 0.2 | 1.3 | 0.2 | 2.2 | 0.2 |
| Commercial Education Program | Savings Not Estimated | | Savings Not Estimated | | | | |
| School Education Program | Savings Not Estimated | | Savings Not Estimated | | | | |
| Non-Program Specific Expenses | Savings Not Estimated | | Savings Not Estimated | | | | |
| **ALL PROGRAMS** | **0** | **58,204** | **0.2** | **1.3** | **0.2** | **2.2** | **0.2** |

## 10.2 *2021 CEO PROGRAMS*

### Residential General Education Program

| | |
|---|---|
| **Program Description** | This program provides information to Residential customers and the general public on natural gas conservation and energy literacy by seeking opportunities to engage with customers directly (either face-to-face or through online tools). This audience includes Low Income and multilingual customers.<br><br>Promotional activities include a multimedia general rebates awareness campaign, engagement campaigns, and participation in home shows and community events. This Program also includes the production of energy efficiency education materials and prizing for events, which are used to start conversations and further engage audiences.<br><br>FEI's partnership with Empower Me focused on reaching non-English speaking customers to drive participation to FortisBC's income qualified programs. Collaborations between internal departments and FortisBC Inc. continue to be sought to achieve cost efficiencies in the budget, particularly for advertising and outreach events.<br><br>FEI will continue to focus on behavioural change opportunities that may result in energy savings. |
| **Target Sub-Market** | Residential, local governments and general public |
| **New vs. Retrofit** | New construction and retrofit |
| **Partners** | BC Hydro, FortisBC Inc., local governments |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **General Residential Education Program** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **0** | **510** | **2,212** | **110** | **312** | **3,145** |
| **2021 Actual** | 0 | 748 | 397 | 0 | 351 | **1,497** |

Notes:

- Underspend is attributed to the pausing of our "We've got rebates" campaign during the fall season, and a smaller campaign in the spring due to higher than anticipated participation following the fall 2020 campaign and double rebates offer.
- FEI, in partnership with BC Hydro, continued to partner with Empower Me, focusing on income-qualified non-English speaking customers driving participation to the utility's income qualified programs. Participants also learned about their utility bills, safety, and behaviour change initiatives to help them save energy and money. FortisBC continued with its "We've got rebates" general marketing campaign which continued to increase awareness of its rebate programs.

### Residential Customer Engagement Tool Program

| | |
|---|---|
| **Program Description** | This program provides customers with an online portal and home energy reports where customers can access targeted energy conservation content. Other engagement measures may be included in future years to foster behavior change.<br><br>FortisBC's Customer Engagement Tool, My Energy Use, is an enhancement to Account Online providing customers with a better understanding of their home's energy use. Through the My Energy Use portal, customers can receive personalized insights into their individual home energy use, rebates, and earn |

| | |
|---|---|
| | reward points for participating in energy-savings activities. Through the portal, FortisBC is able to use the data collected to enhance program recruitment and participation in its programs. In addition to the portal, FEI sent six home energy reports during the year to approximately 80,000 customers. The reports help customers understand their energy usage in comparison to energy used by similar homes and encourages customers to reduce their energy use through actionable advice. |
| **Target Sub-Market** | Residential |
| **New vs. Retrofit** | Retrofit |
| **Partners** | FortisBC Inc. |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Residential Customer Engagement Tool** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **0** | **2,657** | **208** | **40** | **239** | **3,144** |
| **2021 Actual** | 0 | 1,335 | 33 | 49 | 125 | **1,542** |

Notes:

- Underspend is a result of the program launch being delayed into late 2020. As a result, the program expenditures are operating behind the current FEI DSM plan.

## Commercial Education Program

| | |
|---|---|
| **Program Description** | This program provides ongoing communication and education about energy conservation initiatives as well as encouraging behavioural changes that help Commercial customers reduce their organization's energy consumption. The Commercial sector is made up of small and larger businesses in a variety of sub sectors such as retail, offices, multi-family residences, schools, hospitals, hospitality services and municipal/institutions.<br><br>Promotional activities included virtual, face-to-face, print and online communications, and industry association meetings. FEI and FBC jointly hosted its eight Efficiency in Action Awards, which recognizes Commercial customers for their innovation in energy efficiency and achieved natural gas savings.<br><br>FEI continued to support behavior education campaigns delivered by energy specialists in their respective organizations. Collaborations between internal departments, FortisBC Inc. as well as other utilities continued to achieve cost efficiencies such as the Energy Wise Network joint initiative with BC Hydro.<br><br>CEO continued to provide information to customers and the public on natural gas conservation and energy literacy. In collaboration with FBC, FEI supported and funded 742 small to medium size business energy assessments. Customers received advice on saving energy and learned about rebates on high-efficiency upgrades. With the constantly changing COVID-19 restrictions, FEI worked with its vendor to deliver the program both with a virtual and in-person model to ensure continued support. The virtual model expanded the reach to all FortisBC customers across the province. The virtual assessments focused on low cost, no cost measures to reduce business's energy consumption. Customers were referred to the program through the FortisBC contact center, and Energy Solutions Managers, in addition to outbound calling by the vendor. |
| **Target Sub-Market** | Commercial customers, multi-family, energy specialists, energy management staff, municipalities |
| **New vs. Retrofit** | New construction and retrofit |
| **Partners** | BC Hydro, Municipalities, FortisBC Inc. |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Commercial Education Program** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **0** | **402** | **221** | **60** | **209** | **891** |
| **2021 Actual** | 0 | 162 | 386 | 0 | 207 | **754** |

Notes:

- Underspend is attributed to the pausing of our “We’ve got rebates” campaign during the fall season, and a smaller campaign in the spring due to higher than anticipated participation following the fall 2020 campaign and double rebates offer.
- FEI’s partnership with BC Hydro continued in 2021. This included collaboration on the Energy Wise Network Program for commercial customers that led to 31 natural gas behaviour change projects being submitted in 2021 (with a completion date of March 31, 2022).

### School Education Program

| | |
|---|---|
| **Program Description** | This program responds to meeting the “adequacy” component of the Demand-Side Measures Regulation whereby a utility’s DSM portfolio is considered adequate if it includes an education program for students enrolled in [K-12] schools and post-secondary schools in the Company's service area.<br><br>Activities included supporting FEI’s corporate school initiatives, including but not limited to Energy is Awesome and the kindergarten to grade 12 curriculum-connected resource Energy Leaders. Additionally, the assembly style Energy Champions presentation which continued in partnership with the BC Lions.<br><br>Partnerships and funding support for post-secondary initiatives included in-class presentations, as well as supporting education campaigns delivered by energy specialists (or an energy manager). |
| **Target Sub-Market** | Students and teachers |
| **New vs. Retrofit** | New Construction and Retrofit |
| **Partners** | BC Lions, FortisBC Inc. |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **School Education Program** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **0** | **750** | **261** | **53** | **229** | **1,294** |
| **2021 Actual** | 0 | 165 | 342 | 0 | 172 | **679** |

Notes:

- Underspend was due to less than anticipated participation in interactive school program activities, primarily as a result of COVID-19.
- FEI’s Energy Leaders initiative offers curriculum-connected lesson plans for grades K-12 that focus on energy literacy and conservation and efficiency. To further support teachers and parents through the COVID-19 pandemic, 53 grade 11 and 12 lessons were translated to French and/or modified for distance learning, and 40 Grade 6 and 7 French and English worksheets with PDF fillable forms were added to the Energy Leaders site. Additionally, 40 professional development webinars were delivered to help teachers become acquainted with the Energy Leaders lesson materials.
- To better support teachers during the pandemic, the BC Lions Energy Champions and FEI’s Energy is Awesome programs were delivered virtually.

- For students enrolled in post-secondary institutions, FEI delivered virtual presentations about demand side management policies and programs in British Columbia, as well as employment opportunities within the energy management sector. It also provided funding support for the BCIT high performance building lab to provide hands-on training on zero energy buildings using an envelope-first approach and its SEMAC (Sustainable Energy Management) program. It co-sponsored a UBC Okanagan Smart Energy research chair to study optimal energy use and resilient and green infrastructure (Wilden Living Lab2 project).

## 10.3 *SUMMARY*

The CEO Program Area continues to support the DSM Portfolio goals of energy conservation in a variety of ways. In order to foster a culture of conservation, several initiatives and campaigns were undertaken in 2021, providing information about behaviour change and customer attitudes on efficiency. Educating all types of customers, and students remains a strong priority. FEI is continuing to ensure steps are taken to make the information provided relevant and timely.

FEI continued its collaboration with FBC in 2021 to maximize efficiencies across both utilities. Costs continue to be shared on school, residential and commercial outreach as applicable. The eighth annual Efficiency in Action awards were delivered jointly by both utilities virtually. The awards recognize FEI and FBC commercial and community-based customers that have most effectively used C&EM programs and achieved significant natural gas and electricity savings.

FEI continues to focus on behavioural change opportunities to foster a culture of conservation in British Columbia while driving program awareness and participation. CEO costs are included at the Portfolio level and incorporated into the overall DSM Portfolio cost-effectiveness results.

# 11. ENABLING ACTIVITIES

## 11.1 OVERVIEW

**Table 11-1: 2021 Enabling Activities Results – Expenditures**

| Program Area | Utility Expenditures ($000s) | | | | | |
|---|---|---|---|---|---|---|
| | Incentives | | Non-Incentives | | Total Expenditures | |
| | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual | 2021 Plan | 2021 Actual |
| Trade Ally Network | 0 | 0 | 2,346 | 1,339 | 2,346 | 1,339 |
| Codes and Standards | 523 | 1,668 | 1,721 | 1,508 | 2,244 | 3,177 |
| Reporting Tool & Customer Application Portal | 0 | 0 | 564 | 1,169 | 564 | 1,169 |
| Conservation Potential Review | 0 | 0 | 365 | 302 | 365 | 302 |
| Customer Research | 0 | 0 | 177 | 264 | 177 | 264 |
| Commercial Energy Specialist Program | 2,400 | 1,950 | 314 | 305 | 2,714 | 2,254 |
| Community Energy Specialist Program | 750 | 509 | 73 | 185 | 823 | 695 |
| 2020 Carryover Expenditures | 0 | 0 | -509 | 0 | -509 | 0 |
| **ALL PROGRAMS** | **3,673** | **4,128** | **5,049** | **5,071** | **8,722** | **9,199** |

**Table 11-2: 2021 Enabling Activities Results - Savings**

| Program Area | Incremental Annual Gas Savings, Net (GJ) | | Benefit/Cost Ratios | | | | |
|---|---|---|---|---|---|---|---|
| | 2021 Plan | 2021 Actual | TRC | MTRC | UCT | PCT | RIM |
| Trade Ally Network | Savings Not Estimated | | Savings Not Estimated | | | | |
| Codes and Standards | Savings Not Estimated | | Savings Not Estimated | | | | |
| Reporting Tool & Customer Application Portal | Savings Not Estimated | | Savings Not Estimated | | | | |
| Conservation Potential Review | Savings Not Estimated | | Savings Not Estimated | | | | |
| Customer Research | Savings Not Estimated | | Savings Not Estimated | | | | |
| Commercial Energy Specialist Program | 0 | 22,612 | Savings included in portfolio level C/B ratio | | | | |
| Community Energy Specialist Program | Savings Not Estimated | | Savings Not Estimated | | | | |
| **ALL PROGRAMS** | **0** | **22,612** | | | | | |

## 11.2 2021 ENABLING ACTIVITIES BY PROGRAM

### Trade Ally Network

| | |
|---|---|
| **Activity Description** | The Trade Ally Network (TAN) is FEI's contractor network whose main objective is to advance energy efficiency messaging and to promote the company's DSM programs. The TAN comprises of contractors, equipment manufacturers, distributors and Point of Sale partners who offer rebates at the point of sale to commercial customers. FEI recognizes the critical role these industry groups play when it comes to influencing the end-use Residential and Commercial customers who make energy efficiency decisions.<br><br>TAN is an important initiative under Enabling Activities that supports and supplements DSM program development and delivery, by providing FEI with a direct communication channel with industry stakeholders. TAN also supports FEI by:<br>• providing trade allies with co-op funding for advertising, delivering targeted messaging about energy efficiency, and to promote C&EM rebate programs; |

- funding eligible training that relates to the promotion and sales of high efficiency appliances, appliance safety, installation, best practices, or similar courses related to energy efficient measures that support FEI's current rebate programs.

In 2021, TAN contractors who are members of the Trade Ally Network were responsible for 65% percent of the 2021 Residential Furnace and Boiler Replacement Program rebates. To further support Point of Sale Partners and the commercial DSM programs, work was undertaken in 2021 to build an online search tool on the FEI website that allows commercial customers to find and connect with Point of Sale Partners. The tool is expected to launch in Q1 2022. Due to the regional heat wave and supply-chain disruptions caused by the COVID-19 pandemic, trade allies' participation in co-op advertising programs was limited. FEI continues to develop and offer to the trade allies training focused on the best practices for installing high-efficiency natural gas appliances and education that allows TAN members to maintain competitiveness and flexibility to continue selling energy efficient upgrades in the changing marketplace.

Notes:

- The Quality Assurance process was changed in 2020 to virtually conducting site visits and COVID-19 protocols were established based on restrictions. This has remained the same for 2021. Through the FEI site visit process, approximately 728 site visits were conducted with an average of 95% compliance rate.
- Energy Star Verified Installations continued in 2021; contractors were to follow established COVID-19 safety protocols as well as a mobile app was created based on contractor feedback to reduce in-home install time spent and admin process for contractors for commissioning data.
- FEI continues to support the industry, including FEI's contribution to the Home Performance Stakeholder Council (HPSC). The HPSC is an industry led group comprised of key industry players tasked with addressing the fragmented interests, opportunities and challenges that exist in BC's continuously evolving home performance industry. Funding for the HPSC is supported by FEI, FBC, BC Hydro, and EMLI. Only the FEI contribution is reported here.

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Trade Ally Network** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **0** | **416** | **884** | **624** | **421** | **2,346** |
| **2021 Actual** | 0 | 308 | 422 | 301 | 307 | **1,339** |

## Codes and Standards

| | |
|---|---|
| **Activity Description** | Utilities have a unique understanding of energy supply and customer demand cycles, which can be of assistance in the development of codes and standards. The content and timing of code implementation directly affects market transformation in all Program Areas. The Codes and Standards area "supports the development of or compliance with specified standard or a measure respecting energy conservation or the efficient use of energy", as referred to in the definition of "specified demand-side measures" in the DSM Regulation, and supports implementation and adoption of such measures and aims to educate and provide training to the industry.<br><br>With respect to codes and standards development, FEI continued to evaluate, analyze and review the municipal, provincial and national codes and standards initiatives for energy efficiency and participated in various code amendment processes by way of providing comments.<br><br>In terms of implementation and adoption of new codes and standards, FEI collaborated with entities, such as BC Hydro, provincial Building Safety and Standards Branch, and various municipalities in a survey to gauge compliance to Energy Codes in BC. FEI is supporting the development of energy |

performance standards such as a CSA standard on Combination Space and Water Heating standard for radiant heating systems.

In the residential sector, FEI continued to provide support for energy compliance and testing of new homes through the provision of incentives for energy advisor services as required by the BC Energy Step Code. Incentives encourage builders to work with an energy advisor to validate the energy performance of their home through energy modelling, on-site airtightness testing, completion of the Step Code compliance reports and receipt of an EnerGuide label. Additional support was provided to encourage early design activities such as mechanical design, building envelope design and integrated design process (IDP). These activities minimize time and risk when building to the upper tiers of the BC Energy Step Code.

With respect to codes and standards education and training, FEI continued to sponsor BC Energy Step Code educational and training sessions throughout the year and delivered initiatives to provide the industry with education and training on a variety of building techniques and products that contribute to high-performance construction with improved energy efficiency. Throughout 2021~~,~~ the impact of the COVID-19 pandemic continued to have an effect on the delivery of our educational and training sessions. As a result, some sessions were cancelled and others moved to an online / virtual format.

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Codes and Standards** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **523** | **1,214** | **156** | **192** | **158** | **2,244** |
| **2021 Actual** | 1,668 | 566 | 692 | 62 | 188 | **3,177** |

Notes:

- The Codes and Standards expenditure was higher than planned, primarily due to an increase in activity in energy modelling and blower door testing. Financial measures to assist in compliance with building codes via energy modelling and blower door tests for new residential homes was higher in 2021. This activity advances the market to build high performance homes with improved building envelope and enabling compliance with the Air Change per Hour (ACH) metric that was introduced in BC Energy Step Code.

## Reporting Tool & Customer Application Portal

| | |
|---|---|
| **Activity Description** | The Demand-side Management Tracking System (DSMS) Project is transitioning FBC and FEI from their legacy DSM tracking systems onto a new, joint system. These tracking systems are used to manage DSM rebates from the application stage through to payment, including application review, reporting, and customer communications. The primary reasons for transitioning both utilities to a new system are: an improved ability to operate joint programs by sharing a platform, the introduction of online application forms for gas customers, improved reporting via integrated dashboards, and a powerful communications management system. In addition, FEI's legacy system vendor has ceased any further development of that system. |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Reporting Tool & Customer Application Portal** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **0** | **416** | **0** | **0** | **147** | **564** |
| **2021 Actual** | 0 | 825 | 0 | 0 | 344 | **1,169** |

The reporting tool and customer application portal is a joint initiative between FBC and FEI. The tool launched seven residential programs in 2020, five programs launched in 2021, with the remaining programs set to launch in 2022.

The reporting tool offers customers an online portal to apply for rebates and track a rebate's status. The tool also offers FBC and FEI a tracking software to process applications and provide in-depth reporting. The tool is fully integrated to other technologies such as Account Online and SAP. The ongoing evolution of C&EM programs and the highly integrated nature of the tool to support a streamlined customer experience have resulted in a longer project timeline and higher expenditures than anticipated when the Plan values were developed in 2018.

### Conservation Potential Review Program

| | |
|---|---|
| **Activity Description** | FEI considers the CPR to be an important tool for use in developing, supporting, and assessing current and future C&EM expenditure applications, as well as for directional input into program development. The purpose of a CPR study is to examine available technologies and determine their conservation potential, which includes the amount of energy savings that can be explored through conservation and energy management programs over the study period. The CPR does this by comparing the economic and market potential of viable measures to a base case scenario. |
| **Expenditures** | |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Conservation Potential Review** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **0** | **312** | **0** | **0** | **53** | **365** |
| **2021 Actual** | 0 | 276 | 0 | 0 | 26 | **302** |

### Customer Research

| | |
|---|---|
| **Activity Description** | Research activities undertaken under this budget in 2021 included exploring how to integrate our corporate messaging into our rebate campaigns, surveying customers on energy use during the pandemic, research focused on ethnic communities within our service territory as well as ongoing research to track the impact of general C&EM communications, and communications testing. Overspend in budget was due to an increased need for research to support our 2022 communications objectives. |

| Expenditures | | | | | | |
|---|---|---|---|---|---|---|
| **Customer Research** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **0** | **156** | **0** | **21** | **0** | **177** |
| **2021 Actual** | 0 | 0 | 147 | 91 | 25 | **264** |

### Commercial Energy Specialist Program

| | |
|---|---|
| **Activity Description** | This program funded Energy Specialist, Energy Analyst and Thermal Energy Manager positions in large commercial organizations. Funding ranged from $50,000 up to $80,000 per year based on position and an annual contract. A funded position's key priority is to identify and implement opportunities for their organization to participate in FEI's C&EM programs, while also identifying and implementing non-program specific opportunities to use natural gas more efficiently. There were 41 participants in 2021. This program is funded as an enabling activity but claims natural gas savings for those projects completed by energy specialists, energy analysts and thermal energy managers that are not claimed by another FEI DSM program. Total 2021 verified (non-C&EM program) annual savings were 22,612 GJ. FEI considers this to be an energy management program, and hence a specified demand-side measure, as defined in the DSM Regulation. |

| | | | Expenditures | | | |
|---|---|---|---|---|---|---|
| **Commercial Energy Specialist Program** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **2,400** | **104** | **0** | **68** | **142** | **2,714** |
| **2021 Actual** | 1,950 | 27 | 0 | 91 | 186 | **2,254** |

Notes:

- The Energy Specialist Program continues to experience success as an enabling program. In 2021, organizations with Energy Specialists were responsible for 21 percent of natural gas savings and 36 percent of the incentives paid out by Commercial C&EM programs. This is an addition to the Conservation Education and Outreach, Innovative Technologies, Low Income and Residential programs and incentives that the funded positions promoted and used in 2021.
- Some organizations had funded positions for part of the year only as they were new and added to the program later in the year or their funding agreements concluded and were not renewed.
- The energy savings listed only apply to third party verified natural gas projects completed by funded positions in 2021, which did not receive incentive funding from another C&EM program. These energy savings are only reported and have not been included in the calculations for the benefit/cost tests as the required inputs are not available.

**Community Energy Specialist Program**

| | |
|---|---|
| **Activity Description** | This program funded Senior Energy Specialist positions in municipalities and regional districts, up to $100,000 per year based on an annual contract. In the FEI service territory, C&EM contributes 60% of this funding amount with the other 40% coming from FEI's External Relations department. In the FEI/FBC shared service territory, C&EM contributes 75% of this funding (split 50/50 between C&EM FEI and FBC) with the other 25% coming from FEI's External Relations department. Senior Energy Specialists lead policy development and implementation as communities develop or refresh their sustainability and energy plans including BC Energy Step Code support where applicable and raise awareness of and participate in FEI's C&EM programs. There were nine participants in 2020. FEI considers this to be an energy management program, and hence a specified demand-side measure, as defined in the DSM Regulation. |

| | | | Expenditures | | | |
|---|---|---|---|---|---|---|
| **Community Energy Specialist Program** | **Incentives** | **Administration** | **Communication** | **Evaluation** | **Labour** | **TOTAL** |
| **2021 Plan** | **750** | **10** | **0** | **36** | **26** | **823** |
| **2021 Actual** | 509 | 1 | 0 | 29 | 155 | **695** |

Notes:

- Actual participation was under forecast since some communities had Community Energy Specialist for part of the year only related to hiring delays.

## 11.3 *SUMMARY*

Enabling Activities are critical initiatives that support and supplement DSM program development and delivery. The Trade Ally Network provides FEI the opportunity to quickly and effectively communicate new programs or revisions to existing programs. FEI continued to work with industry partners, including FBC, BC Hydro, and EMLI to support the industry and the Home Performance Stakeholder Council - an industry led group tasked with addressing the fragmented interests, opportunities and challenges that exist in BC's home performance industry.

FEI's involvement in codes and standards work in 2021 continued to encompass various activities including monitoring, reviewing and responding to existing and proposed regulatory changes and direct participation in working groups, committees and sub-committees that explore the development of future targets, codes and standards. In collaboration with the provincial Building Safety and Standards Branch, FEI and FBC provided support to educate builders and energy advisors and encourage the building of high performance homes in BC.

The continued development work in 2021 to implement the new DSM management system has further improved customer experience and service delivery for DSM programs. Once fully implemented, this new system will replace the legacy tool and provide improved features and reports to help FEI manage its expanding portfolio of DSM activities and enable new online functions for FEI's customers. Finally, customer research initiatives and the Energy Specialist programs continue to help improve the delivery of programs and energy efficiency awareness and behaviour in BC.

# 12. EVALUATION

In alignment with the Company's Evaluation, Measurement and Verification (EM&V) Framework and industry standard practice, program evaluation activities are assessed at different stages of each program's lifecycle[13]. Based on this ongoing assessment, all programs are evaluated when appropriate. The 2021 evaluation activities presented here reflect the number of programs in market, and the type of evaluation activities required to provide program feedback.

## 12.1 *2021 PROGRAM EVALUATION AND EVALUATION RESEARCH ACTIVITIES*

In 2021, FEI's various evaluation activities included quantifying energy savings, assessing participant awareness and satisfaction, identifying barriers to participation, assessing customer usability, engaging with various FEI DSM outreach activities, conducting industry research, and conducting quality assurance site visits. Measurement and Verification (M&V) activities focused on identifying and verifying project and measure level savings assumptions and understanding any issues associated with equipment installation in the field.

Table 12-1 provides a summary of all program evaluation and evaluation research related activities undertaken in 2021. Expenditures for these activities have been accounted for within the applicable program or Program Area non-incentive costs included in previous sections but are also reported here in order to provide a concise, easy-to-view summary of evaluation activities. Included in the table are: a list of all the 2021 evaluation activities; the Program Area each activity occurred in; the general type of evaluation activity undertaken; the Company's actual 2021 evaluation expenditures; and a status update on each activity. The total expenditure for program evaluation and research activities in 2021 was approximately $1.9 million.

[13] Types of evaluation activities include: Communications evaluations, which focus on advertising and media outreach, and focus groups; Evaluation studies, where quality assurance is conducted to gain more insight on the incented measure, and literature reviews conducted to better understand the incented measure; Market studies, research and interviews with industry stakeholder to assess market penetration; Process evaluations, where surveys and interviews are used to assess customer satisfaction and program success; Impact evaluations, to measure the achieved energy savings attributable from the program; Market Analysis, to characterized the industry and the program's effect on market penetration and, Measurement & Verification, to monitor real time energy savings associated with energy conservation measures and validation of energy savings through energy study and energy model reviews.

**Table 12-1: Inventory of DSM Program Evaluation and Evaluation Research Activities Conducted in 2021[14]**

| Evaluation Name | Program Area | Type of Evaluation | Evaluation Partners | Actual Evaluation Expenditure (000's) | Evaluation Status |
|---|---|---|---|---|---|
| **CUSTOMER RESEARCH** | | | | | |
| FortisBC Communication Tracking: Energy Efficiency Conservation | Enabling Activities | Communications | none | $35 | Customer engagement and awareness of C&EM activities.<br>**Completed in March, June and October 2021 by Sentis Research** |
| MyVoice Panel Software | Enabling Activities | Communications | none | $39 | Various online testing projects:<br>• Home Renovation Rebate & Free Ridership Research<br>**Ongoing by FortisBC Energy Inc.**<br>• Income Qualified DSM Programs Research<br>**Completed November 2021 by FortisBC Energy Inc.** |
| HER & DDSM Service Quality Research | Enabling Activities | Communications | none | $17 | Customer experience and satisfaction with the Home Energy Report and Dynamic Demand Side Management service products.<br>**To be completed Q2 2022** |
| **COMMERCIAL ENERGY SPECIALIST PROGRAM** | | | | | |
| Energy Audit 2020 Update | Enabling Activities | Process & Impact | FortisBC Energy Inc. & FortisBC Inc. | $30 | The study is an update to an energy savings audit to verify energy savings from projects completed in 2021.<br>**Completed June 2021 by Prism Engineering. Preliminary results provided in 2020 AR.** |
| Energy Specialist Program Evaluation 2021 | Enabling Activities | Process & Impact | FortisBC Energy Inc. & FortisBC Inc. | $61 | The evaluation study includes program and industry stakeholder surveys and an energy savings audit on a subset of completed 2021 projects.<br>**To be completed Q2 2022** |
| **COMMUNITY ENERGY SPECIALIST PROGRAM** | | | | | |
| Community Energy Specialist Program Evaluation 2021 | Enabling Activities | Process | FortisBC Energy Inc. & FortisBC Inc. | $29 | Program evaluation consisting of a process evaluation and interviews with internal and external stakeholders in order to gather feedback for future program design.<br>**To be completed Q2 2022** |

[14] Table 12-1 does not include Prefeasibility Studies. Please refer to the Innovative Technologies section (Section 8) for details.

**Table 12-1: Inventory of DSM Program Evaluation and Evaluation Research Activities Conducted in 2021 (continued)**

| | | | | | |
|---|---|---|---|---|---|
| **TRADE ALLIED NETWORK QUALITY ASSURANCE** | | | | | |
| Insulation & Program Compliance Site Visits | Enabling Activities | Evaluation Study | none | $100 | Ongoing site visit of homes with insulation and draft proofing measures with a focus on quality assurance and program compliance in order to provide contractor feedback and promote future contractor education and training. |
| Furnace Quality Assurance & Program Compliance Site Visits | Enabling Activities | Evaluation Study | none | $165 | Ongoing site visit of homes with furnace or boiler upgrades with a focus of quality assurance and program compliance in order to provide contractor feedback and promote future contractor education and training. |
| Furnace Quality Installation Field Study | Enabling Activities | Evaluation Study | none | $35 | In-person site assessments for furnace upgrades with a focus on capturing the pre-change out data to assess the baseline for the furnaces replaced.<br>**To be completed Q2 2022** |
| **CODES & STANDARDS** | | | | | |
| Energy Code Compliance Studies | Enabling Activities | Process | none | $60 | Online survey of industry professionals and building officials regarding compliance with the BC Energy Step Code energy performance requirements for new buildings including residential and commercial.<br>**Completed December 2021 by RDH Building Science** |
| Gas Fired ASHP - Calculation Tool | Enabling Activities | Market Study | none | $0 | Calculation tool development to assist Energy Modelers to calculate savings and evaluate gas fired heat pumps as part of the energy code compliance.<br>**Completed September 2021 by E3 Eco Group Inc.** |
| Evaluation Industry Standard Practices Seminar | Enabling Activities | Communications | none | $3 | Seminar on advanced DSM impact evaluation techniques with emphasis placed on the methods, statistics and data preparation.<br>**Completed November 2021 by Sampson Research** |
| **HOME RENOVATION PROGRAM** | | | | | |
| Fireplace Industry Research | Residential | Market Study | none | $5 | Interviews with manufacturers and retailers were conducted to assess satisfaction, rebate levels and delivery of the program.<br>**Completed May 2021 by DANSIR Energy Solutions** |
| Water Heater Evaluation | Residential | Process & Impact | none | $75 | Program evaluation consisting of participant and contractor interviews and an impact analysis for domestic gas hot water heaters.<br>**Completed August 2021 by Econoler** |

**Table 12-1: Inventory of DSM Program Evaluation and Evaluation Research Activities Conducted in 2021 (continued)**

| Evaluation Name | Program Area | Type of Evaluation | Evaluation Partners | Actual Evaluation Expenditure (000's) | Evaluation Status |
|---|---|---|---|---|---|
| **HOME RENOVATION PROGRAM** | | | | | |
| Double Rebates Offer Evaluation | Residential | Process | none | $59 | Customer and contractor surveys to assess the impacts of the Double Rebates Offer.<br>**Completed November 2021 by Sampson Research** |
| Insulation Measures Characterization Analysis | Residential | Market Study | FortisBC Energy Inc., FortisBC Inc. & BC Hydro | $3 | Characterization analysis of insulation measures incented as part of the Home Renovation Rebate Program.<br>**Completed December 2021 by Dunsky** |
| Furnace Quality Installation Field Analysis | Residential | Evaluation Study | none | $5 | Data analysis component of the Furnace Quality Installation Field Study project.<br>**To be completed Q2 2022.** |
| Space Heating Incremental Cost Research | Residential | Market Study | none | $7 | Industry research on incremental costs associated with furnaces and boilers that are installed as part of the FortisBC Residential and Low Income incentive programs.<br>**To be completed Q2 2022** |
| **NEW HOME PROGRAM** | | | | | |
| New Home Program Evaluation | Residential | Process & Impact | FortisBC Energy Inc. & FortisBC Inc. | $100 | Program evaluation of the New Home rebate program consisting of contractor and customer surveys, impact analysis, and an analysis on customer usage with hybrid models.<br>**To be completed Q2 2022** |
| **RENTAL APARTMENT EFFICIENCY PROGRAM** | | | | | |
| Participant and Building Owner Surveys | Residential / Commercial | Process | FortisBC Energy Inc. & FortisBC Inc. | $3 | Surveys conducted with building owners and tenants to assess customer satisfaction, program awareness, and gather feedback for future program design.<br>**2020 results: Completed April 2021 by Cohesium Research**<br>**2021 results: To be completed Q2 2022** |
| **DIRECT INSTALL PROGRAM** | | | | | |
| Direct Install Quality Assurance | Low Income | Evaluation Study | FortisBC Energy Inc., FortisBC Inc. & BC Hydro | $179 | Ongoing quality assurance to ensure direct install measures are installed according to program policies and procedures. |
| Ongoing Customer Feedback Surveys | Low Income | Process | FortisBC Energy Inc., FortisBC Inc. & BC Hydro | $25 | Ongoing surveys with Direct Install program participants to gather feedback on their customer experience, satisfaction with the program and the program representatives.<br>**Completed February and March 2021 by Sentis Market Research** |

1 **Table 12-1: Inventory of DSM Program Evaluation and Evaluation Research Activities Conducted in 2021 (continued)[15]**

| Evaluation Name | Program Area | Type of Evaluation | Evaluation Partners | Actual Evaluation Expenditure (000's) | Evaluation Status |
|---|---|---|---|---|---|
| **COMMERCIAL PERFORMANCE PROGRAM** | | | | | |
| Third Party Energy Study Reviews | Commercial | Measurement & Verification | none | $133 | Ongoing reviews conducted by third party consultants to review and verify the savings as noted in the project energy study reports. Energy study reviews may include engineering calculations for specific energy conservation measures, plant wide reviews, document reviews, and feasibility study reviews. |
| Third Party Measurement & Verification | Commercial | Measurement & Verification | none | $15 | Ongoing third party M&V conducted as part of the program evaluation. The M&V activities include the completion of an M&V plan, commissioning validation site visits, and M&V reports. M&V activities align with the International Performance Measurement and Verification Protocol (IPMVP). |
| **COMMERCIAL NEW CONSTRUCTION PROGRAM** | | | | | |
| Third Party Energy Model Reviews | Commercial | Measurement & Verification | none | $120 | Ongoing BC Energy Step Code and Non-BC Energy Step Code energy model validations conducted by a third party consultant as part of the program administration and evaluation. |
| **INNOVATIVE TECHNOLOGIES** | | | | | |
| Carbon Capture Pilot | Innovative Technologies | Measurement & Verification | none | $19 | Measurement of energy savings, installation and technology performance associated with the carbon capture system. **To be completed Q3 2023** |
| Gas Absorption Heat Pump Pilot | Innovative Technologies | Measurement & Verification | none | $36 | Measurement of energy savings, installation and customer acceptance of the gas-fired absorption heat pump technology for commercial DHW applications. **Phase 1 & 2: Completed October 2020 by Building Energy Solutions Ltd. Results reported in the 2020 Annual Report.** **Phase 3 &4: Completed September 2021 by Building Energy Solutions Ltd.** |
| Thermal Compression Heat Pump Pilot | Innovative Technologies | Measurement & Verification | none | $80 | Measurement of energy savings, installation and customer acceptance of the thermal compression heat pump technology for residential space heat and DHW applications. **To be completed Q3 2023** |

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[15] Measurement & Verification studies require time to conduct activities which include, but are not limited to, project commissioning, installing and removal of monitoring equipment, data collection, and data analysis and reporting. M&V activities align with the International Performance Measurement and Verification Protocol (IPMVP) Concepts and Options for Determining Energy and Water Savings. Prepared by the Efficiency Valuation Organization: www.evo-world.org. January 2012.

**Table 12-1: Inventory of DSM Program Evaluation and Evaluation Research Activities Conducted in 2021 (continued)**

| Evaluation Name | Program Area | Type of Evaluation | Evaluation Partners | Actual Evaluation Expenditure (000's) | Evaluation Status |
|---|---|---|---|---|---|
| **INNOVATIVE TECHNOLOGIES** | | | | | |
| Residential Gas Absorption Heat Pump Pilot | Innovative Technologies | Measurement & Verification | none | $189 | Measurement of energy savings, installation and customer acceptance of the gas-fired absorption heat pump technology for residential space and water heating applications. **To be completed Q3 2023** |
| Deep Energy Retrofit Pilot | Innovative Technologies | Measurement & Verification | none | $49 | Measurement of energy savings, installation and customer acceptance of building envelope and energy system upgrades for residential and commercial buildings. **To be completed Q4 2025** |
| **INDUSTRIAL PERFORMANCE PROGRAM** | | | | | |
| Third Party Energy Study Reviews | Industrial | Measurement & Verification | none | $70 | Ongoing reviews conducted by third party consultants to review and verify the savings as noted in the project energy study reports. Energy study reviews may include engineering calculations for specific energy conservation measures, plant wide reviews, document reviews, and feasibility study reviews. |
| Third Party Measurement & Verification | Industrial | Measurement & Verification | none | $42 | Ongoing third party M&V conducted as part of the program evaluation. The M&V activities include the completion of an M&V plan, commissioning validation site visits, and M&V reports. M&V activities align with the International Performance Measurement and Verification Protocol (IPMVP). |
| **CONSERVATION EDUCATION AND OUTREACH** | | | | | |
| Customer Engagement Tool Evaluation | CEO | Impact | FortisBC Energy Inc. & FortisBC Inc. | $49 | Evaluation of the overall program, validation of the treatment and control group selection, and net savings attributed to the distribution of the Home Energy Reports. **To be completed Q2 2022** |
| **PORTFOLIO** | | | | | |
| Partnership Program Evaluation Study | Portfolio | Market Study | FortisBC Energy Inc. & FortisBC Inc. | $6 | Research study to gather feedback from industry experts, documentation review of guidelines and best practices for Partnership programs. **Completed May 2021 by Tetra Tech Inc.** |
| Incentives Project Study | Portfolio | Market Study | none | $15 | Sponsorship towards a collaborative exploration of incentive strategies for energy efficiency programs. Project led by ICF and E Source. **Completed September 2021 by ICF** |
| Comprehensive Energy Savings Project | Portfolio | Market Study | none | $47 | A comprehensive review to better understand the tracking of total energy savings and emission reductions that are being employed by other utilities and organizations. **To be completed Q2 2022** |

**Table 12-2: Summary of Key Findings and Methodology for 2021 Completed DSM Program Evaluation Studies and Pilot Program Reports**

| Evaluation Name | Program Area | Type of Evaluation | Methodology | Outcome from Key Findings |
|---|---|---|---|---|
| **CUSTOMER RESEARCH** | | | | |
| FortisBC Communication Tracking: Energy Efficiency Conservation | Enabling Activities | Communications | Three waves of online interviews conducted with approximately 800 per wave of British Columbia adults living within the FortisBC service territory. The waves were conducted in March, June and October 2021. | **Results:** The percentage of participants that were aware of at least one of the three main energy efficiency activities undertaken by FortisBC remained unchanged compared to the previous three years (79% in 2021, 81% in 2018 and 80% in both 2019 and 2020).<br><br>Overall, eight-in-ten participants were at least moderately engaged, an increase of 5 percentage points from 2020. The percentage of respondents that were extremely or highly engaged rose significantly compared to the prior year (43% vs. 35% in 2019).<br><br>**Outcome of Key Findings:** Continue to emphasize the overarching energy efficiency activities rather than individual programs to build awareness. |
| MyVoice Panel Software | Enabling Activities | Communications | FortisBC MyVoice online community panel. | **• Home Renovation Rebate & Free Ridership Research:**<br>**Results** - Fifty-six percent of program participants who completed the rebate application form online found it easy or very easy to complete.<br>**Outcome of Key Findings:** Continue to explore ways to make the application form less onerous and easy to complete.<br><br>**• Income Qualified DSM Programs Research:**<br>**Results** - Thirty-eight percent of survey respondents were not aware that FortisBC had energy efficiency and conservation programs specifically designed for income qualified customers.<br>**Outcome of Key Findings:** Increase marketing and awareness of income qualified energy efficiency and conservation programs. |
| **COMMERCIAL ENERGY SPECIALIST PROGRAM** | | | | |
| Energy Specialist Program Evaluation 2021 | Enabling Activities | Process & Impact | The evaluation comprised of three phases; a preliminary review of the program design and delivery methods, interviews with 35 program stakeholders, including Energy Managers, Key Account Managers and Energy Specialist program roles to assess the effectiveness and delivery of the program, and an energy savings audit for 14 projects completed in 2021.<br><br>The energy savings audit consisted of gas savings projects without FortisBC Incentive program participation. | **Results:** Projects from six organizations were reviewed which included; universities, school districts, heath authorities, and municipalities. 14 completed projects from these organizations were reviewed to represent savings for 2021. The results indicated a total verified savings of 22,612 GJ/year.<br><br>**Outcome of Key Findings:** Results were taken under consideration for future program design. |

**Table 12-2: Summary of Key Findings and Methodology for 2021 Completed DSM Program Evaluation Studies and Pilot Program Reports (continued)**

| Evaluation Name | Program Area | Type of Evaluation | Methodology | Outcome from Key Findings |
|---|---|---|---|---|
| **CODES & STANDARDS** | | | | |
| Energy Code Compliance Studies | Enabling Activities | Process | Online surveys were conducted for 2 groups of building industry practitioners and building officials with experience meeting or assessing energy code compliance for residential and commercial buildings. The survey for the Part 3 buildings was conducted from October to December 2020 with 175 completions. The survey for the Part 9 buildings was conducted from December 2020 to February 2021 with 101 completions. | **Results:** Part 3 buildings – The average As-Built Energy Code Compliance Rates declined in comparison to the previous years. (68% on the individual level and 56% for the industry-wide impressions vs 79% and 61% in 2015). Part 9 buildings – The average As-Built Energy Code Compliance Rate for BC Step Code was 74% (Individual/self-impressions) at the high end, and at the low end (Industry-wide impressions) 61%. Overall, code compliance (or confidence in achievement) drops as step code levels are increased (Step 1 to Step 5).<br><br>**Outcome of Key Findings:** Results were reviewed with appropriate stakeholders via focus groups. Results and recommendations were taken into consideration for future planning. |
| Gas Fired ASHP - Calculation Tool | Enabling Activities | Market Study | An initial assessment of the calculation tool was conducted via literature review and technical data from manufacturer contacts and webinars. This information was used to calibrate inputs to the simulation models and tested in a comparative analysis using the simulation results for a current project that is in its design stage. | **Results:** The results of this comparative analysis showed that the Internal Combustion Engine Heat Pump used less total energy than the electric base models, with less electricity and more natural gas use. Although the total energy use is lower the Greenhouse Gas Emission Intensity results vary with local utility emissions factors.<br><br>**Outcome of Key Findings:** Results were reviewed with appropriate stakeholders. Findings were taken under consideration for future projects. |
| **HOME RENOVATION REBATE PROGRAM** | | | | |
| Retail Program Evaluation | Residential | Process & Impact | A combination of engineering analysis, literature review, and telephone survey with 196 program participants from the 2017 to 2019 program years were conducted to gather feedback about the program. | **Results:** Overall, participant satisfaction is high with over 90 percent of respondents being satisfied with the overall program. Net-to-gross ratios estimated for the appliance program are consistent with similar programs and align with the program targets.<br><br>**Outcome of Key Findings:** Results were taken under consideration for future program design and evaluation planning. |
| Fireplace Industry Research | Residential | Market Study | Twenty-two (22) manufacturers who are members of the Hearth Patio and Barbeque Association of Canada (HPBAC) were identified and contacted to participate in a telephone survey. Interview questions focused on gathering feedback to better improve the program design and delivery. | **Results:** Overall, the manufacturers who were interviewed (12 completions out of 22) were supportive and generally satisfied with the FortisBC fireplace program and incentive levels. The double rebate offer was well received for the increased incentive value and positive market influence however, manufacturers had difficulty keeping up with the demand due to supply chain and labor shortages.<br><br>**Outcome of Key Findings:** Results were taken under consideration for future program design and evaluation planning. |
| Water Heater Evaluation | Residential | Process & Impact | A combination of phone interviews, literature and program documentation reviews were conducted to assess the effectiveness of the program delivery, the quality of the installation and equipment performance, free ridership and spillover attributed to the program. Telephone surveys with 200 program participants from the 2018 to 2020 program years were completed from April to May 2021, and 32 water heater contractors were surveyed between April to June 2021. | **Results:** The overall program satisfaction is very high with participants indicating an average score of 8.7 or higher, and contractors indicating an 8.0 out of a 10-point scale. New unitary savings were realized for the three types of program eligible water heaters; conventional storage tank, condensing tankless and condensing storage tank.<br><br>**Outcome of Key Findings:** Results were reviewed and new savings estimates were used to update the program cost effectiveness calculations as part of the 2021 program updates. |

**Table 12-2: Summary of Key Findings and Methodology for 2021 Completed DSM Program Evaluation Studies and Pilot Program Reports (continued)**

| Evaluation Name | Program Area | Type of Evaluation | Methodology | Outcome from Key Findings |
|---|---|---|---|---|
| **HOME RENOVATION REBATE PROGRAM** | | | | |
| Double Rebates Offer Evaluation | Residential | Process | An online survey of program participants who installed a furnace, boiler or combination boiler under the 2020 to 2021 Double Rebate offer was conducted in August 2021. Interviews with large HVAC contractors, and analyses of the program application form data was also conducted to assess the impact of the double rebate offer customer satisfaction, and the timing of the participant's decision to replace their existing furnace or boiler. | **Results:** A total of 1,197 surveys were completed from a sample of 4,392 participants (27% response rate). Overall, 93% of participants are satisfied with the Double Rebate offer, significantly higher than the 88% satisfaction for participants from the 2016-18 program years. Compared to the 2016-18 program year, 2020-21 program with its higher rebates incented a significantly larger proportion of customers to replace their furnaces sooner than they would have without the program.<br><br>**Outcome of Key Findings:** Results were reviewed and updates were made to the program cost effectiveness calculations as part of the 2021 program inputs. |
| Insulation Measure Characterization Analysis | Residential | Market Study | Savings were estimated using an algorithmic approach and calculated for each measure based on data specific to the Home Renovation Rebate program. | **Results:** New average savings assumption by insulation measures were realized as part of the study.<br><br>**Outcome of Key Findings:** As a result of the findings and recommendations, updates were made, where appropriate for the 2021 program inputs. |
| **RENTAL APARTMENT EFFICIENCY PROGRAM** | | | | |
| Participant and Building Owner Surveys | Residential/ Commercial | Process | This study is an ongoing evaluation conducted annually for the program. In-person installations were temporarily put on hold starting March 2020 therefore a telephone survey with building owners/managers was not conducted. The online survey continued to be active with 31 tenants completing the survey. | **Results:** The survey results continue to show positive feedback with 80% of the tenants surveyed indicating "very" or "somewhat satisfied" with the overall program (76% in 2019). The favorable areas include; the application process, the level of program communications, installation of the fixtures were good, and the professionalism and friendliness of the installer.<br><br>**Outcome of Key Findings:** Continue to conduct ongoing tenant and building owner surveys to provide feedback to program design. |
| **DIRECT INSTALL PROGRAM** | | | | |
| Ongoing Customer Feedback Surveys | Low Income | Process | Two separate surveys were conducted to evaluate the Direct Install Program.<br>The first survey, is a paper survey with an option to be completed online. A total of 506 program participants completed the survey between January 2020 to January 2021. The survey assess customer satisfaction with the program application process, the measures installed and the experience with the installation contractors.<br>A subgroup of participants from the first survey who were eligible for additional draft-proofing, insulation and/or a natural gas furnace upgrades were contacted to participate in a second survey (online and telephone). A total of 40 participants completed the survey between September and December 2020. The purpose of this survey was to assess program satisfaction and contractor experience relating to the additional measures. | **Results:** First survey - Overall satisfaction has trended up for a second consecutive year where 83% are very satisfied with the program (vs. 80% in 2019 and 75% in 2018). There is some indication that satisfaction increases with the number of products installed. On average participants had three products installed with the most common being the energy-saving light bulbs, exterior door weather stripping, and kitchen and bathroom faucet aerators<br>**Results:** Second survey - Satisfaction is somewhat higher for the subgroup of participants who were eligible for additional measures than those who didn't (88% vs 83%, respectively). The primary reason customers participate in the program is consistent with previous years in that the top motivator is to save money on utility bills. For the subgroup who were eligible for the additional measures; bathroom fan, and insulation represented 98% and 78% of the products installed. Satisfaction with the contractor's professionalism remains consistently high, garnering 93% very satisfied ratings overall for the year.<br><br>**Outcome of Key Findings:** Continue to conduct the participant surveys to assess the program's development and contractor experience. |

**Table 12-2: Summary of Key Findings and Methodology for 2021 Completed DSM Program Evaluation Studies and Pilot Program Reports (continued)[16]**

| Evaluation Name | Program Area | Type of Evaluation | Methodology | Outcome from Key Findings |
|---|---|---|---|---|
| **COMMERCIAL PRODUCT REBATE PROGRAM** | | | | |
| Virtual Site Assessment Evaluation Study | Commercial | Process | A combination of stakeholder and participant surveys (online and telephone) and documentation reviews were completed to assess the uptake and satisfaction with conducting virtual site assessment amidst the pandemic. | **Results:** Overall, program participants are satisfied with the virtual site assessment process (mean rating of 4.7 out of 5.0). Satisfaction with the virtual assessment process is consistent when compared to the 4.8 rating for in-person assessments. Recommendations to improve the communication and expectations for the virtual site assessments include; increasing the level of detail and clarity on the templates with guidelines for undertaking the virtual assessment, and providing more detail on how to capture relevant installation pictures.<br><br>**Outcome of Key Findings:** Results and recommendations were reviewed and taken under consideration for future program design. |
| **INNOVATIVE TECHNOLOGIES** | | | | |
| Gas Absorption Heat Pump Pilot | Innovative Technologies | Measurement & Verification | **M&V Plan:** Complies with the International Performance Measurement & Verification Protocol. The selected IPMVP option and measurement boundary was Option A Retrofit Isolation Key Parameter Measurement. | **Pilot Objective:** Stemming from the results of the DHW heating trial which completed in 2020, FortisBC further investigated two existing participant sites to identify GAHP DHW system efficiency improvements (adding modulating condensing boiler) as well as GAHP performance for space heating applications.<br><br>**Outcome of key findings:**<br>The DHW system efficiency improvement trial realized 35.2% energy savings which is a significant increase from the original 21% that was evaluated from original field trials. Savings were attributed to replacing the existing aged mid-efficient boiler with two new condensing modulating tankless units and adding more sophisticated controls to control switchover points.<br>The Space heating trial identified greater potential to increase overall system efficiencies of the heating system by taking one of the GAHP units to tie into the space heating loop while the other GAHP unit satisfied the DHW heating loop. This space heating and DHW heating (hybrid) realized 27.9% energy savings which is significant increase from the original 15.7% savings that was evaluated from the original field trials.<br>As a result of the pilot studies, FortisBC will be implementing the gas absorption heat pump measure for multiple end uses under the commercial prescriptive program area in 2022. |

[16] IPMVP Option A - Measurement of key parameters governing energy use to assess consumption. www.evo-world.org

**Table 12-2: Summary of Key Findings and Methodology for 2021 Completed DSM Program Evaluation Studies and Pilot Program Reports (continued)**

| Evaluation Name | Program Area | Type of Evaluation | Methodology | Outcome from Key Findings |
|---|---|---|---|---|
| **CONSERVATION EDUCATION AND OUTREACH** | | | | |
| Customer Engagement Tool Evaluation | CEO | Impact | The evaluation consisted of program documentation reviews, and a validation of the treatment and control groups based on analysis of the energy consumption data, household characteristics and geographical locations. The evaluation would assist in determining the Year 1 net natural gas savings and provide recommendations on how to improve the accuracy of the savings calculations in preparation for next year's evaluation. | **Results:** A validation of the treatment and control groups from both the gas (85,384 treatment and 34,354 control) and electricity (12,285 treatment and 3,060 control) customers indicated that the selection of households were comparable, followed similar and relatively steady usage patterns in the two years leading up to their inclusion in the program. The program's Year 1 gas savings from December 2020 to November 2021 yield a 0.91 percentage of savings. Given the later program launch for the electricity participants, program electric savings will be evaluated as part of the second phase of this evaluation along with the program Year 2 savings.<br><br>**Outcome of Key Findings:** Results were reviewed and preliminary gas savings estimates were used to update the program cost effectiveness calculations as part of the 2021 program updates. Further evaluations will be conducted for the Year 2 program including a verification of gas and electric savings. |
| **Portfolio** | | | | |
| Partnership Program Evaluation Study | Portfolio | Market Study | Phone interviews with 13 utility program staff, 11 industry experts and consultants across Canada and the U.S. were conducted to gather insights on industry best practices and guidelines for attribution of savings and greenhouse gas emission reductions, and protocol for reporting these savings and associated reductions. Program documentation and literature reviews were also conducted to meet the research objectives. | **Results:** Overall, the research found that how savings and GHG emission reductions are attributed to co-funding entities is situation-specific. The findings provided a guideline that allows for flexibility while taking into account the industry practices gathered from the research study.<br><br>**Outcome of Key Findings:** Results and recommendations were taken under consideration for future guidance. |
| Incentives Project Study | Portfolio | Market Study | An online experience module conjoint survey with 459 customers and phone interviews with a sub-group of 25 customers from 7 utilities across Canada and the U.S. was conducted to gather insight on the customer experience and their journey with utility rebate programs. | **Results:** The findings include looking at the customer's shopping experience, purchasing decision and the impacts of the utility rebates. Contractors play a central role in the customer's shopping experience. Most people either already had a contractor they knew, searched for one online, or asked friends and family. Customers gather information from manufacturer websites and independent user reviews of products to guide their purchase decision. Those who are proactive tend to be more satisfied with their purchase. 74% of customers learned about the rebates through their contractors, and 84% of customers reviewed the rebate amounts before selecting the equipment.<br><br>**Outcome of Key Findings:** Results and recommendations were taken under consideration for future program guidance. |

## 12.2 *Evaluation Collaboration*

In 2021, FEI continued to seek opportunities to increase collaboration activities with FBC, BC Hydro, and other entities to conduct program evaluation for DSM programs. The number of collaboration activities depends on the timing of the activity, program participants, legal and privacy concerns, and available budget to conduct the study. Tables 12-1 and 12-2 provide information on program evaluation activities conducted in partnership with other organizations. FEI, FBC and BC Hydro continue to collaborate in the evaluation projects for the Low Income Direct Install Program – Ongoing Customer Feedback Survey, and Direct Install Quality Assurance study.

In keeping with the MOU on collaboration discussed in Section 2.4, FEI, FBC and BC Hydro continue to hold update project meetings and explore opportunities for future collaboration on program evaluations.

# 13. DATA GATHERING, REPORTING AND INTERNAL CONTROLS PROCESSES

## 13.1 OVERVIEW

The following section outlines FEI's business practices to ensure DSM activities and associated expenditures are in compliance with the Company's internal control processes and with BCUC Decision and Order G-36-09, which directed the Company to include a discussion in the DSM Annual Report of the Company's internal data gathering, monitoring and reporting control practices.

## 13.2 ROBUST BUSINESS CASE PROCESS APPLIED TO ALL PROGRAMS

Before a new DSM pilot or program can be implemented, a business case must first be developed. FEI is committed to putting each pilot or program through the appropriate level of internal scrutiny before moving ahead and believes doing so ensures an increased chance of pilot or program effectiveness.

Business cases include information about program rationale and purpose, as well as a description of the target audience, assumptions, cost-benefit tests and proposed evaluation methods. Cost effectiveness analysis is performed using the California Standard Tests (CST) as outlined in the California Standard Practice Manual. FEI uses an in-house cost-benefit modeling tool developed in partnership with expert industry consultants to apply the program costs and benefits in each of the four standard cost-effectiveness tests based on the California Standard Practice Manual (Rate Impact Measure [RIM], Utility, Participant, and TRC) and the MTRC in accordance with DSM Regulation. The results from this modelling are used as inputs for the business cases, which are approved in accordance with FEI's policy on financial authorization levels.

In addition to the internal business case process, FEI is required to submit a detailed plan for new programs to the BCUC for approval prior to the expenditure of any funds. No new programs, beyond those approved as part of the 2019-2022 DSM Plan and the Application for Updated DSM Expenditures for 2021 and 2022[17], were submitted to the BCUC for approval in 2021.

## 13.3 INCENTIVE APPLICATIONS VETTED FOR COMPLIANCE WITH PROGRAM REQUIREMENTS

Ensuring that all customer applications are compliant with program eligibility requirements as laid out in program terms and conditions is also part of the internal control process. The Company has a number of mechanisms in place to ensure DSM incentive funding applications are in compliance with program requirements. The verification process is specific to each program and is dependent on the type of program, its complexity, the financial value of the incentive and other parameters. The general principles applied are as follows:

[17] Filed on March 19, 2021 and approved by BCUC Order G-135-21.

- Each application is reviewed for completeness and accuracy;
- Applications must meet the criteria outlined in the terms and conditions of the program put forward through the approval process;
- Once approved, incentives are distributed to participants; and

Copies of applications and supporting documents are filed and retained.

## 13.4 *INTERNAL AUDIT SERVICES*

On an approximately biannual basis, FEI engages its own Internal Audit Services (IAS) group to review the internal controls associated with the DSM activities. Such an audit was performed in 2021 assessing the effectiveness of controls that were in place the prior year. That audit (see Appendix A) concluded that key controls are in place and operating effectively to mitigate risk around program development, program administration including rebate payments, and program reporting and evaluation to an appropriately low level.

## 13.5 *SUMMARY*

FEI is committed to strong internal controls in all aspects of its DSM activity. As demonstrated in this section, the Company's business practices related to program development, application processing and ongoing monitoring are all sound and subject to continuous improvement.

# 14. 2021 DSM PROGRAMS ANNUAL REPORT SUMMARY

In 2021, FEI achieved close to 100 percent of its total approved DSM expenditures and estimated annual energy savings for the year, based on its 2019-2022 DSM Plan, including approved amendments. Annual energy savings again exceeded 1.0 million GJ or 1 PJ. Incentive expenditures at year-end were more than four times that of non-incentive expenditures, making up 80 percent of the overall portfolio expenditures. The resulting total lifetime energy savings for 2020 DSM activity is estimated at 12.3 million GJ and corresponding lifetime GHG emissions reductions of 735,700 tonnes CO2e.

The Report details how FEI cost-effectively delivered these programs as set out in the 2019-2022 DSM Plan. A small negative carryover of expenditures from 2020, as approved by BCUC Order G-345-21, was balanced in 2021 with a small carryover amount available for spending in 2022. FEI was able to grow energy savings while maintaining strong COVID-19 pandemic safety protocols in accordance with Provincial Health directives. FEI continues to offer a robust portfolio of DSM programming accessible to all customer groups and locations, meeting the adequacy requirements of the DSM Regulation and operating according to the Company's DSM Guiding Principles.

## Appendix A

# FEI INTERNAL AUDIT REPORT
# CONSERVATION AND ENERGY MANAGEMENT
# INTERNAL CONTROL AND PROCESS REVIEW

**FortisBC Energy Inc.**
**Internal Audit Report**

**Date:** July 5, 2021

**To:** **Diane Roy**, VP, Regulatory Affairs

**CC:** **Danielle Wensink**, Director, Conservation and Energy Management

**From:** **Katrina Craig**, Director, Internal Audit & Risk

**Re:** Conservation and Energy Management – Internal Control and Process Review

---

## INTRODUCTION

The Conservation and Energy Management Program ("the Program") is designed to provide customers with tools and incentives to manage their natural gas consumption, reduce their energy costs, and lower their greenhouse gas emissions.

The British Columbia Utilities Commission ("BCUC") granted approval for a Program expenditure of $72.6 million for 2020 in order G-10-19. The Program includes rebates and incentives on a number of energy efficient appliances, equipment and systems as well as education and outreach initiatives to increase awareness of energy efficiency and conservation.

## SCOPE AND OBJECTIVES

The objective of the review was to evaluate the design and operating effectiveness of the key internal controls over the 2020 Program, namely around development, administration including rebate payments, and reporting and evaluation. In addition, this year's audit included an assessment that IT general controls over the Dynamic Demand Side Management (DDSM) system (currently being implemented) are operating effectively and in compliance with Corporate Information Security policies.

This was accomplished by:

- Inspecting that a cost/benefit analysis is developed for each new business case by Integrated Resource Planning (IRP);
- Understanding, documenting and obtaining evidence that controls are in place that help ensure program criteria are met for each application;
- Verifying the effectiveness of system-based application controls;
- Ensuring that program metrics and reports are produced and reviewed, on a regular basis, by Management for program monitoring and evaluation purposes; and
- Developing recommendations to address any control deficiencies or opportunities for improvement as identified.

**OBSERVATIONS & CONCLUSION**

Based on procedures performed, Internal Audit found that key controls are in place and operating effectively to mitigate risk to an appropriately low level for Program development, administration including rebate payments, and reporting and evaluation. In particular, Internal Audit notes the increased level of maturity in the control environment related to reconciliation and reporting between the Program system and FortisBC's financial system, SAP, which were findings noted in prior year audits, and previously addressed by Management.

The DDSM application controls also enhance the Program control environment. Internal Audit has identified opportunities to strengthen the current design of certain controls of the DDSM system, as value-add solutions for the remainder of the DDSM implementation project, which is expected to be completed this year. The findings and recommendation were discussed with Management and provided in the Management Report. Management has acknowledged and agreed that the remediation for these findings will be addressed through the completion of the DDSM project. Internal Audit will follow up in normal course.

Acknowledgement: Prepared by Farah Hassan, Anna Tom and Brian Williams, Internal Audit

# Appendix C

# DRAFT ORDER

British Columbia Utilities Commission
Suite 410, 900 Howe Street
Vancouver, BC Canada V6Z 2N3
bcuc.com

P: 604.660.4700
TF: 1.800.663.1385
F: 604.660.1102

**ORDER NUMBER**
**G-xx-xx**

IN THE MATTER OF
the *Utilities Commission Act*, RSBC 1996, Chapter 473

and

FortisBC Energy Inc.
Application for Approval of 2023 Demand Side Management Expenditures Plan

**BEFORE:**
[Panel Chair]
Commissioner
Commissioner

on Date

**ORDER**

**WHEREAS:**

A. On July 5, 2022, FEI filed an application for British Columbia Utilities Commission (BCUC) approval of its 2023 Demand Side Management (DSM) Expenditures Plan (DSM Plan);

B. FEI seeks acceptance, pursuant to section 44.2 of the *Utilities Commission Act* (UCA) of total DSM expenditures of $141.077 million in 2023;

C. FEI seeks the following additional approvals:

1. approval of proposed changes to its funding transfers as set out in Section 7.1.1;

2. approval of a new variance allowance rule on total portfolio expenditures as set out in Section 7.1.2;

3. approval of the forecast rate base additions accounting treatment as set out in Section 7.2; and

4. approval of a rate base deferral account to capture the regulatory costs of the Application as set out in Section 7.3;

D. The BCUC has reviewed FEI's DSM Plan and requested approvals for DSM expenditures for 2023 and concludes that the requested expenditure schedules should be accepted.

**NOW THEREFORE,** pursuant to section 44.2(a) of the UCA, the BCUC orders as follows:

1. The BCUC accepts the total FEI DSM expenditures of $141.077 million for the program areas as set out in the DSM Plan.
2. The proposed changes to the funding transfer rules as set out in Section 7.1.1 of the Application are approved;
3. The variance allowance rule on total portfolio expenditures as set out in Section 7.1.2 of the Application is approved;
4. The forecast rate base additions accounting treatment as set out in Section 7.2 of the Application is approved;
5. The rate base deferral account to capture the regulatory costs of the Application as set out in Section 7.3 of the Application is approved.

**DATED** at the City of Vancouver, in the Province of British Columbia, this (XX) day of (Month Year).

BY ORDER

(X. X. last name)
Commissioner

# Appendix D

# CONSERVATION POTENTIAL REVIEW (CPR)

# 2021 Conservation Potential Review

## Final Report

---

Date: 12 July 2021

**Tanja Percival**
**Project Specialist, Innovative Technologies & Projects**
**Conservation & Energy Management**
**FortisBC**
**16705 Fraser Highway, Surrey BC V4N 0E8**

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# Executive Summary

## Background and Objectives

The 2021 Conservation Potential Review (CPR) is the review of energy efficiency opportunities available among FortisBC's residential, commercial, and industrial natural gas customers.

The CPR will support two of FortisBC Energy Inc's (FEI) major regulatory filings in 2022: the long-term gas resource plan (LTGRP) and the Demand Side Management (DSM) plan. For this CPR, Posterity Group reviewed estimated technical, economic, and market potential natural gas savings in FEI's service territory over a 20-year period. The CPR is an important guiding document for ongoing conservation and energy management program development and support at FortisBC.

FEI has also retained Posterity Group to produce the load forecast of natural gas demand of FEI's customers to support the 2022 LTGRP filing. The base year and reference case forecast developed by Posterity Group is common to both the LTGRP and CPR. As a result of the integrated nature of the two projects, the LTGRP project is frequently referenced in this document.

## Findings Summary

- This study has found significant cost-effective and market achievable natural gas savings throughout the study period 2020-2040, and in all sectors and segments.

  Across all sectors, and using the MTRC screen, medium market potential savings are estimated at approximately 8 PJ, or 4% of reference consumption in 2025, rising to 24 PJ, or 10% of reference consumption in 2040.

  This estimated 24 PJ savings by 2040 includes potential savings from Residential, Industrial, and Commercial sectors of 9.9 PJ, 8.6 PJ, and 5.8 PJ respectively.

- In the ***residential sector***, only a small number of measures are cost-effective based on the TRC test, most being low-cost retrofit measures. Measures that pass the MTRC screen only become more important in the residential sector as the study period progresses.
  - The opportunities for equipment replacement measures, especially space heating measures, are much smaller relative to previous studies. This is primarily due to increasingly higher federal and provincial minimum energy performance standards (MEPS) for furnaces, which have caused DSM opportunities to become increasingly scarce.
  - In terms of percentage of reference case consumption forecast, more residential opportunities are available in the domestic hot water end use than the space heating end use throughout the study period. In absolute terms, savings potential for DHW measures (4 PJ by 2040 in the medium market potential scenario, MTRC screen) approaches that of space heating measures (5 PJ by 2040 in the medium market potential scenario, MTRC screen).

- *Commercial sector* savings show the most variance between the high and medium market potential scenarios. Using the MTRC screen, by 2040 the difference in potential between the medium and high market scenarios is 11.6 PJ.

  Gas heat pumps (GHPs) and efficient new construction are major contributing factors to this difference. These measures have high technical and economic potential, but future uptake is uncertain. For example, in the medium scenario, GHPs are modeled as an innovative technology with low forecasted growth. In the high scenario, they are modeled as an innovative technology with high forecasted growth, especially in the second half of the study period (2030-2040).
- The *industrial sector* is estimated to have the largest cost-effective savings potential on the TRC economic screen relative to other sectors. However, industrial customers require shorter payback periods relative to commercial and residential customers. Achieving savings from industrial measures that are cost-effective but have longer customer payback periods may be challenging and/or more expensive due to higher incentives and program costs.

## Scope

**Timing:** The base year for this study is the 2019 calendar year, where the reference case forecast is from 2020 to 2040 with results calculated for each intervening year.

**Regions:** This study divides the FortisBC gas regions in British Columbia into six: City of Vancouver, Lower Mainland (excluding Vancouver), Vancouver Island, Northern BC, Southern Interior, and Whistler.

**Sectors:** The study addresses three sectors: residential, commercial, and industrial. The LTGRP also includes transportation in its scope. EX 1 shows the breakdown of each sector (except transportation), which are organized into segments.

EX 1 – CPR Segments

| Residential | Commercial | Industrial |
|---|---|---|
| • Single Family Detached/Duplexes<br>• Single Family Attached/Row<br>• Mobile/Other Residential | • Apartments – Medium<br>• Apartments – Large Food Retail<br>• Hospital<br>• Hotel – Medium<br>• Hotel – Large<br>• Non-Food Retail – Medium<br>• Non-Food Retail – Large<br>• Nursing Home<br>• Office – Medium<br>• Office – Large<br>• Other Commercial<br>• Restaurant<br>• School – Medium<br>• School – Large<br>• University/College<br>• Warehouse | • Agriculture (includes greenhouses[1])<br>• Chemical<br>• District energy providers<br>• Fabricated Metal<br>• Food & Beverage<br>• Other Manufacturing (includes transportation[2] and other industrial)<br>• Mining<br>• Non-metallic Mineral (includes cement)<br>• Pulp & Paper – Kraft<br>• Pulp & Paper – TMP<br>• Utilities<br>• Wood Products |

End uses vary and are described in more detail in Section 2 of this report. The residential sector is also broken down into vintages that define the time periods when the dwellings were constructed.

## Approach

The CPR model was developed using Posterity Group's Navigator™ Energy and Emissions Simulation Suite. Data was collected from various sources for the analysis and inputted to the model.

The CPR followed these key steps to perform the analysis:

1. **Determine the current (Base Year) customer base and their energy consumption.**
    a. Collect and review data on the building stock in FortisBC's service territory, including end use surveys and previous CPRs.
    b. Develop energy use models of each building or facility type (segments) and model energy consumption by end use.

1 Cannabis included in agriculture segment since there is not enough data at FEI to create a cannabis-specific forecast.
2 In the 2015 CPR, 'transportation' pertained to facilities that supported the transportation sector.

c. Collect and review actual base year (2019) energy use and billing data of FortisBC's customers.
d. Use the billing data to calibrate the base year energy consumption in each sector's energy model.

2. Develop reference case energy consumption forecast.

   a. Collect and review data on all factors that will affect energy use trends over the study period (2020 to 2040 in this study's case).
      i. This includes analyzing and modelling natural improvements in building energy use intensities (e.g. from natural replacement of furnaces with new, higher efficiency ones at replacement time).
      ii. Other factors are existing building demolition / renovation trends, rate of new building stock construction, baseline energy efficiency of new buildings and equipment, and known changes to policies and codes and standards that will impact the energy use of buildings.
   b. Use this data to develop an energy consumption forecast model for each sector.
   c. Calibrate the reference case based on FortisBC's own account forecasts and industrial survey information at the region and rate class level.

3. Characterize energy conservation measures.

   a. Select a set of energy conservation measures for each sector. Measures range from mature, widely known measures that are currently part of FortisBC's program portfolio (e.g. commercial condensing boilers) to innovative or enabling technologies (e.g. smart residential water heater controllers). Behavioural measures are also considered (e.g. thermostat setback).
   b. For each measure, review and collect data on energy savings, costs, useful life, and the baseline equipment or technology that it should be compared with (if applicable).
   c. Use the data to characterize the technology's energy savings potential, cost-effectiveness, and financial attractiveness.
   d. Use the data as inputs to the energy model for each sector.

4. Estimate technical savings potential.

   a. For each measure, determine its technical applicability (i.e. how many buildings or facilities can this measure be applied to, considering only technical barriers).
   b. Determine the measures' current market penetration (i.e. how many buildings or facilities have already installed a measure).
   c. Estimate the measures' reference adoption – their natural rate of uptake in the absence of incentives or utility program intervention.

d. Input all data into the energy model for each sector and develop a hypothetical estimate of the technically feasible energy savings potential within FortisBC's service territory.[3]

5. **Estimate economic savings potential.**

   a. Screen each measure for cost-effectiveness from FortisBC's perspective by determining whether the benefit to cost ratio of each measure is 1.0 or above (pass) or if it is below 1.0 (fail) for two cost effectiveness tests: TRC and MTRC.
   b. Update the technical potential model with only the TRC-passing measures, removing measures that are not cost-effective.
   c. Estimate the economic savings potential of all cost-effective measures applied to all technically feasible buildings in the customer base.[4]
   d. Repeat steps 5b and 5c using the MTRC screen. This study presents findings from two economic (and subsequent market potential) models: One with TRC as the economic screen and one with MTRC.

6. **Estimate market savings potential.**

   a. Based on existing research, develop sets of "generic" adoption curves based on customer payback acceptance and typical market diffusion patterns.[5]
   b. Apply these generic curves to each measure in the economic potential model to develop "simplified market potential" estimates at the measure level.
   c. This data is input into the TRC economic potential model to develop a simplified market potential.
   d. Develop a more realistic market potential for each measure by soliciting feedback from FortisBC and its external stakeholders on the simplified market potential.[6]
   e. Revise the simplified market potential model based on this feedback to develop a realistic market potential scenario (referred to in this study as "medium market potential").
   f. Perform sensitivity analysis by varying incentive levels to model "low" and "high" market potential scenarios.
   g. Repeat steps 6c to 6f using the MTRC economic potential model to estimate low, medium, and high market potential scenarios using the MTRC economic screen.

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3 See Exhibit 2 for an overview of the constraints considered in the technical potential scenario, and the difference between different potential scenarios.
4 See Exhibit 2 for an overview of the constraints considered in an economic potential scenario.
5 Generic adoption curves primarily consider two things: the current market penetration of the measure, and its simple payback. Based on these factors, the curves are applied to each measure to estimate generic participation rates as a percentage of economic potential.
6 This process includes selecting representative, high-impact measures and adjusting their generic participation rates using historical program data, local market knowledge, and industry insights/feedback, then extrapolating these calibrated participation rates to other similar measures within each sector.

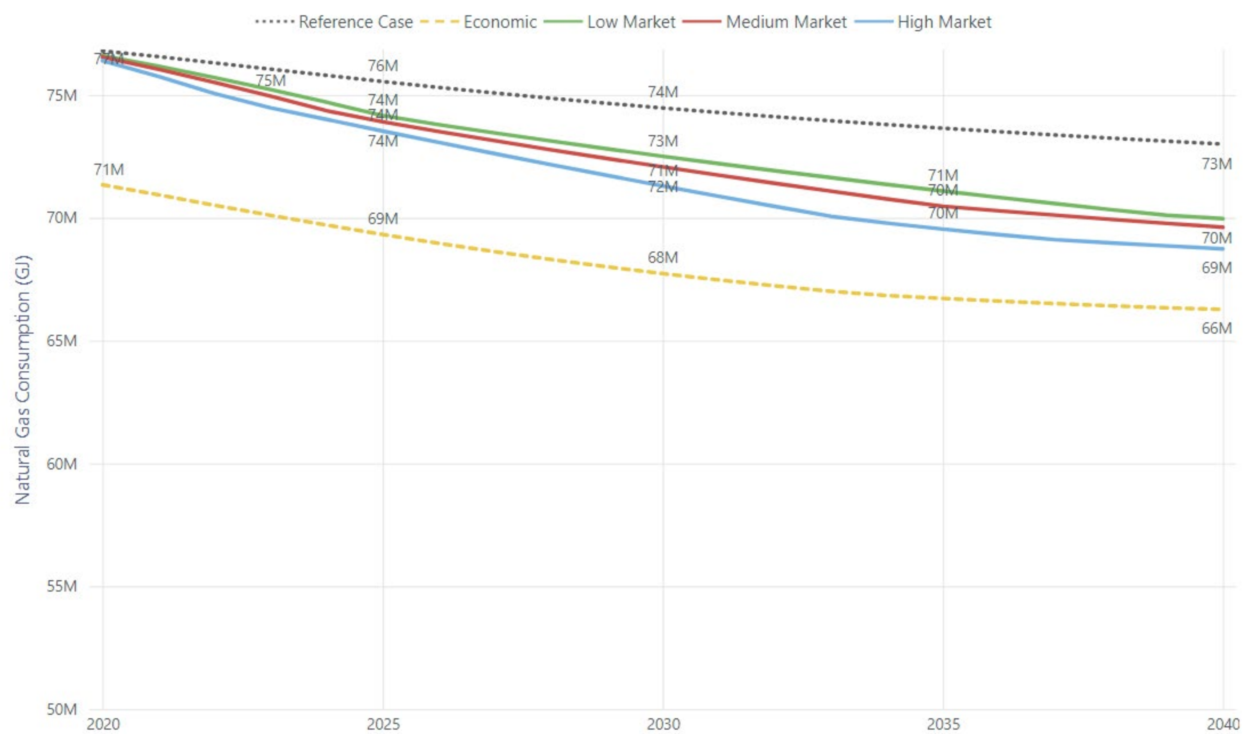
7. **Estimate other energy and non-energy benefits of the potential energy savings.**
    a. Greenhouse gas emissions savings.
    b. Impact of energy conservation measure investments and energy bill savings on provincial employment.

## Results and Findings

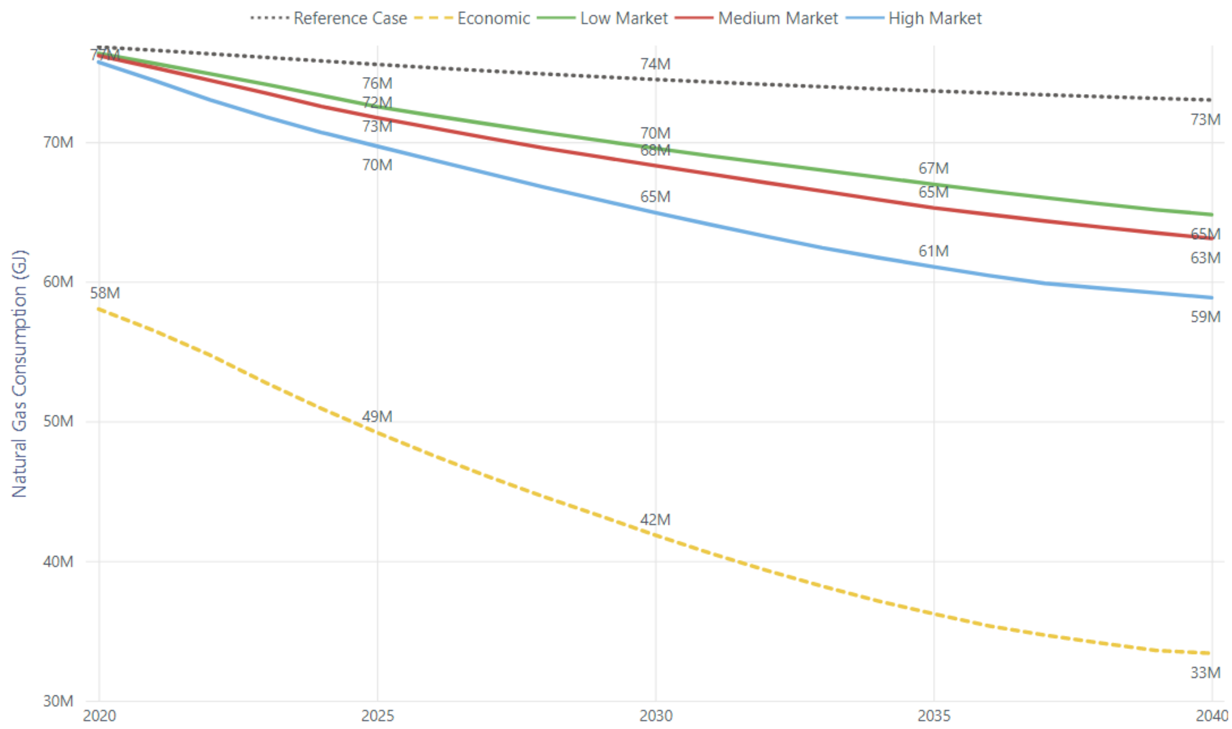
### Residential

EX 2 (TRC) and EX 3 (MTRC) show the forecasted gas consumption under the three market potential scenarios for the commercial sector. The reference consumption is forecasted to drop to 73 PJ in 2040 from 77 PJ today. The residential low, medium, and high market TRC potential consumption levels are estimated to be 70 PJ, 69.6 PJ, and 69 PJ by 2040. For MTRC, the potential consumption levels are estimated to be 65 PJ, 63 PJ, and 59 PJ, respectively.

EX 2 – Market Potential Consumption (GJ) Forecasts – Residential, TRC



EX 3 – Market Potential Consumption (GJ) Forecasts – Residential, MTRC



EX 4 (TRC) and EX 5 (MTRC) show the incentive and non-incentive spending required to achieve the medium and high market potential. Medium and high market incentives are 50% and 100% of measures' incremental costs, respectively. The tables show the total and incremental savings from the new measures installed every year.

### EX 4 – Medium and High Market Incentive Costs and Natural Gas Savings – Residential, TRC

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $3.5M | $0.5M | $4.0M | 255K | 255K | $12.6M | $1.9M | $14.5M | 397K | 397K |
| 2021 | $3.6M | $0.5M | $4.2M | 513K | 258K | $13.0M | $2.0M | $15.0M | 801K | 405K |
| 2022 | $4.0M | $0.6M | $4.6M | 793K | 280K | $14.6M | $2.2M | $16.8M | 1,251K | 450K |
| 2023 | $4.5M | $0.7M | $5.2M | 1,100K | 307K | $10.9M | $1.6M | $12.6M | 1,576K | 325K |
| 2024 | $5.1M | $0.8M | $5.9M | 1,442K | 342K | $8.1M | $1.2M | $9.3M | 1,794K | 219K |
| 2025 | $3.0M | $0.4M | $3.4M | 1,642K | 199K | $8.3M | $1.2M | $9.5M | 2,016K | 221K |
| 2026 | $2.4M | $0.4M | $2.8M | 1,792K | 151K | $8.4M | $1.3M | $9.7M | 2,240K | 225K |
| 2027 | $2.5M | $0.4M | $2.8M | 1,943K | 151K | $8.6M | $1.3M | $9.9M | 2,468K | 228K |
| 2028 | $2.5M | $0.4M | $2.9M | 2,095K | 152K | $8.8M | $1.3M | $10.1M | 2,700K | 232K |
| 2029 | $2.6M | $0.4M | $3.0M | 2,248K | 153K | $9.0M | $1.3M | $10.3M | 2,935K | 236K |
| 2030 | $2.6M | $0.4M | $3.0M | 2,401K | 154K | $9.2M | $1.4M | $10.6M | 3,175K | 240K |
| 2031 | $2.7M | $0.4M | $3.1M | 2,556K | 155K | $9.1M | $1.4M | $10.5M | 3,414K | 239K |
| 2032 | $2.7M | $0.4M | $3.2M | 2,712K | 156K | $9.1M | $1.4M | $10.5M | 3,653K | 239K |
| 2033 | $2.8M | $0.4M | $3.2M | 2,870K | 157K | $9.1M | $1.4M | $10.5M | 3,893K | 239K |
| 2034 | $2.9M | $0.4M | $3.3M | 3,029K | 159K | $8.0M | $1.2M | $9.2M | 4,015K | 123K |
| 2035 | $2.9M | $0.4M | $3.4M | 3,178K | 149K | $8.0M | $1.2M | $9.2M | 4,107K | 92K |
| 2036 | $2.5M | $0.4M | $2.9M | 3,222K | 43K | $7.8M | $1.2M | $9.0M | 4,196K | 89K |
| 2037 | $2.5M | $0.4M | $2.9M | 3,265K | 43K | $6.7M | $1.0M | $7.7M | 4,265K | 69K |
| 2038 | $2.4M | $0.4M | $2.8M | 3,307K | 42K | $4.3M | $0.6M | $4.9M | 4,264K | -1K |
| 2039 | $2.4M | $0.4M | $2.7M | 3,347K | 41K | $4.3M | $0.6M | $4.9M | 4,265K | 1K |
| 2040 | $2.3M | $0.4M | $2.7M | 3,388K | 40K | $4.4M | $0.7M | $5.1M | 4,268K | 4K |

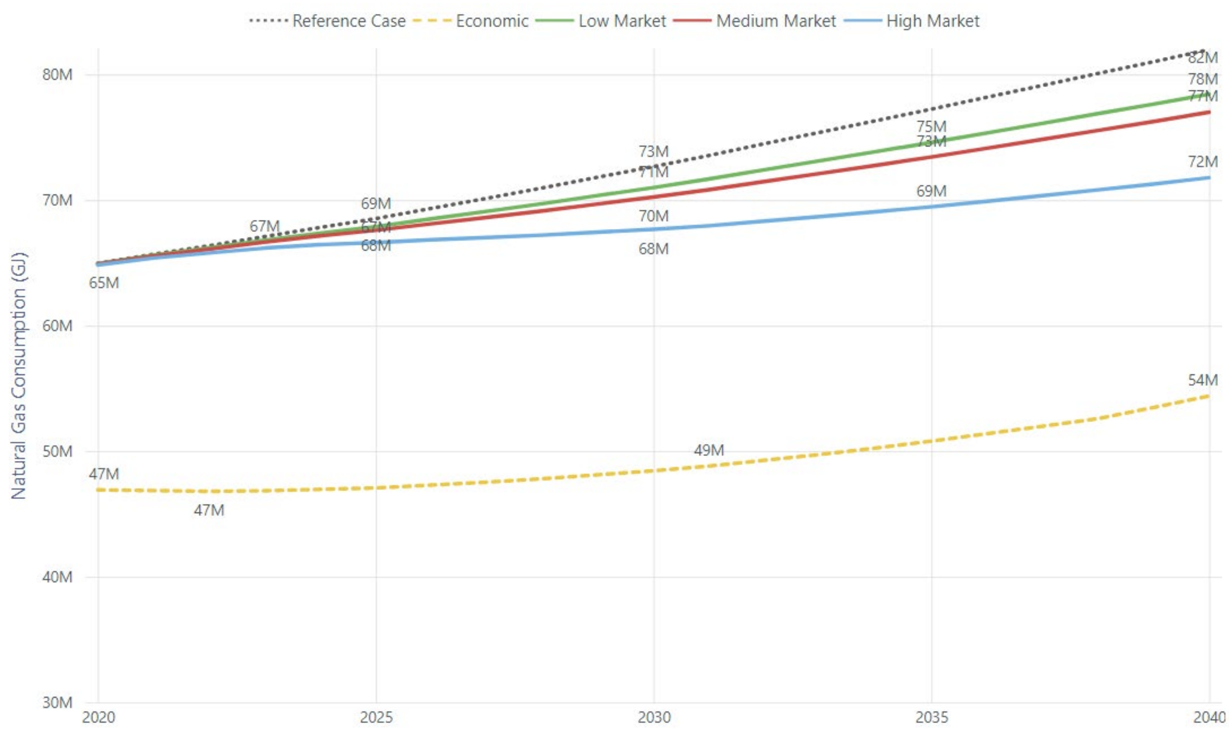
### EX 5 – Medium and High Market Incentive Costs and Natural Gas Savings – Residential, MTRC

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $41.2M | $6.2M | $47.4M | 622K | 622K | $152.3M | $22.8M | $175.1M | 1,080K | 1,080K |
| 2021 | $42.2M | $6.3M | $48.5M | 1,250K | 628K | $155.5M | $23.3M | $178.9M | 2,170K | 1,089K |
| 2022 | $43.1M | $6.5M | $49.6M | 1,897K | 647K | $159.7M | $24.0M | $183.6M | 3,300K | 1,130K |
| 2023 | $44.0M | $6.6M | $50.6M | 2,556K | 659K | $156.9M | $23.5M | $180.4M | 4,267K | 967K |
| 2024 | $45.2M | $6.8M | $51.9M | 3,262K | 706K | $148.8M | $22.3M | $171.1M | 5,117K | 850K |
| 2025 | $43.1M | $6.5M | $49.6M | 3,810K | 548K | $132.1M | $19.8M | $151.9M | 5,855K | 738K |
| 2026 | $43.3M | $6.5M | $49.8M | 4,310K | 500K | $135.8M | $20.4M | $156.2M | 6,601K | 746K |
| 2027 | $44.0M | $6.6M | $50.6M | 4,811K | 501K | $140.0M | $21.0M | $160.9M | 7,355K | 754K |
| 2028 | $44.5M | $6.7M | $51.2M | 5,310K | 499K | $142.9M | $21.4M | $164.3M | 8,112K | 757K |
| 2029 | $36.9M | $5.5M | $42.4M | 5,735K | 424K | $130.6M | $19.6M | $150.2M | 8,822K | 710K |
| 2030 | $38.0M | $5.7M | $43.7M | 6,164K | 429K | $130.4M | $19.6M | $150.0M | 9,529K | 706K |
| 2031 | $39.0M | $5.9M | $44.9M | 6,598K | 434K | $128.0M | $19.2M | $147.2M | 10,214K | 685K |
| 2032 | $40.2M | $6.0M | $46.2M | 7,036K | 438K | $125.9M | $18.9M | $144.8M | 10,879K | 665K |
| 2033 | $41.4M | $6.2M | $47.6M | 7,479K | 443K | $124.4M | $18.7M | $143.0M | 11,527K | 648K |
| 2034 | $42.7M | $6.4M | $49.1M | 7,926K | 448K | $121.6M | $18.2M | $139.9M | 12,077K | 550K |
| 2035 | $44.0M | $6.6M | $50.6M | 8,370K | 443K | $119.1M | $17.9M | $137.0M | 12,589K | 511K |
| 2036 | $41.9M | $6.3M | $48.2M | 8,707K | 337K | $116.2M | $17.4M | $133.6M | 13,076K | 487K |
| 2037 | $41.4M | $6.2M | $47.6M | 9,038K | 331K | $109.0M | $16.4M | $125.4M | 13,502K | 426K |
| 2038 | $39.5M | $5.9M | $45.4M | 9,345K | 307K | $89.6M | $13.4M | $103.0M | 13,710K | 207K |
| 2039 | $37.7M | $5.7M | $43.3M | 9,633K | 289K | $89.6M | $13.4M | $103.1M | 13,923K | 213K |
| 2040 | $36.9M | $5.5M | $42.4M | 9,910K | 276K | $91.9M | $13.8M | $105.7M | 14,153K | 230K |

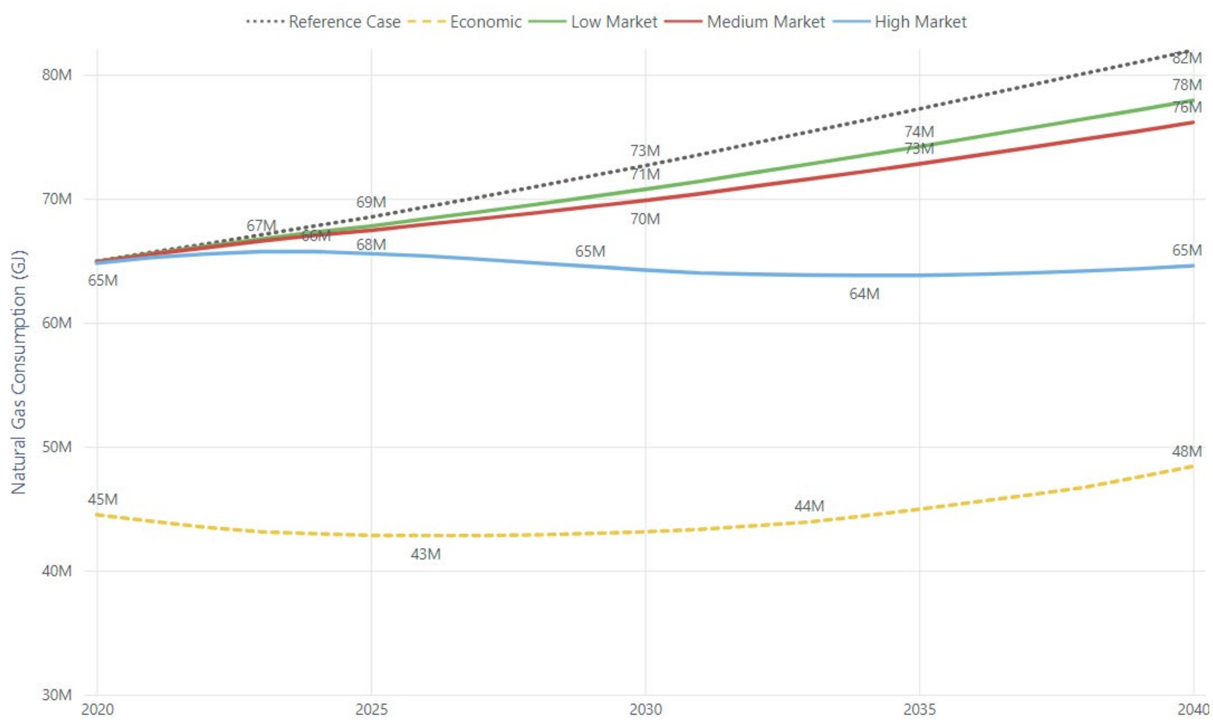
### Commercial

EX 6 (TRC) and EX 7 (MTRC) show the forecasted gas consumption under the three market potential scenarios for the commercial sector. The commercial low, medium, and high market TRC potential consumption levels are estimated to be 78 PJ, 77 PJ, and 72 PJ by 2040, while reference consumption is forecasted to reach 82 PJ. The commercial low, medium, and high market MTRC potential consumption levels are estimated to be 78 PJ, 76 PJ, and 65 PJ by 2040, while reference consumption is forecasted to reach 82 PJ.

EX 6 – Commercial Market Potential Consumption (GJ) Forecasts – Commercial, TRC



EX 7 – Commercial Market Potential Consumption (GJ) Forecasts – Commercial, MTRC



The incentive and non-incentive spending in the MTRC scenario required to achieve the medium and high market potential are shown in EX 8 and EX 9. Medium and high market incentives are assumed to be 50% and 100% of measures' incremental costs, respectively. The tables show the total and incremental savings from the new measures installed every year.

## EX 8 – Medium and High Market Incentive Costs and Natural Gas Savings – Commercial, TRC

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $1.0M | $0.1M | $1.1M | 57K | 57K | $5.9M | $0.9M | $6.8M | 124K | 124K |
| 2021 | $1.6M | $0.2M | $1.9M | 142K | 85K | $9.9M | $1.5M | $11.4M | 306K | 183K |
| 2022 | $2.6M | $0.4M | $3.0M | 267K | 125K | $15.7M | $2.4M | $18.0M | 563K | 256K |
| 2023 | $3.9M | $0.6M | $4.5M | 441K | 174K | $24.1M | $3.6M | $27.7M | 914K | 352K |
| 2024 | $5.4M | $0.8M | $6.2M | 667K | 226K | $34.1M | $5.1M | $39.2M | 1,370K | 456K |
| 2025 | $6.8M | $1.0M | $7.8M | 934K | 267K | $43.9M | $6.6M | $50.5M | 1,912K | 542K |
| 2026 | $8.1M | $1.2M | $9.3M | 1,223K | 289K | $53.2M | $8.0M | $61.2M | 2,501K | 589K |
| 2027 | $8.9M | $1.3M | $10.2M | 1,526K | 302K | $59.1M | $8.9M | $68.0M | 3,124K | 623K |
| 2028 | $9.5M | $1.4M | $10.9M | 1,830K | 304K | $63.7M | $9.6M | $73.2M | 3,757K | 633K |
| 2029 | $9.7M | $1.5M | $11.2M | 2,132K | 302K | $65.4M | $9.8M | $75.2M | 4,384K | 627K |
| 2030 | $9.9M | $1.5M | $11.4M | 2,430K | 298K | $66.3M | $9.9M | $76.3M | 4,999K | 615K |
| 2031 | $9.9M | $1.5M | $11.4M | 2,723K | 293K | $67.0M | $10.0M | $77.0M | 5,597K | 599K |
| 2032 | $10.1M | $1.5M | $11.7M | 3,009K | 286K | $67.7M | $10.2M | $77.9M | 6,170K | 572K |
| 2033 | $9.7M | $1.5M | $11.2M | 3,285K | 276K | $64.9M | $9.7M | $74.6M | 6,712K | 542K |
| 2034 | $9.9M | $1.5M | $11.4M | 3,555K | 270K | $65.9M | $9.9M | $75.8M | 7,249K | 537K |
| 2035 | $9.6M | $1.4M | $11.1M | 3,810K | 255K | $64.6M | $9.7M | $74.2M | 7,773K | 524K |
| 2036 | $9.5M | $1.4M | $11.0M | 4,058K | 248K | $63.5M | $9.5M | $73.0M | 8,283K | 510K |
| 2037 | $9.5M | $1.4M | $11.0M | 4,298K | 240K | $64.0M | $9.6M | $73.6M | 8,782K | 498K |
| 2038 | $9.5M | $1.4M | $10.9M | 4,534K | 237K | $62.0M | $9.3M | $71.2M | 9,269K | 488K |
| 2039 | $9.1M | $1.4M | $10.5M | 4,760K | 226K | $58.1M | $8.7M | $66.8M | 9,735K | 466K |
| 2040 | $9.2M | $1.4M | $10.6M | 4,981K | 221K | $59.2M | $8.9M | $68.0M | 10,197K | 462K |

## EX 9 – Medium and High Market Incentive Costs and Natural Gas Savings – Commercial, MTRC

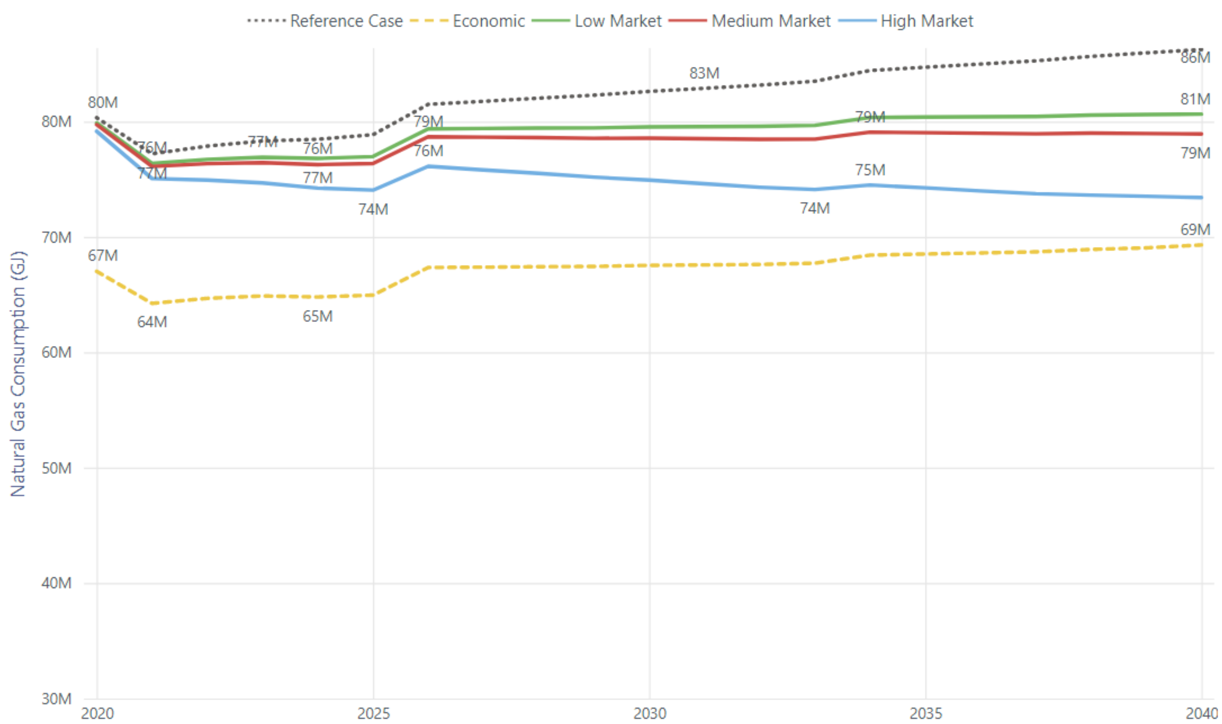
| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $1.2M | $0.2M | $1.4M | 62K | 62K | $10.8M | $1.6M | $12.4M | 160K | 160K |
| 2021 | $2.1M | $0.3M | $2.4M | 159K | 97K | $20.1M | $3.0M | $23.1M | 422K | 262K |
| 2022 | $3.4M | $0.5M | $3.9M | 303K | 144K | $32.7M | $4.9M | $37.6M | 810K | 388K |
| 2023 | $5.1M | $0.8M | $5.8M | 505K | 201K | $49.6M | $7.4M | $57.1M | 1,359K | 549K |
| 2024 | $6.9M | $1.0M | $7.9M | 767K | 262K | $70.0M | $10.5M | $80.5M | 2,083K | 724K |
| 2025 | $8.6M | $1.3M | $9.9M | 1,075K | 309K | $89.6M | $13.4M | $103.1M | 2,961K | 879K |
| 2026 | $10.3M | $1.5M | $11.8M | 1,412K | 336K | $109.6M | $16.4M | $126.0M | 3,954K | 993K |
| 2027 | $11.3M | $1.7M | $13.0M | 1,762K | 351K | $122.4M | $18.4M | $140.7M | 5,027K | 1,072K |
| 2028 | $12.1M | $1.8M | $13.9M | 2,115K | 352K | $132.5M | $19.9M | $152.3M | 6,143K | 1,116K |
| 2029 | $12.4M | $1.9M | $14.2M | 2,465K | 350K | $137.1M | $20.6M | $157.6M | 7,280K | 1,137K |
| 2030 | $12.6M | $1.9M | $14.5M | 2,811K | 345K | $140.6M | $21.1M | $161.6M | 8,419K | 1,139K |
| 2031 | $12.7M | $1.9M | $14.6M | 3,151K | 340K | $140.9M | $21.1M | $162.0M | 9,541K | 1,122K |
| 2032 | $12.9M | $1.9M | $14.9M | 3,485K | 335K | $142.3M | $21.3M | $163.7M | 10,589K | 1,049K |
| 2033 | $12.5M | $1.9M | $14.4M | 3,810K | 325K | $135.8M | $20.4M | $156.2M | 11,557K | 968K |
| 2034 | $12.6M | $1.9M | $14.5M | 4,130K | 319K | $135.8M | $20.4M | $156.1M | 12,504K | 946K |
| 2035 | $12.3M | $1.8M | $14.2M | 4,431K | 302K | $133.0M | $19.9M | $152.9M | 13,422K | 918K |
| 2036 | $12.3M | $1.8M | $14.1M | 4,726K | 295K | $131.3M | $19.7M | $151.0M | 14,292K | 870K |
| 2037 | $12.2M | $1.8M | $14.1M | 5,014K | 288K | $129.9M | $19.5M | $149.4M | 15,127K | 836K |
| 2038 | $12.2M | $1.8M | $14.0M | 5,297K | 283K | $124.3M | $18.6M | $143.0M | 15,918K | 790K |
| 2039 | $11.9M | $1.8M | $13.7M | 5,568K | 271K | $118.5M | $17.8M | $136.3M | 16,673K | 755K |
| 2040 | $12.0M | $1.8M | $13.8M | 5,833K | 266K | $116.1M | $17.4M | $133.5M | 17,391K | 718K |

Industrial

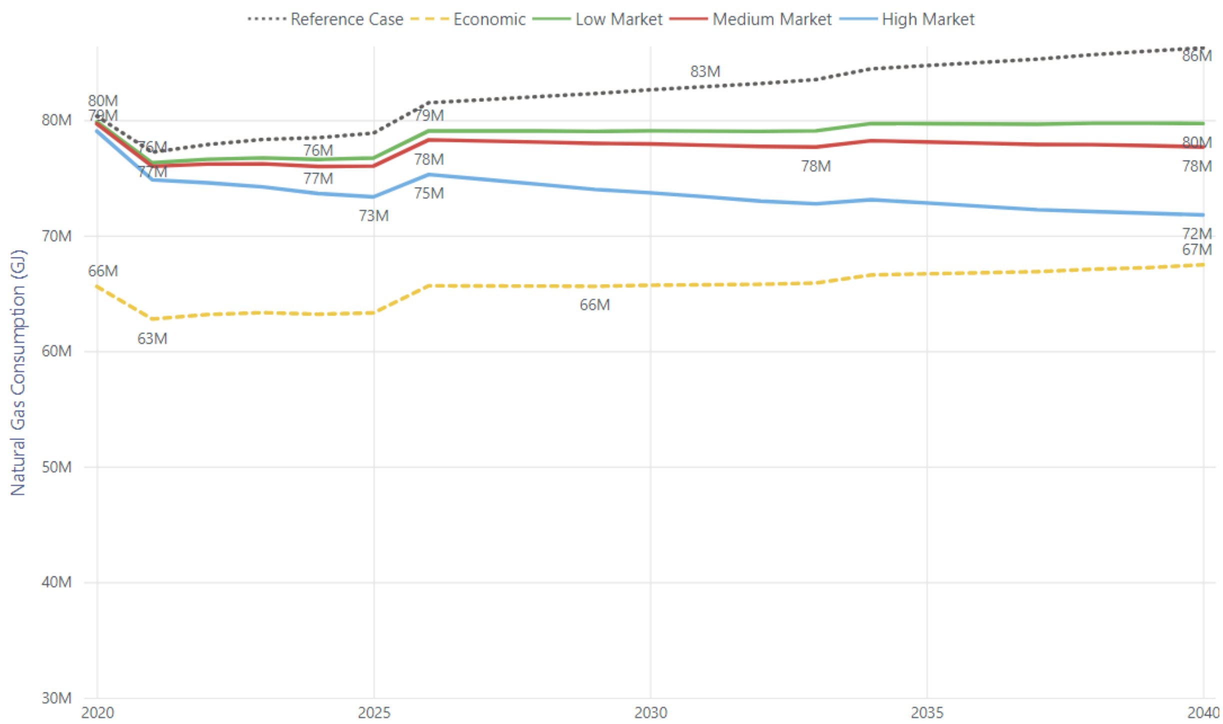
The market potential consumption results are shown in EX 10 and EX 11. The results for the TRC and MTRC screens appear quite similar because of the 39 measures included in the assessment, 34 pass the TRC and 38 pass the MTRC.

The industrial low, medium, and high market TRC potential consumption levels are estimated to be 81 PJ, 79 PJ, and 73 PJ by 2040, while reference consumption is forecasted to reach 86 PJ. The industrial low, medium, and high market MTRC potential consumption levels are estimated to be 80 PJ, 78 PJ, and 72 PJ, by 2040.

EX 10 – Market Potential Consumption (GJ) Forecasts – Industrial, TRC



EX 11 – Market Potential Consumption (GJ) Forecasts – Industrial, MTRC



EX 12 (TRC) and EX 13 (MTRC) show the incentive and non-incentive spending required to achieve the medium and high market potential. Medium and high market incentives are assumed to be 50% and 100% of measures' incremental costs, respectively. The tables show the total and incremental savings from the new measures installed every year.

### EX 12 – Medium and High Market Incentive Costs and Natural Gas Savings – Industrial, TRC

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $3.3M | $0.5M | $3.8M | 600K | 600K | $13.0M | $2.0M | $15.0M | 1,178K | 1,178K |
| 2021 | $3.3M | $0.5M | $3.8M | 1,099K | 499K | $12.9M | $1.9M | $14.8M | 2,144K | 966K |
| 2022 | $3.2M | $0.5M | $3.7M | 1,518K | 419K | $12.7M | $1.9M | $14.6M | 2,949K | 805K |
| 2023 | $3.1M | $0.5M | $3.5M | 1,874K | 356K | $12.1M | $1.8M | $13.9M | 3,631K | 681K |
| 2024 | $3.0M | $0.4M | $3.4M | 2,196K | 323K | $11.5M | $1.7M | $13.2M | 4,234K | 603K |
| 2025 | $2.9M | $0.4M | $3.3M | 2,501K | 305K | $11.3M | $1.7M | $13.0M | 4,805K | 572K |
| 2026 | $2.9M | $0.4M | $3.4M | 2,804K | 303K | $11.4M | $1.7M | $13.1M | 5,373K | 568K |
| 2027 | $3.0M | $0.5M | $3.5M | 3,109K | 305K | $11.6M | $1.7M | $13.4M | 5,944K | 571K |
| 2028 | $3.1M | $0.5M | $3.6M | 3,419K | 310K | $12.0M | $1.8M | $13.8M | 6,520K | 577K |
| 2029 | $3.2M | $0.5M | $3.7M | 3,733K | 315K | $12.5M | $1.9M | $14.4M | 7,103K | 583K |
| 2030 | $3.4M | $0.5M | $3.9M | 4,051K | 317K | $13.0M | $2.0M | $15.0M | 7,689K | 585K |
| 2031 | $3.5M | $0.5M | $4.0M | 4,371K | 320K | $13.4M | $2.0M | $15.4M | 8,276K | 587K |
| 2032 | $3.5M | $0.5M | $4.0M | 4,694K | 323K | $13.2M | $2.0M | $15.2M | 8,848K | 572K |
| 2033 | $3.5M | $0.5M | $4.0M | 5,018K | 324K | $12.7M | $1.9M | $14.6M | 9,386K | 538K |
| 2034 | $3.5M | $0.5M | $4.0M | 5,343K | 325K | $12.6M | $1.9M | $14.4M | 9,924K | 538K |
| 2035 | $3.5M | $0.5M | $4.0M | 5,667K | 324K | $12.4M | $1.9M | $14.3M | 10,458K | 534K |
| 2036 | $3.5M | $0.5M | $4.0M | 5,994K | 327K | $12.4M | $1.9M | $14.2M | 10,990K | 532K |
| 2037 | $3.5M | $0.5M | $4.0M | 6,323K | 329K | $12.4M | $1.9M | $14.2M | 11,518K | 528K |
| 2038 | $3.6M | $0.5M | $4.1M | 6,653K | 331K | $12.0M | $1.8M | $13.8M | 12,020K | 502K |
| 2039 | $3.6M | $0.5M | $4.1M | 6,986K | 333K | $9.1M | $1.4M | $10.5M | 12,434K | 414K |
| 2040 | $3.7M | $0.6M | $4.2M | 7,323K | 337K | $8.8M | $1.3M | $10.1M | 12,833K | 399K |

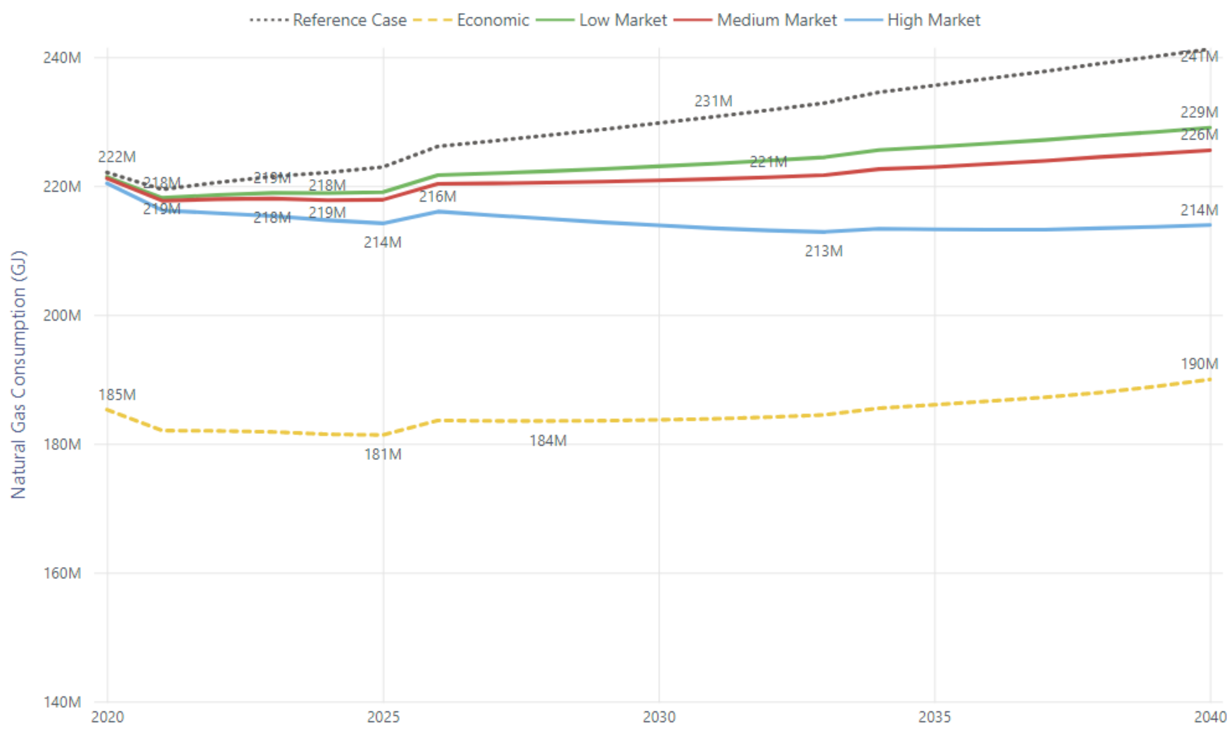
### EX 13 – Medium and High Market Incentive Costs and Natural Gas Savings – Industrial, MTRC

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $8.8M | $1.3M | $10.2M | 658K | 658K | $35.2M | $5.3M | $40.5M | 1,298K | 1,298K |
| 2021 | $8.8M | $1.3M | $10.1M | 1,215K | 557K | $35.0M | $5.3M | $40.3M | 2,384K | 1,086K |
| 2022 | $8.8M | $1.3M | $10.1M | 1,692K | 477K | $34.9M | $5.2M | $40.1M | 3,309K | 925K |
| 2023 | $8.6M | $1.3M | $9.9M | 2,105K | 414K | $34.3M | $5.1M | $39.4M | 4,110K | 801K |
| 2024 | $8.5M | $1.3M | $9.8M | 2,486K | 381K | $33.7M | $5.1M | $38.8M | 4,833K | 723K |
| 2025 | $8.5M | $1.3M | $9.7M | 2,848K | 362K | $33.5M | $5.0M | $38.6M | 5,524K | 691K |
| 2026 | $8.5M | $1.3M | $9.7M | 3,209K | 361K | $33.6M | $5.0M | $38.7M | 6,211K | 687K |
| 2027 | $8.6M | $1.3M | $9.8M | 3,572K | 363K | $33.9M | $5.1M | $39.0M | 6,901K | 690K |
| 2028 | $8.7M | $1.3M | $10.0M | 3,940K | 367K | $34.3M | $5.1M | $39.4M | 7,597K | 696K |
| 2029 | $8.8M | $1.3M | $10.1M | 4,313K | 373K | $34.8M | $5.2M | $40.0M | 8,299K | 703K |
| 2030 | $8.9M | $1.3M | $10.3M | 4,688K | 376K | $15.2M | $2.3M | $17.5M | 8,914K | 615K |
| 2031 | $9.1M | $1.4M | $10.4M | 5,067K | 379K | $15.7M | $2.3M | $18.0M | 9,532K | 618K |
| 2032 | $9.1M | $1.4M | $10.5M | 5,451K | 383K | $25.7M | $3.9M | $29.5M | 10,182K | 649K |
| 2033 | $9.1M | $1.4M | $10.5M | 5,835K | 384K | $15.2M | $2.3M | $17.5M | 10,753K | 571K |
| 2034 | $9.1M | $1.4M | $10.5M | 6,221K | 386K | $15.1M | $2.3M | $17.4M | 11,326K | 572K |
| 2035 | $9.1M | $1.4M | $10.5M | 6,607K | 386K | $15.1M | $2.3M | $17.3M | 11,895K | 569K |
| 2036 | $9.2M | $1.4M | $10.5M | 6,997K | 389K | $15.1M | $2.3M | $17.4M | 12,464K | 569K |
| 2037 | $9.2M | $1.4M | $10.6M | 7,389K | 392K | $15.2M | $2.3M | $17.5M | 13,030K | 566K |
| 2038 | $9.3M | $1.4M | $10.7M | 7,783K | 394K | $14.9M | $2.2M | $17.1M | 13,572K | 542K |
| 2039 | $9.4M | $1.4M | $10.8M | 8,180K | 397K | $12.1M | $1.8M | $13.9M | 14,026K | 454K |
| 2040 | $9.5M | $1.4M | $10.9M | 8,582K | 402K | $11.9M | $1.8M | $13.7M | 14,467K | 441K |

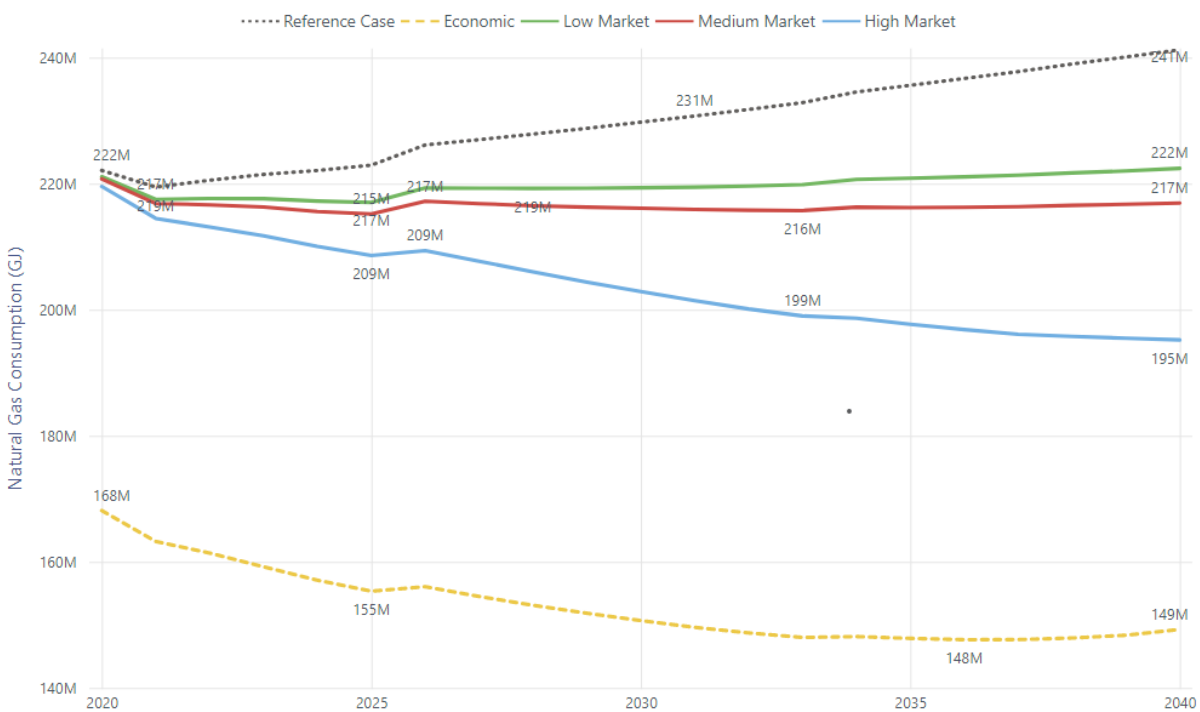
Portfolio

EX 14 (TRC) and EX 15 (MTRC) show the forecasted total natural gas consumption under the three market potential scenarios. The reference consumption is forecasted to increase to 241 PJ in 2040 from 222 PJ today. The total low, medium, and high market TRC potential consumption levels are estimated to be 229 PJ, 226 PJ, and 214 PJ. The low, medium, and high market MTRC potential consumption levels are estimated to be 222 PJ, 217 PJ, and 195 PJ.

EX 14 – Market Potential Consumption (GJ) Forecasts – All Sectors, TRC



EX 15 – Market Potential Consumption (GJ) Forecasts – All Sectors, MTRC

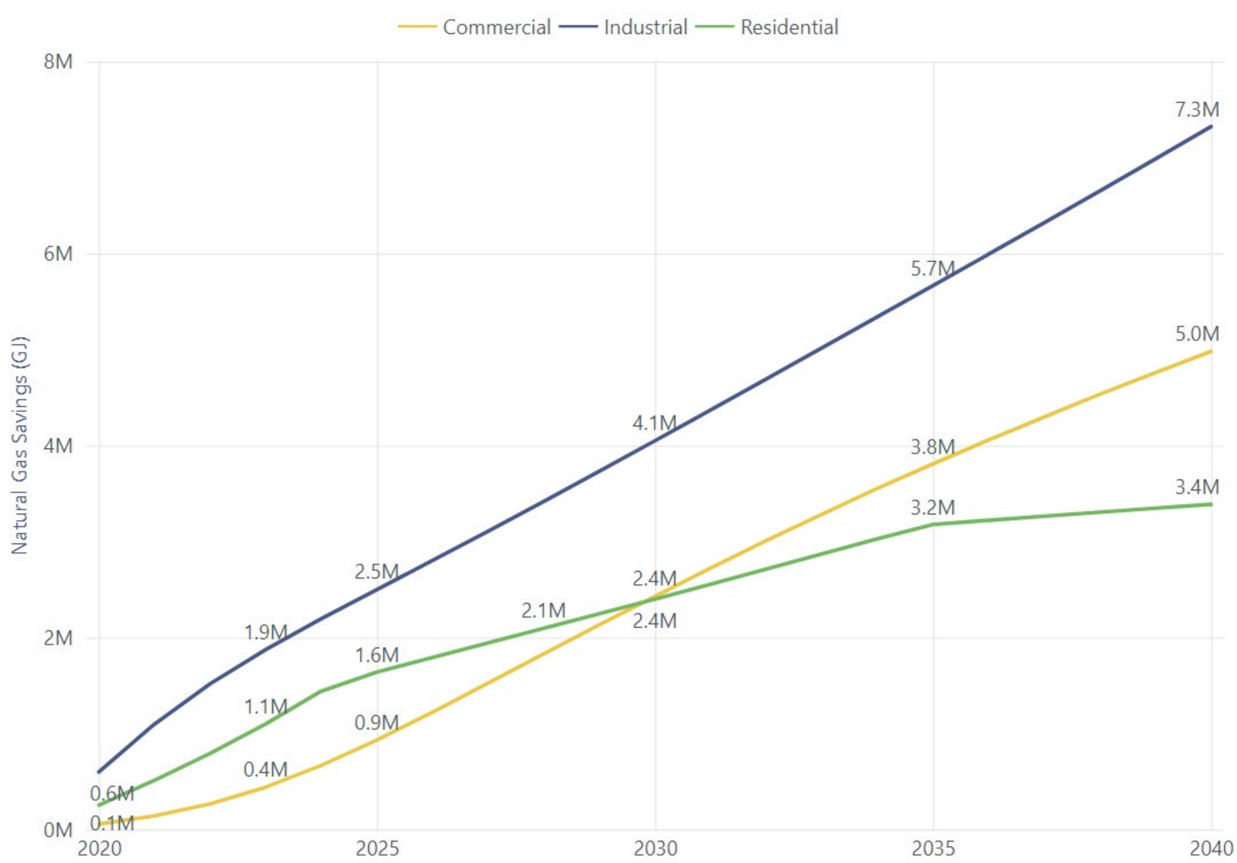


The medium market potential savings from the commercial, industrial, residential sectors are plotted together in EX 16 (TRC) and EX 17 (MTRC).

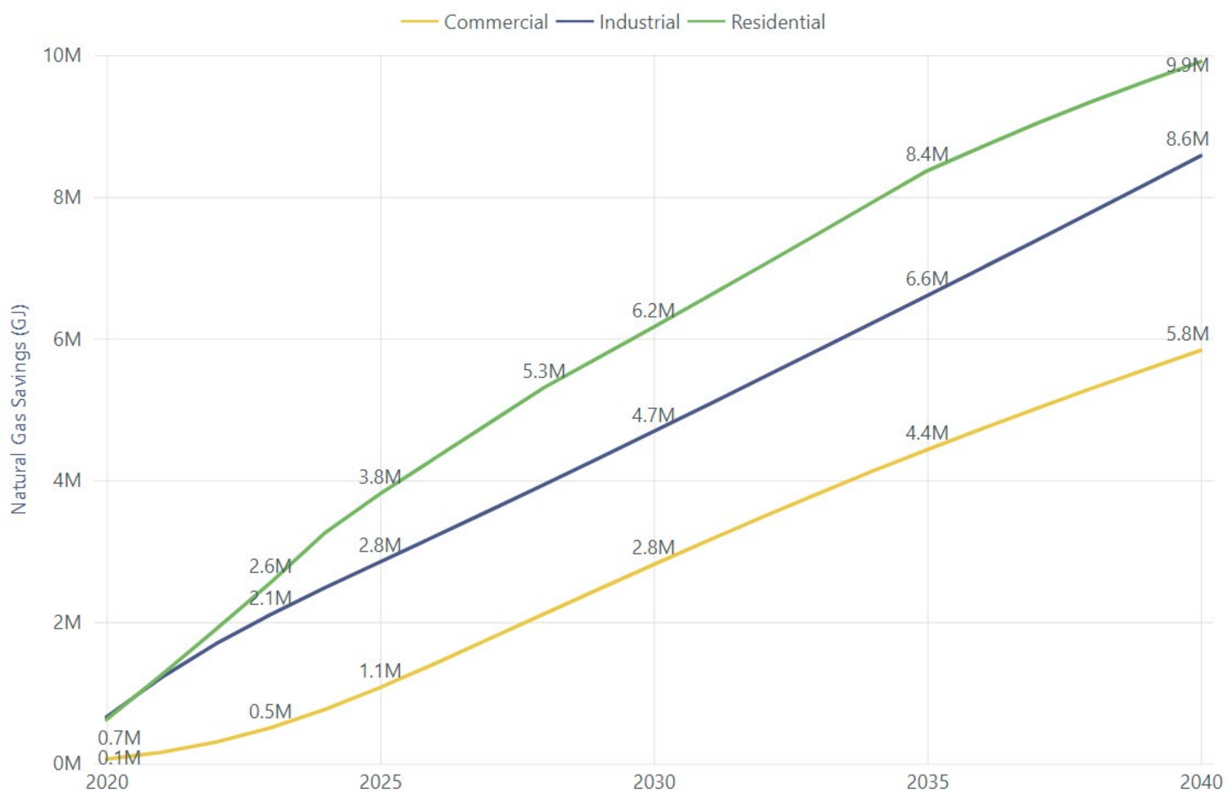
By 2025, the TRC medium market scenario for the industrial sector is expected to have the most savings potential, followed by residential and then commercial sectors. By 2030, the commercial sector overtakes residential. This is because there are only 14 residential measures that pass the TRC, and almost all of them are retrofit measures that can be implemented early in the study period. By 2040, potential savings from industrial, commercial, and residential sectors are estimated to be 7.3 PJ, 5.0 PJ, and 3.4 PJ.

Under the MTRC medium market scenario, the residential sector is estimated to have the most savings potential for the entire study period, followed by the industrial and then commercial. By 2040, potential savings from residential, industrial, and commercial sectors are estimated to be 9.9 PJ, 8.6 PJ, and 5.8 PJ.

EX 16 – Medium Market Potential Savings (GJ) – All Sectors, TRC



EX 17 – Medium Market Potential Savings (GJ) – All Sectors, MTRC



EX 18 (TRC) and EX 19 (MTRC) show the incentive and non-incentive spending required to achieve the medium and high market potential. Medium and high market incentives are assumed to be 50% and 100% of measures' incremental costs, respectively. The tables show the total and incremental savings from the new measures installed every year.

## EX 18 – Medium and High Market Incentive Costs and Natural Gas Savings – All Sectors, TRC

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $7.8M | $1.2M | $8.9M | 912K | 912K | $31.5M | $4.7M | $36.3M | 1,698K | 1,698K |
| 2021 | $8.5M | $1.3M | $9.8M | 1,754K | 842K | $35.8M | $5.4M | $41.2M | 3,252K | 1,554K |
| 2022 | $9.9M | $1.5M | $11.3M | 2,578K | 824K | $42.9M | $6.4M | $49.4M | 4,763K | 1,511K |
| 2023 | $11.5M | $1.7M | $13.2M | 3,415K | 837K | $47.0M | $7.1M | $54.1M | 6,120K | 1,357K |
| 2024 | $13.5M | $2.0M | $15.5M | 4,306K | 891K | $53.7M | $8.1M | $61.8M | 7,398K | 1,278K |
| 2025 | $12.6M | $1.9M | $14.5M | 5,077K | 771K | $63.5M | $9.5M | $73.0M | 8,733K | 1,334K |
| 2026 | $13.5M | $2.0M | $15.5M | 5,819K | 743K | $73.0M | $11.0M | $84.0M | 10,114K | 1,382K |
| 2027 | $14.4M | $2.2M | $16.5M | 6,578K | 759K | $79.3M | $11.9M | $91.2M | 11,536K | 1,421K |
| 2028 | $15.1M | $2.3M | $17.4M | 7,344K | 766K | $84.5M | $12.7M | $97.1M | 12,976K | 1,441K |
| 2029 | $15.5M | $2.3M | $17.9M | 8,114K | 770K | $86.9M | $13.0M | $99.9M | 14,422K | 1,446K |
| 2030 | $15.9M | $2.4M | $18.3M | 8,882K | 769K | $88.5M | $13.3M | $101.8M | 15,863K | 1,440K |
| 2031 | $16.1M | $2.4M | $18.5M | 9,650K | 767K | $89.5M | $13.4M | $102.9M | 17,288K | 1,425K |
| 2032 | $16.4M | $2.5M | $18.9M | 10,415K | 766K | $90.1M | $13.5M | $103.6M | 18,671K | 1,384K |
| 2033 | $16.1M | $2.4M | $18.5M | 11,172K | 757K | $86.7M | $13.0M | $99.7M | 19,991K | 1,320K |
| 2034 | $16.2M | $2.4M | $18.7M | 11,926K | 754K | $86.5M | $13.0M | $99.5M | 21,189K | 1,198K |
| 2035 | $16.0M | $2.4M | $18.4M | 12,655K | 729K | $85.0M | $12.7M | $97.7M | 22,338K | 1,149K |
| 2036 | $15.5M | $2.3M | $17.8M | 13,273K | 618K | $83.7M | $12.5M | $96.2M | 23,469K | 1,131K |
| 2037 | $15.5M | $2.3M | $17.9M | 13,885K | 612K | $83.0M | $12.5M | $95.5M | 24,565K | 1,095K |
| 2038 | $15.4M | $2.3M | $17.8M | 14,494K | 609K | $78.2M | $11.7M | $90.0M | 25,554K | 989K |
| 2039 | $15.1M | $2.3M | $17.4M | 15,094K | 599K | $71.6M | $10.7M | $82.3M | 26,434K | 880K |
| 2040 | $15.2M | $2.3M | $17.5M | 15,692K | 598K | $72.4M | $10.9M | $83.3M | 27,299K | 865K |

## EX 19 – Medium and High Market Incentive Costs and Natural Gas Savings – All Sectors, MTRC

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $51.3M | $7.7M | $59.0M | 1,343K | 1,343K | $198.3M | $29.8M | $228.1M | 2,538K | 2,538K |
| 2021 | $53.1M | $8.0M | $61.1M | 2,625K | 1,282K | $210.7M | $31.6M | $242.3M | 4,975K | 2,437K |
| 2022 | $55.3M | $8.3M | $63.6M | 3,892K | 1,267K | $227.2M | $34.1M | $261.3M | 7,418K | 2,443K |
| 2023 | $57.7M | $8.7M | $66.3M | 5,166K | 1,274K | $240.8M | $36.1M | $276.9M | 9,736K | 2,317K |
| 2024 | $60.6M | $9.1M | $69.7M | 6,514K | 1,349K | $252.5M | $37.9M | $290.3M | 12,032K | 2,296K |
| 2025 | $60.2M | $9.0M | $69.2M | 7,734K | 1,219K | $255.2M | $38.3M | $293.5M | 14,340K | 2,308K |
| 2026 | $62.1M | $9.3M | $71.4M | 8,931K | 1,197K | $279.0M | $41.9M | $320.9M | 16,766K | 2,426K |
| 2027 | $63.9M | $9.6M | $73.5M | 10,146K | 1,215K | $296.2M | $44.4M | $340.6M | 19,282K | 2,516K |
| 2028 | $65.3M | $9.8M | $75.1M | 11,365K | 1,219K | $309.6M | $46.4M | $356.1M | 21,852K | 2,569K |
| 2029 | $58.0M | $8.7M | $66.7M | 12,512K | 1,147K | $302.5M | $45.4M | $347.8M | 24,402K | 2,550K |
| 2030 | $59.5M | $8.9M | $68.5M | 13,663K | 1,151K | $286.2M | $42.9M | $329.1M | 26,862K | 2,461K |
| 2031 | $60.8M | $9.1M | $69.9M | 14,816K | 1,153K | $284.5M | $42.7M | $327.2M | 29,287K | 2,424K |
| 2032 | $62.2M | $9.3M | $71.6M | 15,972K | 1,156K | $293.9M | $44.1M | $338.0M | 31,650K | 2,363K |
| 2033 | $63.0M | $9.5M | $72.5M | 17,124K | 1,152K | $275.4M | $41.3M | $316.7M | 33,838K | 2,188K |
| 2034 | $64.4M | $9.7M | $74.1M | 18,277K | 1,153K | $272.5M | $40.9M | $313.4M | 35,907K | 2,069K |
| 2035 | $65.4M | $9.8M | $75.3M | 19,408K | 1,131K | $267.1M | $40.1M | $307.2M | 37,905K | 1,999K |
| 2036 | $63.3M | $9.5M | $72.8M | 20,430K | 1,022K | $262.6M | $39.4M | $302.0M | 39,832K | 1,927K |
| 2037 | $62.9M | $9.4M | $72.3M | 21,440K | 1,011K | $254.1M | $38.1M | $292.2M | 41,660K | 1,828K |
| 2038 | $61.0M | $9.1M | $70.1M | 22,425K | 984K | $228.8M | $34.3M | $263.1M | 43,199K | 1,539K |
| 2039 | $58.9M | $8.8M | $67.7M | 23,381K | 957K | $220.3M | $33.0M | $253.3M | 44,622K | 1,423K |
| 2040 | $58.3M | $8.8M | $67.1M | 24,325K | 944K | $219.8M | $33.0M | $252.8M | 46,010K | 1,388K |

# 1 Introduction

## 1.1 Background and Study Goals

The 2021 Conservation Potential Review (CPR) is the review of energy efficiency opportunities available among FortisBC's residential, commercial, and industrial natural gas customers.

The CPR will support two of FortisBC Energy Inc's (FEI) major regulatory filings in 2022: the long-term gas resource plan (LTGRP) and the Demand Side Management (DSM) plan. For this CPR, Posterity Group (PG) reviewed estimated technical, economic, and market potential natural gas savings in FEI's service territory over a 20-year period. The CPR is an important guiding document for ongoing conservation and energy management program development and support at FortisBC.

FEI has also retained Posterity Group to produce the load forecast of natural gas demand of FEI's customers to support the 2022 LTGRP filing. The base year and reference case forecast developed by Posterity Group is common to both the LTGRP and CPR. As a result of the integrated nature of the two projects, the LTGRP project is frequently referenced in this document.

## 1.2 Report Organization and Results Presentation

### This Report

The 2021 CPR has been prepared as <u>a single report that contains results for three sectors: residential, commercial, and industrial.</u> The report has been structured as follows:

**Section 1** provides an overview of the CPR scope and definitions of key terms and acronyms.

**Section 2** presents the overall steps taken and approach followed to complete this CPR. This section is applicable to all three sectors.

**Section 3** presents the **residential** sector results. These include findings on base year and reference case energy forecasts, measure analysis, technical potential, economic potential, and market potential.

**Section 4** presents the **commercial** sector results, following the same format as Section 4.

**Section 5** presents the **industrial** sector results, following the same format as Section 4.

**Section 6** presents aggregate portfolio-level results covering all three sectors. These include market potential, greenhouse gas emissions impacts, and employment impacts.

### Presentation of CPR Potential Results

There are five deliverables included in the CPR report:

- **This report**, which presents the conservation potential results for the residential, commercial, and industrial sectors.
- **Method Appendices Document** that includes all method-related memos that were shared between the study and client team through the course of the project, compiled into a stand-alone document.
- **CPR Data Visualization Tool** that provides a dashboard built using Power BI, with access provided to the FortisBC project team and sector leads. During project execution, this

dashboard was used to facilitate detailed review of draft potential analysis outputs. In its final form, it can be used by FortisBC staff to explore output data for the purposes of DSM planning, program research and program design.

- **Market Potential Model Outputs** that include raw model output that has been organized into Excel workbooks with built-in tables and graphs and provided with this report. There are two workbooks per sector: one using TRC as the economic screen and one with MTRC.
- **Measure Analysis Workbooks** that provide final versions of the workbooks containing measure assumptions for each sector have been shared for reference.

## 1.3 Caveats and Limitations

Forecasting and modelling are a key part of this CPR study. Both activities require extensive research and more importantly, require assumptions, engineering estimates and the professional judgement of the study team. The study team strove to ensure that these assumptions are in line with the FortisBC team's knowledge of their customer base and are made with the best information available. However, given the nature of forecasting, the results in this report should be considered as estimates.

All potential scenarios in this report are estimated in relation to a "business as usual" reference case scenario. The CPR reference case incorporates FortisBC's account forecast, observed customer consumption trends, and industrial customer demand survey results. By incorporating these sources, the reference case implicitly includes the effects of current policy, but does not adjust for potential future policy changes. Scenarios with specific regulation/policy drivers, including high electrification, are not assessed within the scope of the CPR. High electrification scenarios have been modelled separately, in support of FortisBC's LTGRP.

# 2 Study Scope

This section defines some common terms used in this study and an overview of what is covered in this CPR.

## 2.1 Definition of Terms

**Accounts** – Number of FEI customer accounts. This report refers to 'accounts' rather than customers, as one customer could have multiple accounts.

**Benefit/Cost Ratio** – Expresses the attractiveness of a measure relative to its costs. A measure with a ratio of 1 or higher has benefits that outweigh its costs. For this study, two measure cost tests were used, both expressed as a Benefit/Cost ratio. These tests, the Total Resource Cost (TRC) test and the Modified Total Resource Cost Test (MTRC), are defined below.

**Early Replacement** – The act of replacing equipment prior to failure, while it has some remaining useful life. Contrast with "Replace on Burnout (ROB)", below.

**End Use, Sub-End Use** – The final purpose for which energy is being used. For example, space heating, domestic hot water (DHW), or industrial process heat. In the CPR model, end uses are occasionally further divided into smaller subcategories referred to as Sub-End Uses. For example, Residential DHW is further divided by into shower DHW, washer DHW, dishwasher DHW, and other DHW to facilitate analysis of measures that apply to a specific portion of the und-use energy.

**Energy Conservation Measure (ECM, or Measure)** – An equipment, technology, or a behavior that results in reduction of energy use in a dwelling, building, or facility.

**Fuel Share** – Ratio of a specific end use load that is met by a particular fuel. For example, if 90% of single-family dwelling space heating load is met by natural gas equipment, the natural gas fuel share for space heating in single-family dwellings is 90%.

**Full Cost Measure** – A measure whose benefit/cost ratio is evaluated on the basis of its full cost, as opposed to their incremental cost between the measure and a less-efficient "baseline" alternative. See "Retrofit (RET)" below for further explanation.

**Gas-Heated Dwelling, Non-Gas-Heated Dwelling** – In the residential sector, a dwelling that primarily uses gas for space heating heat (>50% of the fuel share for space heating) is considered a gas-heated dwelling. A dwelling that has a natural gas space heating fuel share <50% is considered a non-gas-heated dwelling. Gas-heated dwellings may have other fuels serving the space heating end use, but gas comprises at least 50% of the fuel share.

**GJ** – Gigajoule, or one billion joules. The unit of energy used by FortisBC for billing purposes.

**Incremental Cost Measure** – A measure whose benefit/cost ratio is evaluated on the basis of its incremental cost relative to a less-efficient alternative. See definition of "Replace on Burnout (ROB)" for further explanation.

**Modified Total Resource Cost (MTRC)** – A modified version of the TRC test that includes an alternate avoided cost and an adder for non-energy benefits. Per section 4(1.1)(a) of the province's DSM Regulation, the MTRC test incorporates the avoided cost of electricity – BC Hydro's marginal cost of acquiring electricity generated from clean or renewable resources, called the Zero Emission Energy Alternative (ZEEA) - rather than the marginal cost of new gas supply.

**Participation or Participation Rate** – The rate or percentage of buildings or end users that take part in a utility's program. This is a measurement of customer uptake of a measure and is an input to determine market potential.

**Region** – In this CPR, FEI's gas service territory is divided into six regions: City of Vancouver, Lower Mainland excluding Vancouver ("Lower Mainland x Vancouver"), Vancouver Island, Northern BC, Southern Interior, and Whistler.

**Replace on Burnout (ROB)** – One of two primary measure replacement types. Replace-on-burnout measures are typically time, labor, and cost intensive and are applied at the end of the useful life of the underlying equipment. For example, boiler replacements are typically evaluated as replace on burnout. ROB measures are typically evaluated on the basis of their incremental cost relative to a less-efficient, code-compliant alternative. Contrast with "Early Replacement", above and Retrofit (RET) below.

**Retrofit (RET)** – One of two primary measure replacement types. Retrofit measures are typically less costly measures that can be installed at any time. For example, a communicating thermostat or low-flow showerhead. RET measures are typically evaluated on their full costs. Contrast with "Early Replacement" and "Replace on Burnout (ROB)" above.

**R-Value** – A measure of a material's resistance to heat flow. In the context of building science, R-value is used to measure the effectiveness of insulation for building envelope components (e.g. attic insulation). The higher the R value, the better the measure's ability to insulate.

**Saturation** – For most end uses, Saturation is the extent to which an end use is present in a region, and segment. For some specific end uses that are associated with appliances, Saturation is defined as the average number of appliances per Unit.

**Sector** – Grouping or category of customers or buildings by customer type: residential, commercial, and industrial.

**Segment** – Grouping or category of buildings (e.g., single-family detached in residential, large offices in commercial). Segments reflect the main purpose of the building and helps to differentiate between energy use intensity or patterns across building types within a sector.

**Simple Payback** – The duration of time to recover the cost of a project based on cumulative savings, without taking into account the time value of money. In the context of energy conservation measures, savings are accrued based on the value of energy savings. Simple payback is calculated from the perspective of the end user and is presented as a number of years. For example, a measure that costs $600 and results in energy savings valued at $200 annually has a simple payback $600 / $200 = 3 years.

**Size Factor** – The change in average number of units per account. This is primarily used to reflect the forecast change in production volumes in industry.

**Step Code** – Compliance path in British Columbia Building Code (BCBC) for achieving energy efficiency in new construction beyond the minimum code requirements.

**Stock Average Efficiency** – Average efficiency of equipment serving the tertiary load for that end use.

**Tertiary Load** – The useful energy delivered to an end use. In the context of the CPR, tertiary load is the amount of energy required to be delivered as an end use service, for example, heat delivered by a furnace to a residential dwelling.

**Total Resource Cost (TRC)** – A metric for evaluating the cost-effectiveness of an energy conservation measure based on both the participants and utility's costs and benefits.

**Unit Energy Consumption (UEC)** – The amount of energy used by each end use per unit.

**Units** – The sector-specific unit of analysis: dwellings in the residential sector, square metres in the commercial sector, and production capacity in the industrial sector.

**Vintage** – A grouping of facilities based on their age.

### 2.1.1 Acronyms

| | |
|---|---|
| BAS | Building Automation System |
| C&EM | Conservation and Energy Management |
| CCE | Cost of Conserved Energy |
| CEUS | Commercial End Use Survey |
| CPR | Conservation Potential Review |
| DHW | Domestic Hot Water |
| DIY | Do-It-Yourself |
| DSM | Demand Side Management |
| ECM | Energy Conservation Measure |
| EECAG | Energy Efficiency and Conservation Advisory Group |
| EUI | Energy Use Intensity |
| FEI | FortisBC Energy Inc. |
| GJ | Gigajoule |
| HE | High Efficiency |
| HVAC | Heating, Ventilation, and Air Conditioning |
| LTGRP | Long Term Gas Resource Plan |
| MUA | Make Up Air |
| NAICS | North American Industry Classification System |
| NEW | New Construction |
| O&M | Operation and Maintenance |
| PJ | Petajoule, i.e. 1 million gigajoules |
| RET | Retrofit |
| REUS | Residential End Use Survey |
| ROB | Replace-on-burnout |
| RTU | Remote Terminal Unit |
| TAC | Technical Advisory Committee |
| TMP | Thermomechanical Pulping – an industrial Pulp & Paper segment term |
| TRM | Technical Resource Manual |
| UEC | Unit Energy Consumption |
| ZEEA | Zero Emission Energy Alternative |

## 2.2 CPR Coverage

### 2.2.1 Timing

The base year for the CPR Study is the 2019 calendar year. The reference case forecast is for 2020 to 2040. Results are calculated for each intervening year.

### 2.2.2 Regions

The CPR divides the FortisBC gas regions in British Columbia (BC) into six:

- City of Vancouver
- Lower Mainland excluding Vancouver (“Lower Mainland x Vancouver”)
- Vancouver Island
- Northern BC
- Southern Interior
- Whistler

### 2.2.3 Sectors, Segments, and End Uses

A segment is a grouping or category of buildings, such as a single-family Detached dwelling in Residential, or large offices in Commercial, for example. Segments reflect the main purpose of the building and help to differentiate between energy use intensity or patterns across building types within a sector.

The 2021 CPR covers three sectors: residential, commercial, and industrial.[7] Each sector is unique and has important differences which are reflected in how inputs and outputs are organized. Please see the supporting Method Appendices Document for details of how the sector model was developed. Exhibit 1 presents the specific way each sector is organized into segments, energy end uses, and building vintages in the CPR model.

7 The LTGRP includes these three sectors as well as transportation.

**Exhibit 1 – CPR Segments, End Uses, & Vintages by Sector**

| | Residential | Commercial | Industrial |
|---|---|---|---|
| *Segments* | • Single Family Detached/Duplexes<br>• Single Family Attached/Row<br>• Mobile/Other Residential | • Apartments – Medium<br>• Apartments – Large<br>• Food Retail<br>• Hospital<br>• Hotel – Medium<br>• Hotel – Large<br>• Non-Food Retail – Medium<br>• Non-Food Retail – Large<br>• Nursing Home<br>• Office – Medium<br>• Office – Large<br>• Other Commercial<br>• Restaurant<br>• School – Medium<br>• School – Large<br>• University/College<br>• Warehouse | • Agriculture (includes greenhouses[8])<br>• Chemical<br>• District energy providers<br>• Fabricated Metal<br>• Food & Beverage<br>• Other Manufacturing (includes transportation[9] and other industrial)<br>• Mining<br>• Non-metallic Mineral (includes cement)<br>• Pulp & Paper – Kraft<br>• Pulp & Paper – TMP<br>• Utilities<br>• Wood Products |

8 Cannabis included in agriculture segment since there is not enough data at FEI to create a cannabis-specific forecast.
9 In the 2015 CPR, 'transportation' pertained to facilities that supported the transportation sector.

| | Residential | Commercial | Industrial |
|---|---|---|---|
| *End Uses*[10] | • Clothes dryer<br>• Cooking<br>• Domestic hot water[11]<br>  ○ Dishwasher DHW<br>  ○ Washer DHW<br>  ○ Shower DHW<br>  ○ Other DHW<br>• Fireplace<br>• Other gas uses (outdoor fireplaces, patio heaters)<br>• Pool & spa heaters<br>• Space heating | • Cooking<br>• Domestic Hot Water<br>• Other[12]<br>• Pools, Spas & Hot tubs<br>• Space Heating | • Direct-fired heating<br>• Direct Consumption of Gas in Process[13]<br>• Heat Treating<br>• Kilns<br>• On-Site Power Generation[13]<br>• Other[12]<br>• Ovens<br>• Petrochemical Refining and Process Heating<br>• Process Boilers<br>• Product Drying<br>• Space Heating [includes HVAC air heating and HVAC boilers]<br>• Water heaters |
| *Vintages*[14] | • Pre-1950<br>• 1950-1975<br>• 1976-1985<br>• 1986-1995<br>• 1996-2005<br>• 2006-2015<br>• Post-2015 (Existing)<br>• New | • Existing<br>• New | • Existing<br>• New |

10 All-electric end uses, such as clothes washer, lighting or plug loads, are not included in the reported results therefore are excluded from the End Uses row of this table.
11 In some cases, end uses are broken out into sub-end uses to facilitate CPR measure analysis. DHW can be reported at the end use or sub-end use level in the CPR.
12 The 'other' end use is a catch all for equipment that account for a small portion of consumption in the sector. In the commercial sector, examples of 'other' equipment are patio heaters and laundry dryers.
13 No CPR measures are applied to this end use; included for tracking purposes only.
14 The residential sector segments are divided into vintages that define time periods when residential dwellings were built. 'New' residential dwellings do not appear until the first year of the reference case.

# 3 Study Approach

This section presents the major steps that were taken to complete this CPR. Subsequent sections present the process for completing each CPR step in further detail.

For this study, Posterity Group developed a common base year and reference case model (steps 1 and 2 below) for the CPR and FortisBC's 2022 LTGRP.

## 3.1 Major CPR Analysis Steps

1. **Determine the current (Base Year) customer base and their energy consumption.**
   a. Collect and review data on the building stock in FortisBC's service territory, including end use surveys and previous CPRs.
   b. Develop energy use models of each building or facility type (segments) and model energy consumption by end use.
   c. Collect and review actual base year (2019) energy use and billing data of FortisBC's customers.
   d. Use the billing data to calibrate the base year energy consumption in each sector's energy model.
2. **Develop reference case energy consumption forecast.**
   a. Collect and review data on all factors that will affect energy use trends over the study period (2020 to 2040 in this study's case).
      i. This includes analyzing and modelling natural improvements in building energy use intensities (e.g. from natural replacement of furnaces with new, higher efficiency ones at replacement time).
      ii. Other factors are existing building demolition / renovation trends, rate of new building stock construction, baseline energy efficiency of new buildings and equipment, and known changes to policies and codes and standards that will impact the energy use of buildings.
   b. Use this data to develop an energy consumption forecast model for each sector.
   c. Calibrate the reference case based on FortisBC's own account forecasts and industrial survey information at the region and rate class level.
3. **Characterize energy conservation measures.**
   a. Select a set of energy conservation measures for each sector. Measures range from mature, widely known measures that are currently part of FortisBC's program portfolio (e.g. commercial condensing boilers) to innovative or enabling technologies (e.g. smart residential water heater controllers). Behavioural measures are also considered (e.g. thermostat setback).
   b. For each measure, review and collect data on energy savings, costs, useful life, and the baseline equipment or technology that it should be compared with (if applicable).
   c. Use the data to characterize the technology's energy savings potential, cost-effectiveness, and financial attractiveness.

   d. Use the data as inputs to the energy model for each sector.

4. **Estimate technical savings potential.**
   a. For each measure, determine its technical applicability (i.e. how many buildings or facilities can this measure be applied to, considering only technical barriers).
   b. Determine the measures' current market penetration (i.e. how many buildings or facilities have already installed a measure).
   c. Estimate the measures' reference adoption – their natural rate of uptake in the absence of incentives or utility program intervention.
   d. Input all data into the energy model for each sector and develop a hypothetical estimate of the technically feasible energy savings potential within FortisBC's service territory.[15]

5. **Estimate economic savings potential.**
   a. Screen each measure for cost-effectiveness from FortisBC's perspective by determining whether the benefit to cost ratio of each measure is 1.0 or above (pass) or if it is below 1.0 (fail) for two cost effectiveness tests: TRC and MTRC.
   b. Update the technical potential model with only the TRC-passing measures, removing measures that are not cost-effective.
   c. Estimate the economic savings potential of all cost-effective measures applied to all technically feasible buildings in the customer base.[16]
   d. Repeat steps 5b and 5c using the MTRC screen. This study presents findings from two economic (and subsequent market potential) models: One with TRC as the economic screen and one with MTRC.

6. **Estimate market savings potential.**
   a. Based on existing research, develop sets of "generic" adoption curves based on customer payback acceptance and typical market diffusion patterns.[17]
   b. Apply these generic curves to each measure in the economic potential model to develop "simplified market potential" estimates at the measure level.
   c. This data is input into the TRC economic potential model to develop a simplified market potential.
   d. Develop a more realistic market potential for each measure by soliciting feedback from FortisBC and its external stakeholders on the simplified market potential.[18]

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15 See Exhibit 2 for an overview of the constraints considered in the technical potential scenario, and the difference between different potential scenarios.
16 See Exhibit 2 for an overview of the constraints considered in an economic potential scenario.
17 Generic adoption curves primarily consider two things: the current market penetration of the measure, and its simple payback. Based on these factors, the curves are applied to each measure to estimate generic participation rates as a percentage of economic potential.
18 This process includes selecting representative, high-impact measures and adjusting their generic participation rates using historical program data, local market knowledge, and industry insights/feedback, then extrapolating these calibrated participation rates to other similar measures within each sector.

e. Revise the simplified market potential model based on this feedback to develop a realistic market potential scenario (referred to in this study as "medium market potential").
f. Perform sensitivity analysis by varying incentive levels to model "low" and "high" market potential scenarios.
g. Repeat steps 6c to 6f using the MTRC economic potential model to estimate low, medium, and high market potential scenarios using the MTRC economic screen.

7. **Estimate other energy and non-energy benefits of the potential energy savings.**[19]

a. Greenhouse gas emissions savings.
b. Impact of energy conservation measure investments and energy bill savings on provincial employment.

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19 Due to uncertainty regarding measure-level impacts on regional and system peak demand, detailed analysis of the system peak impacts from energy efficiency measures has not been undertaken as part of the CPR.

### Exhibit 2 – Difference Between Technical, Economic, and Market Potential

| Constraints | Description | Potential |
|---|---|---|
| Technical applicability | Is the measure compatible with the current systems in place in the building or facility? Are there any technical constraints that will prevent installation in specific buildings or facilities? If not, then the measure's hypothetical energy savings can be included in the technical potential.<br><br>Example: If this is a furnace-related measure, do I have a forced air heating system in my building? | Technical Potential |
| Cost-Effectiveness | In addition to the technical constraints above:<br><br>From the utility's perspective, are the energy savings that result from installing the measure financially attractive? Do they provide a return on investment (i.e., the capital and installation costs) based on the economic screen the utility is required to use? If yes, then the measure's hypothetical energy savings can be included in the economic potential. | Economic Potential |
| Market-related | In addition to the technical and economic constraints above:<br><br>Are there any constraints related to the market, logistics, or the target customers? Is the measure readily available in the market? Are customers aware of the measure? Realistically, how many customers will have the willingness or interest to install the measure given its costs and benefits? How would the customers' willingness change if the incentives to install these measures increased? | Market Potential *(this study's ultimate objective)* |
| Utility-related<br><br>*(out of scope for this study, as this is typically a program design activity)* | In addition to all the constraints above:<br><br>What are the utility's constraints around encouraging the uptake of this measure? How much budget does the utility have to spend on a program and incentives for a measure? How many resources can a utility allocate to delivering a program realistically? | Program Potential |

## 3.2 Base Year Energy Use Model Development

The CPR model is developed in the following sequence for each sector:

- Base Year (2019): the first year of a forecast period and is based on historical data provided by FEI.
- Reference Case (2020-2040)[20]: forecast of natural gas consumption over a twenty-year (2020-2040) period based on exogenous conditions that follow a "business-as-usual" scenario.

The base year and reference case was modelled for each sector using Posterity Group's Navigator™ Energy and Emissions Simulation Suite. This section provides an overview of the model structure and the process to develop the base year and reference case.

Exhibit 3 defines the six parameters that provide the structure for the model used for the CPR.[21]

**Exhibit 3 – 2021 CPR Model Parameters**

| Parameter | Definition |
|---|---|
| Accounts[22] | Number of FEI customer accounts. |
| Units | The basis for how energy consumption is expressed. The unit of analysis is unique to each sector: dwellings in the residential sector, square metres in the commercial sector and production capacity in the industrial sector. |
| Size Factor | The change in average number of units per account.<br>This is primarily used to reflect the forecast change in production volumes in industry. |
| Saturation | For most end uses, saturation is the extent to which an end use is present in a region, and segment.[23]<br>For some specific end uses that are associated with appliances, Saturation is defined as the average number of appliances per Unit. |
| Fuel Share | The percentage of the energy end use that is supplied by each fuel. |
| Unit Energy Consumption (UEC) | The amount of energy used by each end use per unit. |

20 Note that the LTGRP forecast period is 2020-2042. The LTGRP will not be filed until 2022 and requires a twenty-year reference case.
21 Some of the model parameters are adjusted when necessary to reflect a distinct characteristic of a sector. Any adjustments are explained in this document.
22 PG uses 'accounts' instead of customers in this document as one customer could have multiple accounts.
23 A segment is a grouping or category of buildings (e.g., single-family detached in residential, large offices in commercial). Segments reflect the main purpose of the building and helps to differentiate between energy use intensity or patterns across building types within a sector.

Once each parameter of the model is populated with the applicable data, energy consumption is calculated for a specific end use for each region, segment, and vintage each year using the following equation:

$$Consumption = Units * Saturation * Fuel\ Share * Unit\ Energy\ Consumption$$

Exhibit 4 presents the detailed steps that the team took to calibrate the base year energy consumption in the CPR model with FortisBC's actual customer energy use.

Exhibit 4 – Base Year Calibration Steps for All Sectors

| Step | Description |
|---|---|
| 1 | Compile and analyze available data on FortisBC's existing building stock by segment, including consultation of Residential End Use Survey (REUS), Commercial End Use Survey (CEUS) and relevant third-party data. |
| 2 | Develop detailed technical descriptions of the existing building stock at the subsector, end use, and end use equipment level. For each sector, detailed regional and subsector assumptions regarding fuel shares, end use penetrations, equipment saturations and equipment efficiency levels are aggregated in Excel workbooks as inputs into the Navigator™ model under step 4. |
| 3 | Compile utility billing data by subsector and region. |
| 4 | Create sector model inputs and generate preliminary results. |
| 5 | Adjust input assumptions for end uses with greater uncertainty until the results closely match the actual utility billing data. |

The results of the base year energy consumption model are presented in Section 4.2 (residential), Section 5.2 (commercial), and Section 6.2 (industrial).

## 3.3 Reference Case Forecast Development

As explained in Section 3.2 Base Year Energy Use Model Development, the reference case begins with the base year values and forecasts natural gas use based on exogenous conditions that follow a "business-as-usual" scenario. The reference case for the CPR is intended to represent the baseline from which calculation of new potential can be calculated. It considers current energy consumption patterns and known future changes, including expected customer growth, current and known future changes to codes and standards, and natural replacement of equipment at end of life. The reference case does not account for potential changes in fuel share or end use saturations, except those that would occur incidentally because of different rates of new construction for different types of buildings or in the different regions.

The reference case starts with actual 2019 consumption, which includes all DSM activity up to that point. The subsequent years of the reference case incorporate natural conservation, such as the natural turnover of furnaces and other appliances. It does not include conservation from DSM activities carried out after 2019.

**Exhibit 5 – Reference Case Development Steps for All Sectors**

| Step | Description |
|---|---|
| 1 | Compile and analyze available data on FortisBC's new building stock by segment and gather forward-looking estimates of demolition rates. |
| 2 | Develop detailed technical descriptions of the new building stock at the subsector, end use, and equipment level. |
| 3 | Compile data on forecast levels of construction, demolition and natural (non-utility-influenced) efficiency within the existing and new (post 2020) buildings stock. |
| 4 | Create sector model inputs and generate gas use forecasts by adding accounts to match forecast construction levels in cooperation with FortisBC Load Forecasting staff. |

The results of the reference case energy consumption forecasts are presented in Section 4.3 (residential), Section 5.3 (commercial), and Section 6.3 (industrial).

## 3.4 Measure Characterization

In this CPR activity, energy conservation measures were selected and analyzed. The team started with developing a list of measures to consider, then finalized this list in collaboration with FortisBC and external stakeholders. For each measure, the team collected and reviewed information on energy savings, costs, useful life, and the baseline equipment or technology that it should be compared with (if applicable). This data was used to characterize the technology's energy savings potential, cost-effectiveness, and financial attractiveness to the utility and the end user.

### 3.4.1 Development of Measures List

Under this task, the study team reviewed existing energy efficiency measure analysis and program assumptions, assessed gaps and developed a measure list for input by FortisBC staff.

The team started by reviewing the 2015 CPR measure analysis, existing FortisBC Conservation and Energy Management (C&EM) program assumptions, and publicly available resources, especially Technical Resource Manuals (TRMs) from other utilities. Previous measure analysis and prefeasibility studies completed by FortisBC were also reviewed.

Measures range from mature and widely known to innovative or enabling technologies. Several behavioural measures (e.g. thermostat setback) are included as well. The team also developed "mature market" versions of several innovative technologies, such as gas heat pumps. These mature market measures assumed that within two to five years, various measures that are currently at an early stage of market entry would have lower costs, improved energy performance, or both. This approach allowed the study team to include these measures in subsequent analysis at a point after the first forecast year (2020) consistent with best estimates of market entry.

The study team solicited feedback on the measures list from both FortisBC as well as external stakeholders, the CPR Technical Advisory Committee (TAC). Ultimately, more than 180 measures were shortlisted for inclusion in this CPR: 70 in residential, 72 in commercial, and 40 in industrial. For comparison, the 2015 CPR included 97 measures: 45 residential, 36 commercial, and 16 industrial.

### 3.4.2 Energy Performance and Costs of Selected Measures

Under this task, the study team collected and reviewed information on each selected measure's energy savings, costs, useful life, and other relevant information. The analysis used several types of data sources to gather and establish this information: FortisBC's TRMs, previous FortisBC measure analysis (e.g. 2015 CPR, pre-feasibility studies), TRMs and literature from other jurisdictions, as well as the study team's own technical analysis and building modelling.

Using a typical FortisBC TRM template as guidance, the team developed one Excel-based measure analysis workbook per sector in which all measure data was recorded. The intent of these workbooks was to have each measure's metrics and assumptions easily reviewable, referenceable, and reusable by the FortisBC team. Exhibit 6 shows an example of a measure from the workbook.

Measures were characterized in a way that was consistent with FortisBC's measure TRM templates:

- Type of replacement (Retrofit or Replace on Burnout)
- Cost basis on which the measure should be evaluated – full or incremental
- Energy performance metrics and savings (% against end use and absolute)
- Technical applicability to various segments and / or vintages

- Cost of Conserved Energy (CCE) and simple payback metrics
- Cost-effectiveness on TRC and MTRC scales
- Ability to enter previous program results and customer enrollment (participation) rates, specific regional and segment subtleties

## Exhibit 6 – CPR Measure Characterization Workbook Example: Residential Communicating Thermostat

| MEASURE SUMMARY | | NOTES | DATA SOURCES |
|---|---|---|---|
| Measure Description | Installation of a communicating (also often referred to as "smart," advanced, wi-fi or connected) thermostat to replace a manually operated or conventional programmable thermostat. Thermostat must be on the ENERGY STAR® list of Smart Thermostats and be able to:<br>- Work as a basic thermostat in absence of connectivity to the service provider.<br>- Give residents some form of feedback about the energy consequences of their settings.<br>- Provide information about HVAC energy use, such as monthly run time.<br>- Provide the ability to set a schedule.<br>- Provide the ability to work with utility programs to prevent brownouts and blackouts, while preserving consumers' ability to override those grid requests. | | |
| Measure Type | Controls | | |
| Baseline Condition Description | The baseline condition is an assumed mix of manual and programmable thermostats. | | |
| Calculation Method Description | Space heating and cooling savings estimated based on review of MN and Mid-Atlantic TRMs assumptions for ENERGY STAR® qualifying communicating thermostats. Also reviewed FortisBC's SLT pilot study results. See general notes and sources section below for additional details. | | |
| Measure Applicability | Applies to existsing homes where a manual or programmable thermostat previously existed. | | |

| APPLICABILITY | | | | | |
|---|---|---|---|---|---|
| Affected Natural Gas End-Uses | Space Heating | | | | You can select up to 2 end-uses affected by this measure. Leave second one blank if not |
| Affected Electricity End-Uses | Space Cooling | | | | You can select up to 2 end-uses affected by this measure. Leave second one blank if not |
| Applicable Codes / Standards | n/a | | | | |
| Meets DSM Definition | Yes | | | | |
| Meets Tech Innovation Definition | Yes | | | | |
| Applicable Years | **First:** | 2020 | **Last:** | 2040 | |

| MODEL INPUT ASSUMPTIONS | | | | |
|---|---|---|---|---|
| **Measure Specifications** | **Base Case** | **Upgrade Case** | **Notes** | **Data Sources** |
| Effective Useful Life (years) | 12 | 12 | FortisBC's EUL estimate is high compared to other TRMs (e.g., Mid-Atlantic TRM states 7.5 years, MN TRM states 10 years). 12 years is still in a reasonable range, so did not change it. | 1, 6, 7 |

| RESULTS (SPECIFIC TO A GIVEN REGION, SEGMENT AND VINTAGE) | | | |
|---|---|---|---|
| Region | Whistler | Segment Sheet Row # | Change the selections in light blue to see the results specific to a region, segment and vintage. |
| Segment | SFD/Duplex | 82 | |
| Vintage | Post-2015 | Comm T-Stat - Segment | |

| **Costs** | **Base Case** | **Upgrade** | **Increme** | **Units** | **Notes** | **Data Sources** |
|---|---|---|---|---|---|---|
| Capital | $ - | $ 250 | $ 250 | per thermostat | FortisBC's estimate of $250 per connected thermostat seems reasonable compared to costs listed in other TRMs. | 1, 6, 7 |
| Installation | $ - | $ - | $ - | per thermostat | | |
| O&M | $ - | $ - | $ - | per thermostat | | |

| **Energy Savings (%)** | **Space Heating** | **Notes** | **Data Sources** |
|---|---|---|---|
| Natural Gas (%) | 6% | Estimating 6% savings based on MN and Mid-Atlantic TRMs. | 1,7 |
| | **Space Cooling** | | |
| Electricity (%) | 8% | Estimating 8% savings based on MN and Mid-Atlantic TRMs. | 1,7 |

| **Energy Use (Absolute)** | **Base Case** | **Upgrade** | **Saving** | **Units** |
|---|---|---|---|---|
| Natural Gas | 51.9 | 48.8 | 3.1 | GJ /year |
| Electricity | 515.3 | 474.1 | 41.2 | kWh /year |
| Water | - | - | - | m3 /year |

| **Financial Metrics** | | **Units** |
|---|---|---|
| Simple Payback | 8.86 | years |
| NPV of Avoided Utility Costs (TRC) | 244.94 | $ / yr |
| NPV of Avoided Utility Costs (mTRC) | 897.46 | $ / yr |
| Cost of Conserved Energy (CCE) | 6.69 | $ / GJ |

| **Cost Effectiveness** | | **Units** |
|---|---|---|
| Measure TRC | 1.0 | total |
| Measure mTRC | 4.1 | total |

The final measures and their information can be found in Section 4.4 (residential), Section 5.4 (commercial), and Section 6.4 (industrial).

## 3.5 Technical Potential Forecast Development

The technical potential forecast includes the installation of all conservation measures that are technically feasible. This exercise is hypothetical in nature and is used to provide the team with a starting point on which to develop the economic and market potential. Refer to Exhibit 2 for an overview of the differences between the potential scenarios.

Technical potential estimates ignore all non-engineering and financial constraints, such as cost-effectiveness and the willingness of end users to adopt measures. This is done to estimate the theoretical maximum amount of energy use that could be captured by energy efficiency measures. In this study, the following assumptions were made:

- Retrofit (RET) measures that are technically feasible are applied immediately (that is, in the first year of CPR study period, 2020).
- Replace on burnout (ROB) measures that are technically feasible are implemented at the rate of failure of the underlying baseline equipment, to better match in-market replacement rates. However, there are ROB measures that have "Early Replacement" versions (e.g. early replacement of a commercial boiler) that are treated the same way as RET measures.
- New construction measures that are technically feasible are implemented immediately as new buildings are added to the stock each year.

Development of the technical potential involved the following steps:

- Select the measures to be included from the Measure Analysis Workbook.
- Determine each measure's technical applicability (i.e. what portion of buildings can a measure be applied to considering only technical constraints) and current market penetration (i.e. what portion of buildings have already installed a measure).

  This information is gathered from various data sources and literature review, including FortisBC's Residential End-Use Survey (REUS), Commercial End-Use Survey (CEUS), and industrial datasets. The percentage of technically applicable customers that have already adopted a measure are excluded from the technical potential.
- Estimate reference adoption – the natural rate of adoption of a measure. For example, if 2% of the technically eligible customers are expected to implement a measure each year without any utility intervention, reference adoption is 2%. These customers are excluded from the technical potential.
- Apply measure information to the model. For each measure, the following inputs are required: measure's description, the baseline equipment it affects, incremental or full costs, energy savings information, the total proportion of accounts or dwellings under different segments and vintages that the measure is applicable to, and the pre-retrofit and post-retrofit energy consumption.
- Determine the order that measures should be applied against the baseline energy end-use, and whether these measures are applied in series (in which case measure impacts

"cascade") or in parallel (in which case measure impacts are directly additive). This is an important feature of Posterity Group's modelling software that serves two purposes:

  - It avoids overestimation and double counting of savings in instances where measures are not additive. For example, assume there is a reference-case house that uses 100 GJ of natural gas for the space heating end use. An air sealing measure is applied to this house, and it is expected to save 20% of space heating energy. A communicating thermostat can also be installed – it is expected to save 5% of total remaining space heating natural gas use.
  - If both measures are applied to the same house, the air sealing measure would reduce the overall heating load, reducing the absolute potential savings for the thermostat. In other words, the thermostat saves 5% of 80 GJ (post-air-sealing consumption), not 5% of 100 GJ. Total natural gas savings in this example are 20 GJ + 4 GJ = 24 GJ.
  - It avoids applying two mutually exclusive technologies to the same building. For example, a typical single-family house can be upgraded to a new high-efficiency furnace, or a new high-efficiency boiler, but almost never both. Additionally, there are many upgrade measures that apply to the same end use and baseline equipment. The model's cascade feature ensures that only one appropriate upgrade measure is applied to an eligible account or building.

- Run the model to calculate technical potential – this includes savings from all retrofit measures that can be immediately applied, savings from replace-on-burnout measure at their natural rate of replacement, and savings from new construction measures.

The results of the technical potential forecasts can be found in Section 4.5 (residential), Section 5.5 (commercial), and Section 6.5 (industrial).

## 3.6 Economic Potential Forecast Development

Economic potential is the subset of technical potential that is financially cost-effective. Cost-effectiveness is determined by screening each measure with the benefit/cost ratio test required by the utility's regulatory authorities. Economic potential considers the cost of the efficiency measures themselves, ignoring market constraints and programmatic barriers. Using economic screening, measures that have a benefit/cost ratio of greater than 1.0 under either the Total Resource Cost Test (TRC) or modified TRC (MTRC) "pass" the screening test and are included in the economic potential. Measures that score below 1.0 are not considered cost-effective and are excluded from future analysis.

Retrofit (RET) measures are evaluated on the basis of their full costs including capital, labor and maintenance costs. This is because the baseline for a retrofit measure is typically "do-nothing": the customer has the option to not install the measure, in which case they would not incur any costs.

Replace on burnout (ROB) measures are evaluated on the basis of their incremental costs – the cost difference between the high-efficiency measure versus the baseline, less-efficient option. This is because the baseline for a replace on burnout measure is typically "do something" because the underlying base equipment has reached the end of its useful life.

New construction measures were also evaluated based on their incremental costs.

Two economic models were developed for each sector – one with TRC as the economic screen and one with MTRC.

Development of the economic potential scenarios involved:

- Determining how measures should be assessed based on their replacement type: retrofit (immediate replacement at full cost), replace on burnout (end of life replacement at incremental cost), or new construction (immediate installation at incremental cost).
- Running the technical potential model using the TRC economic screen – this produces the subset of measures that are cost-effective in terms of TRC (i.e. they have a TRC benefit/cost ratio 1.0 or higher).
- Rerunning the technical potential model using the MTRC economic screen – this produces the subset of measures that are cost-effective in terms of MTRC (i.e. they have an MTRC benefit/cost ratio of 1.0 or higher).

The results of the economic potential forecasts are presented in Section 4.6 (residential), Section 5.6 (commercial), and Section 6.6 (industrial).

## 3.7 Market Potential Forecast Development

Market potential refers to the subset of the economic potential that is likely to be realized based on expected customer uptake. To be included in the market potential forecasts, customers must have the knowledge of various measures that are economically attractive to the utility and must have the willingness and means to adopt them.

The Low, Medium, and High market potential scenarios in this CPR estimate how customers' adoption rates would change as the simple customer payback varies based on varying incentive levels.

For this study, the market potential forecast was developed in two phases: first a Simplified Market Potential was developed using standard relationships between measure awareness, customer payback and measure uptake. Next, that simplified model was refined based on input from FortisBC staff, local market experts and other external stakeholders to develop a FortisBC-specific Market Potential.

Development of the market potential involved the following steps:

- Develop Simplified Market Potential.
    - At the measure level, this potential estimate was based on standard curves estimating the relationship between measure awareness, measure payback, and measure uptake consistent with the approach taken in the 2015 CPR.
    - Analysis included the development of a library of payback-acceptance and market diffusion curves, and their application to each measure based on attributes such as capital cost and reference market penetration.
    - These curves were then applied at three incentive levels: 25% 50%, and 100% of incremental cost to develop generic measure participation rates at the three spending levels.
- Market Potential Consultation and Workshops.

    This step consisted of two workshops for each sector:

    - Three sector-specific workshops engaging FortisBC Conservation & Energy Management program personnel, discussing and gathering input on the Simplified Market Potential participation rates based on prior program experience and known barriers and factors promoting uptake.
    - Three subsequent workshops attended by both FortisBC staff and members of Fortis BC's CPR Technical Advisory Committee[24] aimed at gathering external input on the Simplified Market Potential participation rates based on local market knowledge and capacity.

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24 The Technical Advisory Group was made up of various external stakeholders including industry professionals, environmental nongovernmental organization representatives, and municipal/provincial government staff, and industry organization representatives.

- **Develop Market Potential.**
  - Based on the results of these consultations, updated measure uptake assumptions were developed and re-run through the model. This produced a Market Potential, meant to be the "expected" outcome from DSM programs at a typical incentive level (50% of incremental cost) and a sensitivity analysis at 25% and 100% of incremental cost.
  - The Low, Medium, and High market potential scenarios in this report assume that measure incentive levels will be 25%, 50% and 100% of incremental costs, respectively. For example, assume that a high-efficiency furnace may cost $200 more than a standard furnace, meaning the furnace would have an incremental cost of $200. In the medium scenario, this measure's hypothetical incentive from FortisBC would be $100. The other $100 would be paid by the end user.
  - In all scenarios, the non-incentive program costs are assumed to be 15% of the incentive cost.[25] In the example above, FortisBC's non-incentive spending would be $15. FortisBC's total cost for providing the measure to an end user would be $115.

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25 Non-incentive program costs include activities such as program administration, communications, and research & evaluation. These costs have been estimated at 15%, a figure that is consistent with typical industry practice and the assumptions included in the 2017 CPR. Actual non-incentive program costs are dependent on several factors including program design, administrative structure, and evaluation requirements. For the purposes of this analysis, non-incentive spending that is not associated with specific measures or programs (including conservation education and outreach, and portfolio-level enabling activities) are not considered.

# 4 Residential Sector Results

This section presents the residential sector results and key findings, including:

- Base year (2019) natural gas use
- Reference case consumption forecast (2020-2040)
- Energy conservation measures evaluated in this CPR
- Technical potential savings
- Economic potential savings
- Market potential savings and scenarios

## 4.1 Residential Segments, End Uses, Vintages

The residential sector is divided into three segments, seven major energy end uses, and eight housing vintages. The residential domestic hot water (DHW) end use is subdivided into four as shown in Exhibit 7.

**Exhibit 7 – Residential Sector Segments, End Uses, and Vintages**

| | Segments (3) | End Uses[26] (7) | Vintages[27] (8) |
|---|---|---|---|
| *Residential Sector* | • Single Family Detached/Duplexes<br>• Single Family Attached/Row<br>• Mobile/Other Residential | • Clothes dryer<br>• Cooking<br>• Domestic hot water[28]<br>  ○ Dishwasher DHW<br>  ○ Washer DHW<br>  ○ Shower DHW<br>  ○ Other DHW<br>• Fireplace<br>• Other gas uses (outdoor fireplaces, patio heaters)<br>• Pool & spa heaters<br>• Space heating | • Pre-1950<br>• 1950-1975<br>• 1976-1985<br>• 1986-1995<br>• 1996-2005<br>• 2006-2015<br>• Post-2015 (Existing)<br>• New |

26 All-electric end uses, such as clothes washer, lighting or plug loads, are not included in the reported results therefore are excluded from the end uses row of this table.
27 The residential sector has vintages to define time periods when residential dwellings are built. Existence Categories also apply to the residential vintages, as there is conversion of existing dwellings into new homes (i.e., renovations). 'New' residential dwellings do not appear until the first year of the reference case.
28 The DHW end use has been broken out into sub-end uses to facilitate CPR measure analysis. DHW can be reported at the end use or sub-end use level in the CPR.

## 4.2 Base Year Natural Gas Use

This section profiles the base year (2019) natural gas consumption for the residential sector. The following exhibits summarize how natural gas is used in the residential sector by segment, end use, vintage, and region, respectively.

Natural gas consumption in the residential sector base year is highest:

- In single-family detached (SFD)/duplex segment (~90% of consumption)
- For space heating end use (~62%)
- In the Lower Mainland excluding Vancouver region (~55%)
- In homes built between 1950 and 1975 (26%)

Exhibit 8 – Residential Natural Gas Consumption (GJ) in 2019 by Segment

| Segment | Natural Gas Consumption (GJ) | % of Total |
|---|---|---|
| SFD/Duplex | 69,593,368 | 90.3% |
| Attached/Row | 5,609,684 | 7.3% |
| Mobile/other | 1,888,575 | 2.4% |
| **Total** | **77,091,627** | **100.0%** |

Exhibit 9 – Residential Natural Gas Consumption (GJ) in 2019 by End Use

| Parent End Use | Natural Gas Consumption (GJ) | % of Total |
|---|---|---|
| Space Heating | 48,159,206 | 62.5% |
| Domestic Hot Water (DHW) | 13,800,150 | 17.9% |
| Fireplace | 11,367,123 | 14.7% |
| Other Gas Uses | 1,779,960 | 2.3% |
| Cooking | 1,252,716 | 1.6% |
| Pool & Spa Heaters | 509,960 | 0.7% |
| Clothes Dryer | 222,511 | 0.3% |
| **Total** | **77,091,627** | **100.0%** |

Exhibit 10 – Residential Natural Gas Consumption (GJ) in 2019 by Region[29]

| Region | Natural Gas Consumption (GJ) | % of Total |
|---|---|---|
| Lower Mainland x Van | 42,239,373 | 54.8% |
| Southern Interior | 14,848,987 | 19.3% |
| City of Vancouver | 9,339,690 | 12.1% |
| Vancouver Island | 5,832,901 | 7.6% |
| Northern BC | 4,564,223 | 5.9% |
| Whistler | 266,452 | 0.3% |
| **Total** | **77,091,627** | **100.0%** |

Exhibit 11 – Residential Natural Gas Consumption (GJ) in 2019 by Vintage [30]

| Segment Vintage | Natural Gas Consumption (GJ) | % of Total |
|---|---|---|
| 1950-1975 | 19,633,614 | 26.1% |
| 1986-1995 | 12,634,000 | 16.8% |
| 1976-1985 | 10,907,142 | 14.5% |
| 1996-2005 | 10,070,375 | 13.4% |
| Pre-1950 | 9,196,994 | 12.2% |
| 2006-2015 | 7,805,930 | 10.4% |
| Post-2015 | 4,954,997 | 6.6% |

29 Recall that the 2019 actuals from FEI were based on FEI's billing system premise city and mapped by PG into the regions included in the study coverage.
30 "Mobile" has been excluded from the vintage results in this report; "mobile/other" appears in the segment results. The sample sizes for mobile dwellings in the REUS were too small to reliably divide the segment into vintages.

### 4.2.1 Accounts

Base year residential natural gas accounts are presented in Exhibit 12 by segment, region, and vintage. As shown in the table, the largest number of residential accounts in 2019 were:

- SFD / duplex type homes (806k out of 933k total)
- In Lower Mainland x Vancouver region (463k out of 933k total)
- Homes built between 1950 and 1975 (210k out of 933k total)

**Exhibit 12 – Number of Residential Dwellings in 2019**

| Segment | City of Vancouver | Lower Mainland x Van | Northern BC | Southern Interior | Vancouver Island | Whistler | Total |
|---|---|---|---|---|---|---|---|
| **SFD/Duplex** | **80,641** | **395,571** | **40,486** | **180,309** | **106,270** | **2,527** | **805,804** |
| 1950-1975 | 20,353 | 99,839 | 10,219 | 45,509 | 26,822 | 639 | **203,381** |
| 1986-1995 | 13,310 | 65,294 | 6,683 | 29,763 | 17,541 | 417 | **133,008** |
| 1976-1985 | 11,779 | 57,782 | 5,913 | 26,337 | 15,523 | 369 | **117,703** |
| 1996-2005 | 11,132 | 54,606 | 5,589 | 24,890 | 14,670 | 349 | **111,236** |
| 2006-2015 | 9,490 | 46,551 | 4,764 | 21,219 | 12,506 | 297 | **94,827** |
| Pre-1950 | 8,780 | 43,065 | 4,408 | 19,630 | 11,569 | 275 | **87,727** |
| Post-2015 | 5,797 | 28,434 | 2,910 | 12,961 | 7,639 | 181 | **57,922** |
| **Attached/Row** | **11,638** | **57,086** | **2,949** | **10,017** | **8,677** | **140** | **90,507** |
| 1986-1995 | 3,197 | 15,682 | 810 | 2,751 | 2,384 | 38 | **24,862** |
| 1996-2005 | 2,736 | 13,425 | 694 | 2,356 | 2,041 | 32 | **21,284** |
| Post-2015 | 1,902 | 9,329 | 482 | 1,637 | 1,418 | 23 | **14,791** |
| 2006-2015 | 1,599 | 7,841 | 405 | 1,376 | 1,191 | 20 | **12,432** |
| 1976-1985 | 1,236 | 6,058 | 313 | 1,063 | 921 | 15 | **9,606** |
| 1950-1975 | 823 | 4,039 | 208 | 709 | 614 | 10 | **6,403** |
| Pre-1950 | 145 | 712 | 37 | 125 | 108 | 2 | **1,129** |
| **Mobile/other** | **2,024** | **9,928** | **8,459** | **12,764** | **2,706** | **179** | **36,060** |
| All | 2,024 | 9,928 | 8,459 | 12,764 | 2,706 | 179 | **36,060** |
| **Total** | **94,303** | **462,585** | **51,894** | **203,090** | **117,653** | **2,846** | **932,371** |

### 4.2.2 Tertiary Load

Tertiary load is the useful energy delivered to an end use, or end use energy requirement: heat delivered by a furnace to a house, for example. This differs from natural gas consumption which is impacted by equipment efficiency: in the furnace example, consumption is equal to the tertiary load divided by seasonal efficiency of the furnace.

### 4.2.3 Unit Energy Consumption

As explained in Exhibit 3, unit energy consumption (UEC) is the end-use energy per unit (a “unit” in the residential sector is a dwelling). Fuel share is the percentage of the energy end use that is supplied by each fuel.

This section presents UEC by end use for dwellings that have gas as the predominant heating fuel and dwellings that have fuels other than gas as the predominant heating fuel[31] (referred to as “gas-heated” and “non-gas-heated” dwellings for simplicity). Tertiary loads for gas-heated and non-gas-heated dwellings are modelled identically for all end uses, except for space heating. Based on market research, non-gas-heated dwellings in FortisBC’s service territory have been shown to have slightly lower space heating loads, meaning that they are somewhat smaller, better insulated, heated to a lower temperature, or some combination of these three.

This section also presents *stock average efficiency*, the average efficiency of equipment serving the tertiary load for that end use. UEC by end use is calculated by dividing unit tertiary load with stock average efficiency.

Exhibit 13 presents the 2019 modelled values for unit tertiary load, stock average efficiency and UEC values for all end uses (DHW sub-end uses are shown separately in Exhibit 14) for gas-heated and non-gas-heated SFD dwellings in the Lower Mainland excluding Vancouver region.

**Exhibit 13 – 2019 Modelled UEC Values by End Use, Gas and Non-Gas-Heated SFD/Duplex Dwellings in the Lower Mainland**

| | Unit Tertiary Load (GJ/Dwelling/Yr.) | Stock Average Efficiency (%)[32] | UEC |
|---|---|---|---|
| **Predominantly Gas-Heated Dwellings** | | | |
| Clothes Dryer | 3.9 | 86% | 4.6 |
| Cooking | 2.9 | 51% | 5.7 |
| Fireplace | 7.3 | 50% | 14.5 |
| Other Gas Uses | 2.3 | 100% | 2.3 |
| Pool & Spa Heaters | 23.7 | 86% | 27.7 |

31 “Predominant heating fuel” represents if a building primarily uses gas for heat (>50% of the fuel share for space heating is from gas) or other fuels (>50% of fuel share for space heating is from fuels other than gas). In this report, we refer to this as ‘gas-heated’ and ‘non-gas-heated’ dwellings to simplify the text. Note that gas-heated dwellings can have other fuels supplying space heating, but gas is at least 50% of the fuel share.

32 Average stock efficiencies are only used to calculate tertiary load and are not used in the measure savings calculations or elsewhere in the modelling.

| | Unit Tertiary Load (GJ/Dwelling/Yr.) | Stock Average Efficiency (%)[32] | UEC |
|---|---|---|---|
| Space Heating | 59.1 | 85% | 69.4 |
| Domestic Hot Water | 12.0 | 62% | 19.5 |
| **Predominantly Non-Gas-Heated Dwellings** | | | |
| Clothes Dryer | 3.9 | 86% | 4.6 |
| Cooking | 2.9 | 51% | 5.7 |
| Fireplace | 7.3 | 50% | 14.5 |
| Other Gas Uses | 2.3 | 100% | 2.3 |
| Pool & Spa Heaters | 23.7 | 86% | 27.7 |
| Space Heating | 55.8 | 85% | 65.5 |
| Domestic Hot Water | 12.0 | 62% | 19.5 |

Exhibit 14 presents the 2019 modelled values for unit tertiary load, stock average efficiency, and UEC values for the DHW sub-end uses. As DHW gas consumption does not vary by the predominant heating fuel in the dwelling, the table does not differentiate by gas versus non-gas-heated dwellings. The values are specific to the SFD/Duplex segment in the Lower Mainland excluding Vancouver ("LML") region.

**Exhibit 14 – 2019 Modelled UEC Values for DHW Sub-End Uses, SFD/Duplex Dwellings in the LML**

| | Unit Tertiary Load (GJ/Dwelling/Yr.) | Stock Average Efficiency (%) | UEC |
|---|---|---|---|
| Other DHW | 2.3 | 62% | 3.7 |
| Dishwasher DHW | 1.4 | 62% | 2.3 |
| Shower DHW | 6.5 | 62% | 10.5 |
| Washer DHW | 1.8 | 62% | 2.9 |

### 4.2.4 Average Natural Gas Use per Dwelling

The following exhibits present average annual natural gas consumption per account by end use. Included in the exhibits are:

- UEC: the amount of energy used by each end use per unit (the "unit" in the residential sector is typically a dwelling, with some minor exceptions described below).
- Fuel Share: the percentage of the energy end use that is supplied by each fuel (in this case, natural gas).
- Saturation: For most end uses, saturation reflects the extent to which an end use is present in a region, and segment. In the residential sector, cooking, space heating, DHW, and 'other gas uses' have a saturation of 100% as these end uses are assumed to be present in all residential dwellings.

  Three end uses – clothes dryers, fireplaces, and pool & spa heaters – are not present in every residential dwelling. In these cases, saturation is used to show the average number of appliances per dwelling supplying those end uses, and the "unit" referred to in the UEC is one equipment unit: a fireplace for example. In the exhibits below, saturation for these three end uses is not 100%: greater than 100% means that the average residential dwelling has more than one appliance related to that end use (e.g., fireplaces) and less than 100% means that the average residential dwelling has less than one (therefore no) appliances related to that end use (e.g., pool & spa heaters).

Average annual gas consumption per unit is calculated by multiplying these three variables together; therefore, they are included in the exhibits below.

Exhibit 15 presents the modelled average annual gas use per residential dwelling by end use (DHW sub-end uses are presented separately in Exhibit 16) for gas and non-gas-heated dwellings, respectively. Note that these values are specific to the SFD/Duplex segment and the Lower Mainland excluding Vancouver ("LML") region.[33]

**Exhibit 15 – 2019 Modelled Average Annual Gas Use Per Dwelling by End Use, Gas and Non-Gas SFD/Duplex Heated Dwellings in the Lower Mainland**

| | UEC | Fuel Share | Saturation | Average Annual Gas Use (GJ/yr.) |
|---|---|---|---|---|
| **Predominantly Gas-Heated Dwellings** | | | | |
| Clothes Dryer | 4.6 | 6% | 104% | 0.3 |
| Cooking | 5.7 | 29% | 100% | 1.6 |
| DHW | 19.5 | 87% | 100% | 17.0 |
| Fireplace | 14.5 | 95% | 110% | 15.1 |
| Other Gas Uses | 2.3 | 100% | 100% | 2.3 |
| Pool & Spa Heaters | 27.7 | 26% | 9% | 0.7 |
| Space Heating | 69.4 | 93% | 99% | 63.8 |
| **Total Annual Consumption for an Average Residential Customer in LML** | | | | **100.8** |
| **Predominantly Non-Gas-Heated Dwellings** | | | | |
| Clothes Dryer | 4.6 | 7% | 104% | 0.4 |
| Cooking | 5.7 | 35% | 100% | 2.0 |
| DHW | 19.5 | 58% | 99% | 11.2 |
| Fireplace | 14.5 | 96% | 121% | 17.0 |
| Other Gas Uses | 2.3 | 100% | 100% | 2.3 |
| Pool & Spa Heaters | 27.7 | 10% | 9% | 0.2 |
| Space Heating | 65.5 | 17% | 95% | 10.8 |
| **Total Annual Consumption for an Average Residential Customer in LML** | | | | **43.9** |

33 Note that the average annual natural gas use for all residential customers within FortisBC's service territory is approximately 90 GJ per year.

Exhibit 16 presents the modelled average annual gas use per residential dwelling by DHW sub-end use for gas and non-gas-heated dwelling, respectively. Note that these values are specific to the SFD/Duplex segment and the Lower Mainland excluding Vancouver region.

**Exhibit 16 – 2019 Modelled Average Annual Gas Use Per SFD/Duplex Dwellings in the LML by DHW Sub-End Uses and Predominant Heating Fuel**

| | UEC | Gas Fuel Share | Saturation | Average Annual Gas Use (GJ/dwelling/yr.) |
|---|---|---|---|---|
| **Predominantly Gas-Heated Dwellings** | | | | |
| Other DHW | 3.7 | 87% | 100% | 3.3 |
| Dishwasher DHW | 2.3 | 87% | 100% | 2.1 |
| Shower DHW | 10.5 | 87% | 100% | 9.2 |
| Washer DHW | 2.9 | 87% | 100% | 2.5 |
| **Predominantly Non-Gas-Heated Dwellings** | | | | |
| Other DHW | 3.7 | 58% | 100% | 2.2 |
| Dishwasher DHW | 2.3 | 58% | 100% | 1.4 |
| Shower DHW | 10.5 | 58% | 100% | 6.0 |
| Washer DHW | 2.9 | 58% | 100% | 1.7 |

## 4.3 Reference Case Natural Gas Use

This section profiles the reference case forecast (2020-2040) natural gas consumption for the residential sector.

Overall gas consumption is forecasted to decline by approximately 5% by 2040 (as shown in Exhibit 19) compared to 2020 consumption, with an average annual decrease of about 0.25%. While the forecast shows an increase in the number of residential accounts (as seen in Exhibit 18), the growth in accounts is less than the decrease in usage per account, so the net result is that consumption declines.

### Exhibit 17 – 2020 vs 2040 Residential Gas Consumption (GJ) by Segment

| Segment | 2020 | 2040 | Change |
|---|---|---|---|
| SFD/Duplex | 69,263K | 65,033K | -6% |
| Attached/Row | 5,646K | 6,046K | 7% |
| Mobile/other | 1,891K | 1,927K | 2% |
| **Total** | **76,801K** | **73,006K** | **-5%** |

### Exhibit 18 – Number of Residential Accounts, 2019 vs 2040, by Region, Segment, and Vintage

| Region | City of Vancouver | | Lower Mainland x Van | | Northern BC | | Southern Interior | | Vancouver Island | | Whistler | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Segment | 2019 | 2040 | 2019 | 2040 | 2019 | 2040 | 2019 | 2040 | 2019 | 2040 | 2019 | 2040 | 2019 | 2040 |
| **SFD/Duplex** | **80,641** | **84,969** | **395,571** | **413,166** | **40,486** | **44,763** | **180,309** | **200,305** | **106,270** | **146,349** | **2,527** | **3,274** | **805,804** | **892,826** |
| 1950-1975 | 20,353 | 13,358 | 99,839 | 65,502 | 10,219 | 6,788 | 45,509 | 30,366 | 26,822 | 21,015 | 639 | 445 | **203,381** | **137,474** |
| 1986-1995 | 13,310 | 8,736 | 65,294 | 42,838 | 6,683 | 4,439 | 29,763 | 19,859 | 17,541 | 13,743 | 417 | 290 | **133,008** | **89,905** |
| 1976-1985 | 11,779 | 7,731 | 57,782 | 37,910 | 5,913 | 3,927 | 26,337 | 17,574 | 15,523 | 12,163 | 369 | 257 | **117,703** | **79,562** |
| 1996-2005 | 11,132 | 7,306 | 54,606 | 35,826 | 5,589 | 3,713 | 24,890 | 16,608 | 14,670 | 11,494 | 349 | 243 | **111,236** | **75,190** |
| 2006-2015 | 9,490 | 6,229 | 46,551 | 30,541 | 4,764 | 3,164 | 21,219 | 14,159 | 12,506 | 9,799 | 297 | 207 | **94,827** | **64,099** |
| Pre-1950 | 8,780 | 5,762 | 43,065 | 28,254 | 4,408 | 2,928 | 19,630 | 13,099 | 11,569 | 9,064 | 275 | 192 | **87,727** | **59,299** |
| Post-2015 | 5,797 | 35,847 | 28,434 | 172,295 | 2,910 | 19,804 | 12,961 | 88,640 | 7,639 | 69,071 | 181 | 1,640 | **57,922** | **387,297** |
| **Attached/Row** | **11,638** | **13,214** | **57,086** | **68,550** | **2,949** | **3,668** | **10,017** | **13,414** | **8,677** | **13,914** | **140** | **464** | **90,507** | **113,224** |
| 1986-1995 | 3,197 | 2,098 | 15,682 | 10,289 | 810 | 538 | 2,751 | 1,836 | 2,384 | 1,868 | 38 | 26 | **24,862** | **16,655** |
| 1996-2005 | 2,736 | 1,796 | 13,425 | 8,807 | 694 | 461 | 2,356 | 1,573 | 2,041 | 1,599 | 32 | 23 | **21,284** | **14,259** |
| Post-2015 | 1,902 | 6,824 | 9,329 | 37,219 | 482 | 2,029 | 1,637 | 7,822 | 1,418 | 8,226 | 23 | 383 | **14,791** | **62,503** |
| 2006-2015 | 1,599 | 1,049 | 7,841 | 5,144 | 405 | 269 | 1,376 | 918 | 1,191 | 933 | 20 | 14 | **12,432** | **8,327** |
| 1976-1985 | 1,236 | 811 | 6,058 | 3,974 | 313 | 208 | 1,063 | 709 | 921 | 722 | 15 | 10 | **9,606** | **6,434** |
| 1950-1975 | 823 | 541 | 4,039 | 2,650 | 208 | 138 | 709 | 473 | 614 | 481 | 10 | 7 | **6,403** | **4,290** |
| Pre-1950 | 145 | 95 | 712 | 467 | 37 | 25 | 125 | 83 | 108 | 85 | 2 | 1 | **1,129** | **756** |
| **Mobile/other** | **2,024** | **2,153** | **9,928** | **10,564** | **8,459** | **9,432** | **12,764** | **14,332** | **2,706** | **3,773** | **179** | **251** | **36,060** | **40,505** |
| All | 2,024 | 2,153 | 9,928 | 10,564 | 8,459 | 9,432 | 12,764 | 14,332 | 2,706 | 3,773 | 179 | 251 | **36,060** | **40,505** |
| **Total** | **94,303** | **100,336** | **462,585** | **492,280** | **51,894** | **57,863** | **203,090** | **228,051** | **117,653** | **164,036** | **2,846** | **3,989** | **932,371** | **1,046,555** |

The following exhibits present how natural gas is forecasted to be used from 2020 to 2040 by segment, end use, and region, respectively. (Section 4.3.1 focuses on consumption from existing and new dwellings over the reference case). These exhibits illustrate forecasted trends in consumption over the reference case, including:

- Many consumption patterns evident in the base year are expected to persist throughout the reference case: natural gas is predominately used in the SFD/Duplex segment, in the Lower Mainland excluding Vancouver region, and for space heating throughout the study period.
- In 2020, post-2015 residential dwellings are forecasted to account for approximately 9% of consumption. By 2040, this vintage is projected to use about 38% of consumption.

Exhibit 19 – 2020 vs 2040 Residential Gas Consumption (GJ) by End Use

| Parent End Use | 2020 | 2040 | Change |
|---|---|---|---|
| Space Heating | 47,864K | 43,877K | -8% |
| Domestic Hot Water (DHW) | 13,680K | 12,445K | -9% |
| Fireplace | 11,407K | 11,710K | 3% |
| Other Gas Uses | 1,844K | 2,728K | 48% |
| Cooking | 1,268K | 1,453K | 15% |
| Pool & Spa Heaters | 514K | 556K | 8% |
| Clothes Dryer | 224K | 238K | 6% |
| **Total** | **76,801K** | **73,006K** | **-5%** |

Exhibit 20 – 2020 vs 2040 Residential Gas Consumption (GJ) by Region

| Region | 2020 | 2040 | Change |
|---|---|---|---|
| Lower Mainland x Van | 41,954K | 38,521K | -8% |
| Southern Interior | 14,828K | 14,406K | -3% |
| City of Vancouver | 9,275K | 8,502K | -8% |
| Vancouver Island | 5,915K | 6,830K | 15% |
| Northern BC | 4,557K | 4,425K | -3% |
| Whistler | 271K | 322K | 19% |
| **Total** | **76,801K** | **73,006K** | **-5%** |

### 4.3.1 Reference Case Natural Gas Use: Existing versus New Residential Dwellings

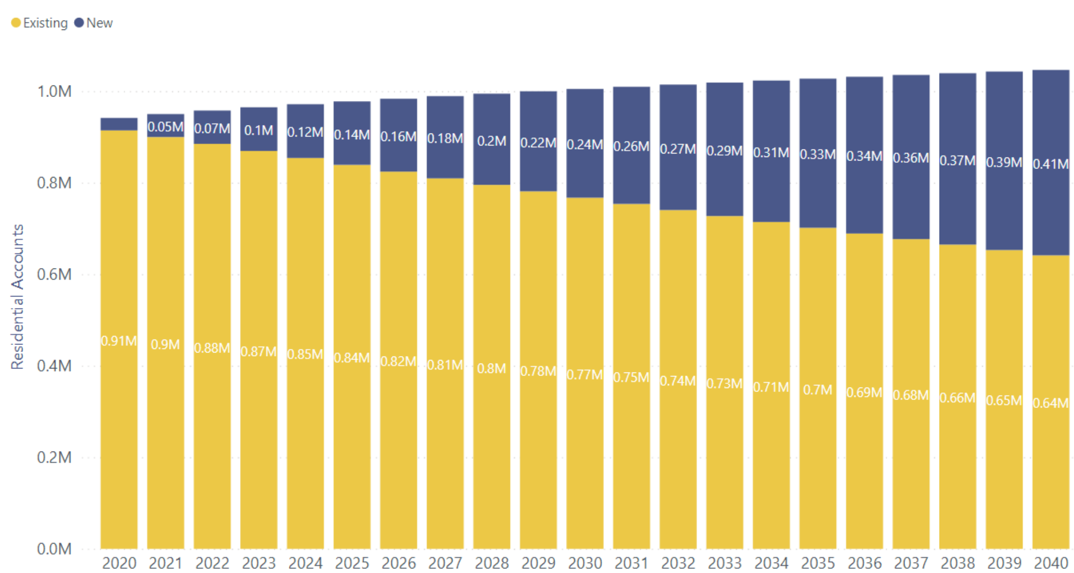
Exhibit 21 illustrates the expected increase in consumption from new residential dwellings over the reference case, from 2% in 2020 to approximately 33% in 2040, compared to existing dwellings.

**Exhibit 21 – 2020-2040 Gas Consumption (GJ) by New and Existing and Segment**

| Existing/New | 2020 | 2040 | Change |
|---|---|---|---|
| **Existing** | **75,137K** | **48,621K** | **-35%** |
| SFD/Duplex | 67,800K | 43,427K | -36% |
| Attached/Row | 5,462K | 3,456K | -37% |
| Mobile/other | 1,875K | 1,737K | -7% |
| **New** | **1,664K** | **24,385K** | **1365%** |
| SFD/Duplex | 1,464K | 21,605K | 1376% |
| Attached/Row | 184K | 2,590K | 1305% |
| Mobile/other | 16K | 190K | 1078% |
| **Total** | **76,801K** | **73,006K** | **-5%** |

Despite the reference case showing a 5% decrease in residential sector gas use from 2020 to 2040, residential accounts are expected to grow by approximately 11% from 2020 to 2040, from 932,000 to 1,047,000. The portion of FEI accounts from new residential dwellings is forecasted to increase over the reference case from 3% in 2020 to almost 40% in 2040, with new construction contributing approximately 400,000 new accounts, and approximately 290,000 existing dwellings being demolished over the reference case period. This represents 30% of the existing dwellings being demolished between 2020 and 2040, a demolition rate of approximately 2% per year. Slightly countering this trend is the inclusion of some conversion customers, which are existing homes to which gas service is extended sometime after their construction. In most regions, conversion customers are a small fraction of new connections.

**Exhibit 22 – 2020 vs 2040 Residential Gas Accounts Forecast by Existing and New Vintage**



## 4.4 Measure Assessment

### 4.4.1 List of Measures

The list of residential measures that were included in this CPR are presented in Exhibit 23. The measures are divided into categories by end use and measure type.

Please see the MS Excel file entitled "Res_Measure Analysis Workbook" for a description of each measure and a full analysis.

Measures were classified in five measure type categories:

- Building Envelope (also referred to as "envelope measures")
- Equipment
- Controls
- Energy Management (including behavioral measures)
- New Construction – all new construction measures were placed in a separate category

New construction measures are analyzed using a whole-building approach, represented by the Step 3 - Step 5 BC Energy Step Code measures listed below. See Appendix M of the CPR method for the modelling approach used to assess residential Step Code measures.

### Exhibit 23 – Residential Sector Conservation and Energy Management Measures

#### Space Heating – Building Envelope

Attic Duct Insulation
Attic Insulation
Basement or Crawlspace Insulation
Comprehensive Air Sealing
Comprehensive Draft Proofing
Exposed Floor Insulation
High Performance Windows and Doors
Manufactured Homes Duct Sealing
Manufactured Homes Floor Insulation
Wall Insulation

#### Water Heating – Equipment

Connected Water Heater Controller
Drain Water Heat Recovery
Faucet Aerator
Gas Heat Pump – Domestic Hot Water
High-Efficiency Condensing Gas Tankless Water Heater
High-Efficiency Condensing Gas Water Heater
High-Efficiency Storage Gas Water Heater
Low Flow Showerhead
Pipe Wrap
Solar Water Heating System
Thermostatic Restrictor Shower Valve
Water Heater Tune-Up

#### Space Heating – Equipment

Boiler Early Retirement
Boiler Reset Controls
Boiler Tune-Up
Communicating Thermostat
Electric Air Source Heat Pump with Existing Gas Furnace Backup (Dual-Fuel Measure)
Electric Air Source Heat Pump with New Gas Furnace Backup (Dual-Fuel Measure)
Fireplace Timer
Furnace Early Retirement
Furnace Tune-Up
Gas Heat Pump – Space Heating
High Efficiency Boiler
High Efficiency Boiler Dual Fuel-Gas Primary
High Efficiency Fireplace
High Efficiency Furnace
High Efficiency Furnace Dual Fuel-Gas Primary
High Quality Furnace Installation
High-Efficiency Heat Recovery Ventilator
HVAC Zoning

#### Appliances

Convection Oven
ENERGY STAR Dishwasher
High Efficiency (ENERGY STAR®) Clothes Washer
High Efficiency (ENERGY STAR®) Gas Clothes Dryer
High Efficiency Gas Range

#### Pool & Spa Heaters – Equipment

HE Gas Pool Heater
Outdoor Pool Cover
Solar Pool Heater

#### New Construction

New Construction - Step 3 Homes
New Construction - Step 4 Homes
New Construction - Step 5 Homes

#### Space Heating & Water Heating - Equipment

Combination System - Type 1 and 2
Combination System - Type 1 and 2 Early Retirement
Combination System - Type 3
Gas Heat Pump Combination System – Type 1 and 2

#### Other

Deep Energy Retrofits[34]
ENERGY STAR Manufactured Home
Home Energy Report

[34] Note that analysis that forms the technical, economic and market potential is based on individual measures rather than on "packages of measures" or program delivery approaches. Measures packaged in comprehensive programs such as FortisBC's Rental Apartment Efficiency program, Social Housing Retrofit Support program and deep energy retrofits were assessed within this analysis individually but not also collectively as a program package.

### 4.4.2 Results

Exhibit 24 shows measure-level results for the residential sector in order of decreasing cost effectiveness.

Measures were assessed based on their replacement type: **retrofit** (immediate replacement at full cost), **replace on burnout** (end of life replacement at incremental cost), or **new construction** (immediate installation at incremental cost).

The TRC and MTRC are presented at the measure-level and exclude program costs and free ridership.

Key findings of the measure assessment for the residential sector include:

- Of the 65 measures included in the analysis, only 14 pass the TRC screen. Substantially more, 54 measures, pass the MTRC screen.
- The most attractive water heating measures (i.e. measures with the highest TRC) include faucet aerators, pipe wrap and low flow showerheads.
- The most attractive space heating measures are certain building envelope (walls, attic duct, and basement) insulation measures, high-efficiency fireplaces, and communicating thermostats.
- Other building envelope measures, such as attic, floor insulation and air sealing measures do not pass the TRC (i.e. TRC is less than 1.0).
- Gas heat pumps combination systems and the mature market version of DHW gas heat pumps pass the MTRC. Neither pass the TRC.
- Most Step Code new construction measures pass the MTRC but neither pass the TRC.

Exhibit 24 – Residential Sector Results: Sector Averages (Sorted by High to Low MTRC)

| # | Measure | Measure Type | Replacement Type | TRC | MTRC |
|---|---|---|---|---|---|
| 1 | Faucet Aerator | Equipment | RET | 8.2 | 42.2 |
| 2 | Pipe Wrap | Equipment | RET | 7.7 | 38.5 |
| 3 | Low Flow Showerhead | Equipment | RET | 5 | 25.8 |
| 4 | Combination System - Type 1 and 2 | Equipment | ROB | 10 | 10 |
| 5 | ENERGY STAR Dishwasher | Equipment | ROB | 10 | 10 |
| 6 | Fireplace Timer | Equipment | RET | 1.8 | 8.6 |
| 7 | High Efficiency (ENERGY STAR) Clothes Washer | Equipment | ROB | 1.7 | 8.5 |
| 8 | Wall Insulation - Cavity (R-3 baseline) | Building Envelope | RET | 1.7 | 7.6 |
| 9 | High Efficiency (EnerChoice) Gas Fireplace or Vertically Direct Vented Fireplace | Equipment | ROB | 1.5 | 7.4 |
| 10 | Attic Duct Insulation | Building Envelope | RET | 1.4 | 6.1 |
| 11 | Communicating Thermostat | Controls | RET | 1.2 | 5.2 |
| 12 | Basement or Crawlspace Insulation | Building Envelope | RET | 1.1 | 5 |
| 13 | High Efficiency (ENERGY STAR) Gas Clothes Dryer | Equipment | ROB | 1 | 4.8 |
| 14 | Attic Insulation (R-12.6 Baseline) | Building Envelope | RET | 0.9 | 4 |
| 15 | GHP Combination System - Type 1 and 2 | Equipment | ROB | 0.7 | 3.6 |

| | | | | | |
|---|---|---|---|---|---|
| 16 | Home Energy Report | Energy Management | RET | 1.4 | 3.2 |
| 17 | Air Source Heat Pump (Central) - Retrofit Existing Gas Furnace | Equipment | RET | 0.6 | 3.1 |
| 18 | Outdoor Pool Cover | Equipment | RET | 0.6 | 3.1 |
| 19 | Air Source Heat Pump (Central) - New Gas Furnace | Equipment | ROB | 0.6 | 2.9 |
| 20 | Comprehensive Air Sealing | Building Envelope | RET | 0.6 | 2.8 |
| 21 | Drain Water Heat Recovery | Equipment | RET | 0.6 | 2.7 |
| 22 | Attic Insulation (R-20 Baseline) | Building Envelope | RET | 0.5 | 2.5 |
| 23 | HVAC Zoning (HVAC Zone Control) | Equipment | RET | 0.6 | 2.4 |
| 24 | Exposed Floor Insulation | Building Envelope | RET | 0.5 | 2.1 |
| 25 | New Construction - Step 4 Homes - Electric DHW | New Construction | NEW | 0.9 | 2.1 |
| 26 | Wall Insulation - Cavity (R-10 baseline) | Building Envelope | RET | 0.4 | 2.1 |
| 27 | High Efficiency Furnace | Equipment | ROB | 0.4 | 2 |
| 28 | New Construction - Step 4 Homes | New Construction | NEW | 0.4 | 2 |
| 29 | Gas Heat Pump - DHW - Mature Market Costs | Equipment | ROB | 0.4 | 1.9 |
| 30 | Thermostatic Restrictor Shower Valve | Equipment | RET | 0.3 | 1.8 |
| 31 | Furnace Early Retirement | Equipment | RET | 0.3 | 1.8 |
| 32 | High-Efficiency Storage Gas Water Heater | Equipment | ROB | 0.3 | 1.7 |
| 33 | High-Efficiency Heat Recovery Ventilator | Equipment | RET | 0.4 | 1.6 |
| 34 | Boiler Reset Controls | Equipment | RET | 0.3 | 1.6 |
| 35 | Combination System - Type 3 | Equipment | ROB | 0.3 | 1.6 |
| 36 | High-Efficiency (ENERGY STAR) Condensing Gas Tankless Water Heater - Mature Market Costs | Equipment | ROB | 0.3 | 1.6 |
| 37 | High Quality Furnace Installation - ENERGY STAR Verified | Equipment | ROB | 0.3 | 1.6 |
| 38 | Wall Insulation - Sheathing (R-7 baseline) | Building Envelope | RET | 0.3 | 1.6 |
| 39 | New Construction - Step 5 Homes - Mature Market Costs | New Construction | NEW | 0.3 | 1.5 |
| 40 | New Construction - Step 3 Homes - Electric DHW | New Construction | NEW | 0.6 | 1.4 |
| 41 | High Efficiency Furnace Dual Fuel-Gas Primary | Equipment | ROB | 0.3 | 1.4 |
| 42 | Combination System - Type 1 and 2 Early Retirement | Equipment | ROB | 0.3 | 1.4 |
| 43 | New Construction - Step 5 Homes - Electric DHW | New Construction | NEW | 0.6 | 1.4 |
| 44 | High Efficiency Boiler | Equipment | ROB | 0.3 | 1.4 |
| 45 | New Construction - Step 5 Homes | New Construction | NEW | 0.3 | 1.3 |
| 46 | Comprehensive Draft Proofing | Building Envelope | RET | 0.3 | 1.3 |
| 47 | New Construction - Step 3 Homes | New Construction | NEW | 0.3 | 1.3 |
| 48 | Solar Pool Heater | Equipment | RET | 0.3 | 1.2 |
| 49 | Boiler Early Retirement | Equipment | RET | 0.2 | 1.1 |
| 50 | Gas Heat Pump - Space Heating | Equipment | ROB | 0.2 | 1.1 |
| 51 | High Efficiency Boiler Dual Fuel-Gas Primary | Equipment | ROB | 0.2 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| 52 | Manufactured Homes Duct Sealing | Equipment | RET | 0.2 | 1 |
| 53 | Manufactured Homes Floor Insulation | Equipment | RET | 0.2 | 0.9 |
| 54 | High Efficiency Gas Range | Equipment | ROB | 0.2 | 0.8 |
| 55 | Solar Water Heating System | Equipment | RET | 0.1 | 0.7 |
| 56 | Gas Heat Pump - DHW | Equipment | ROB | 0.1 | 0.7 |
| 57 | Convection Oven | Equipment | ROB | 0.1 | 0.7 |
| 58 | High-Efficiency (ENERGY STAR) Condensing Gas Water Heater | Equipment | ROB | 0.1 | 0.5 |
| 59 | Connected Water Heater Controller | Controls | RET | 0.2 | 0.5 |
| 60 | Boiler Tune-Up | Equipment | RET | 0.1 | 0.3 |
| 61 | Furnace Tune-Up | Equipment | RET | 0.1 | 0.3 |
| 62 | ENERGY STAR Manufactured Home | Equipment | RET | 0.1 | 0.3 |
| 63 | High Performance Windows and Doors | Building Envelope | ROB | 0.1 | 0.3 |
| 64 | Water Heater Tune-Up | Energy Management | RET | 0 | 0.2 |
| 65 | High Efficiency Gas Pool Heater | Equipment | ROB | 0 | 0.2 |

## 4.5 Technical Potential

This section provides an overview of the technical potential savings results for the residential sector. Overall results are presented below, followed by measure level results and supply curves for the TRC and MTRC results.

As shown in Exhibit 25, almost half of the residential technical potential (24 PJ) would be available in 2021 and would increase to 43 PJ in 2040. This indicates that a large amount of the potential, approximately 19 PJ, would come from replace on burnout measures over the next two decades. The forecasted natural gas consumption for the residential sector is included for reference.

**Exhibit 25 – Residential Technical Potential Savings (GJ)**

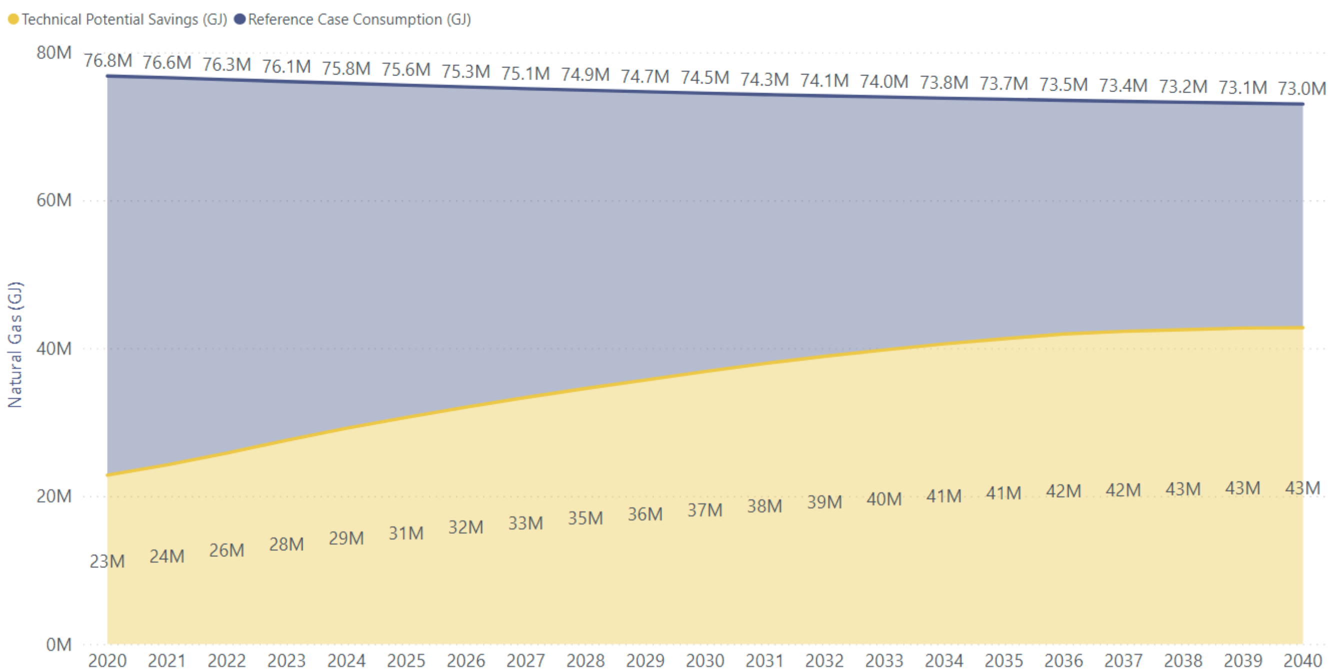
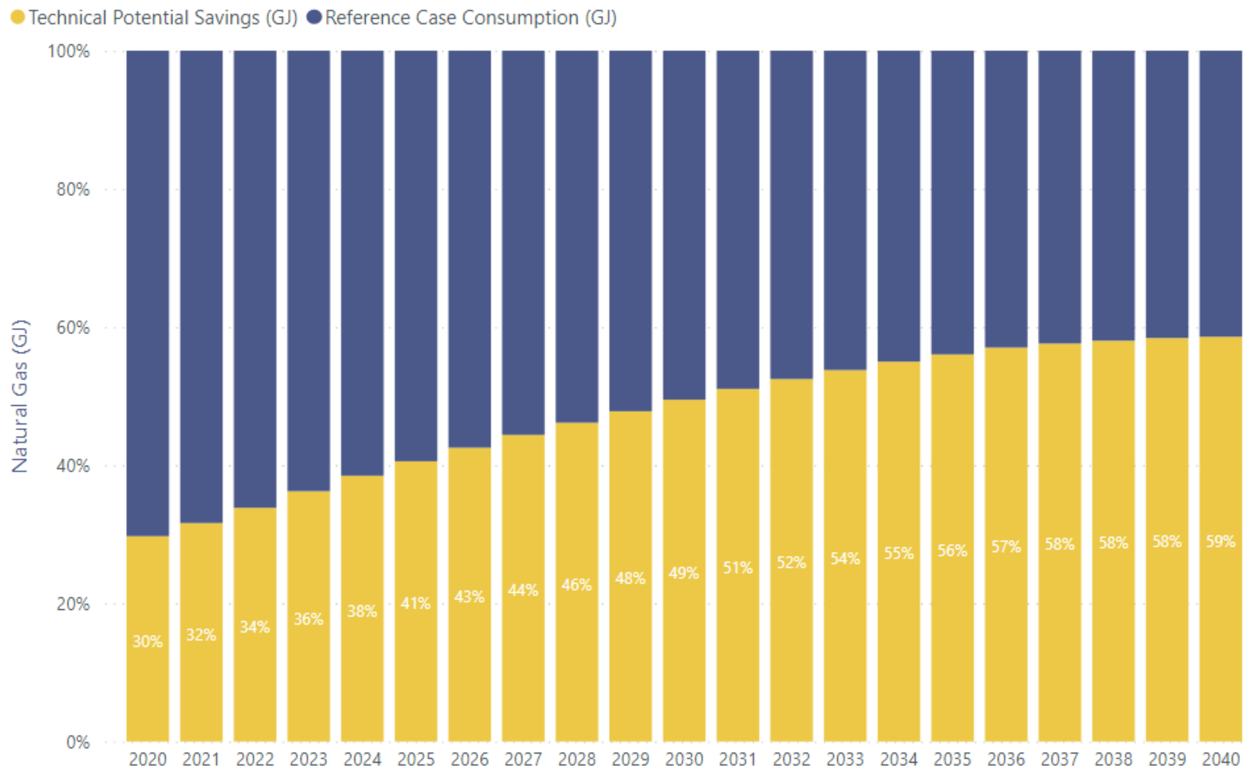


Exhibit 26 – Technical Savings Potential as a Percent of Residential Reference Case Consumption (%)




As shown in Exhibit 26, the technical potential savings is about 32% of residential reference case consumption in 2021 and increases to 59% by 2040, further indicating a that a substantial portion of the potential is expected to come from replace on burnout measures.

The technical potential savings by 2025 broken down by measure (only showing the top 25) are presented in Exhibit 27. The top three measures are all space heating measures (including gas heat pumps), followed by Step 4 new construction.

### Exhibit 27 – Technical Potential – Annual Gas Savings from Top 30 Residential Measures in 2025 (GJ)

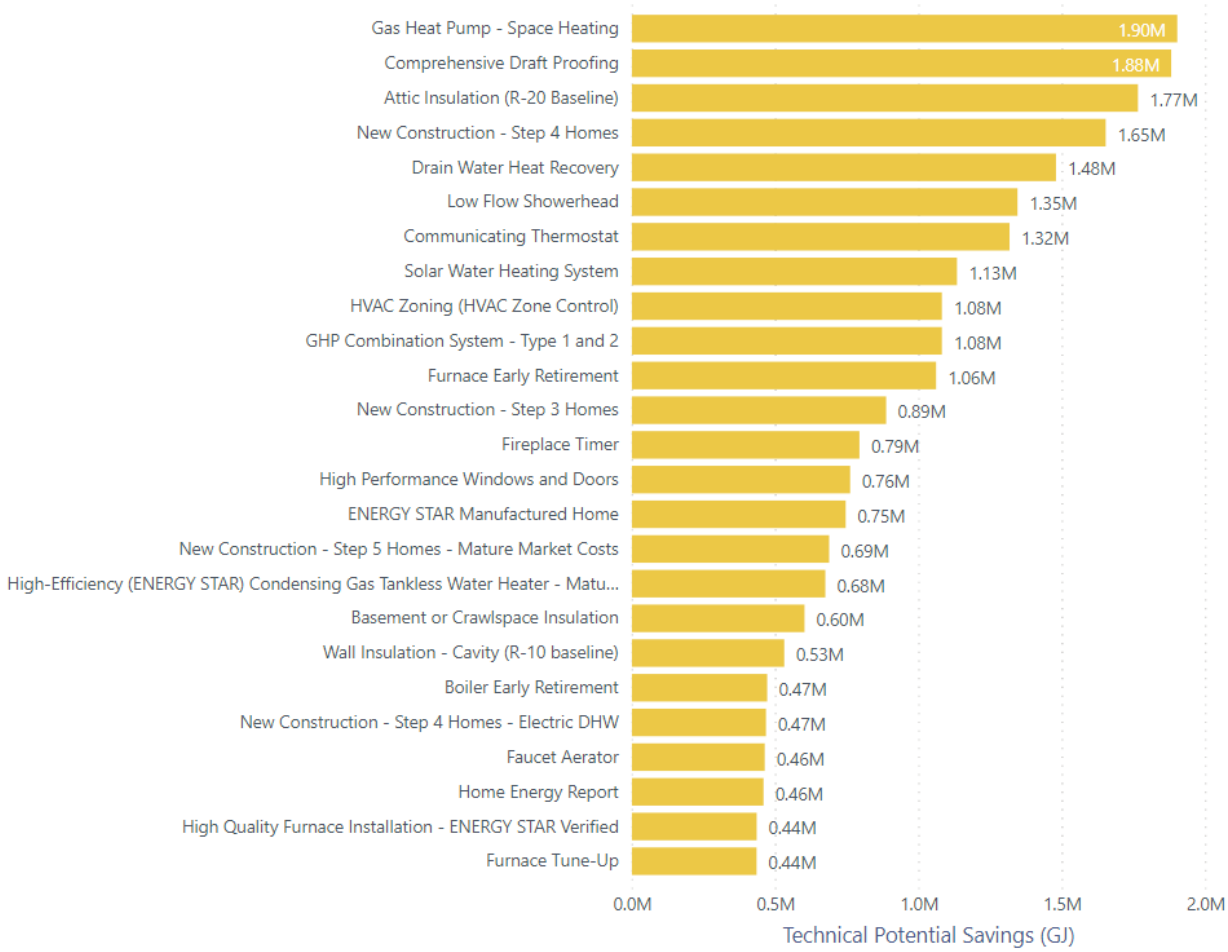


Exhibit 28 shows the cumulative residential sector technical potential savings in 2040 arranged as a supply curve, with measures ordered by decreasing TRC ratio from left to right. The graph shows that roughly 16% (around 7 out of 43 PJ) of the residential sector's technical potential by 2040, comes from measures with a TRC of 1.0 or higher. Approximately 1.5 PJ of savings come from measures with a TRC ratio of greater than 2. These are shown in aggregate.

### Exhibit 28 – Residential Sector: Technical Potential Supply Curve – TRC

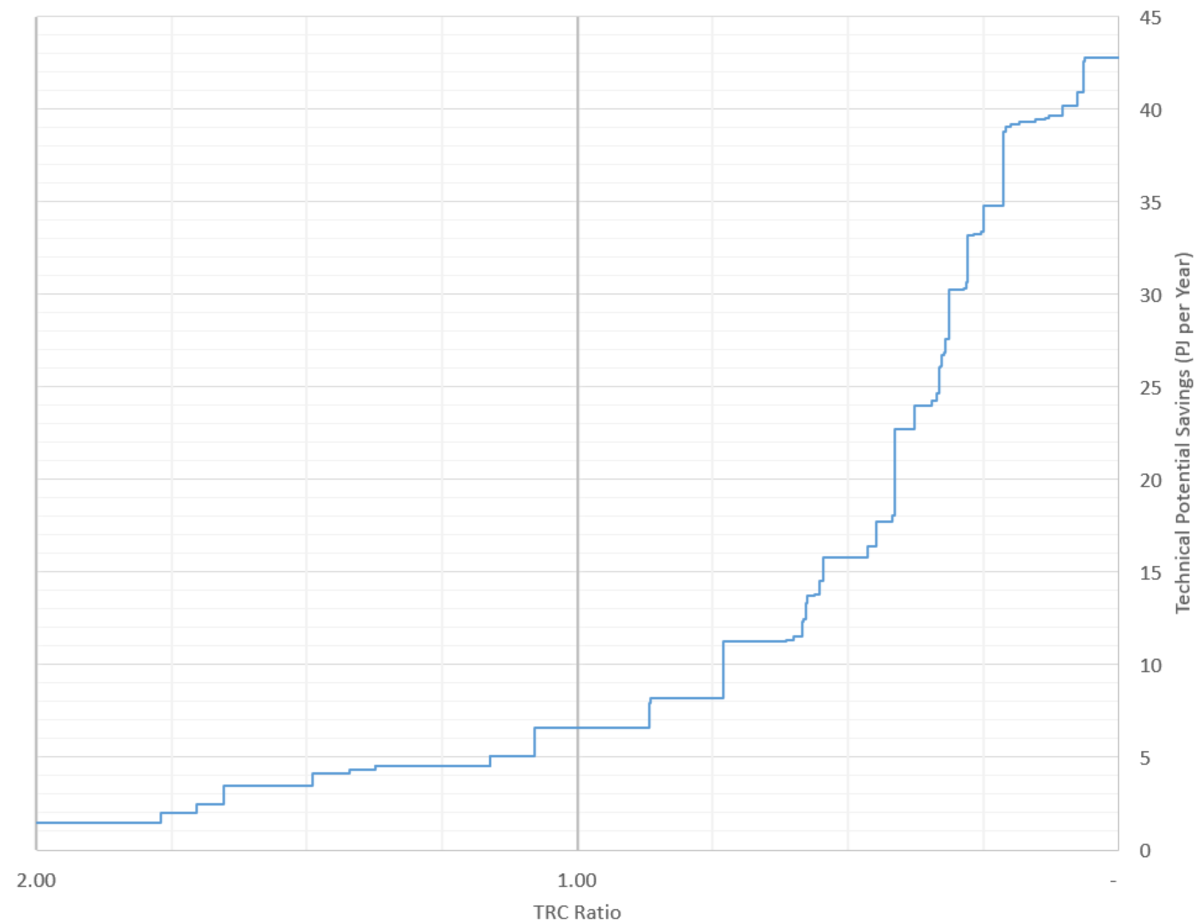
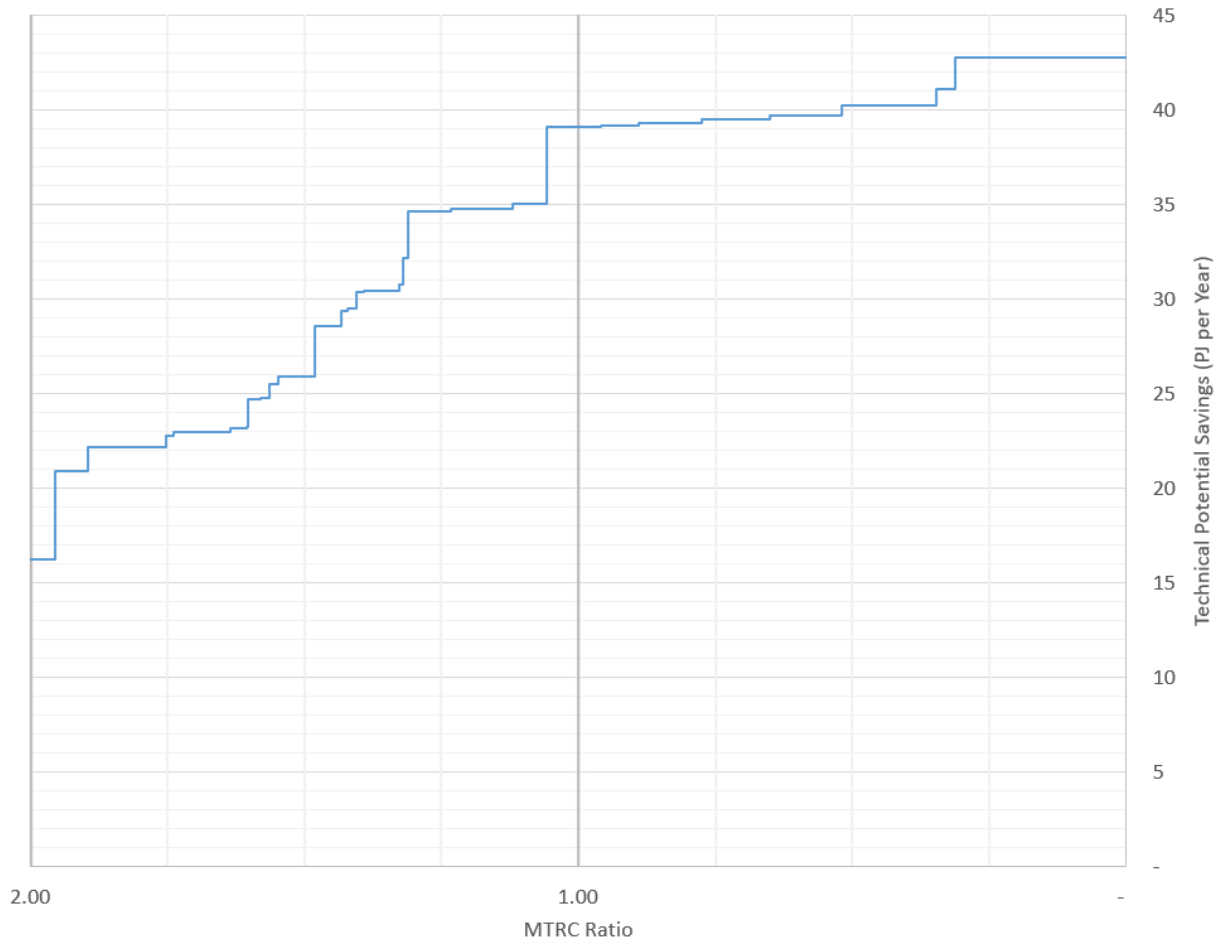


Exhibit 29 shows a similar supply curve, but with measures ordered by decreasing MTRC ratio from left to right. The graph shows that 90% (around 39 out of 43 PJ) of residential sector's technical potential by 2040 comes from cost-effective measures with an MTRC of 1.0 or higher. Approximately 16 PJ of savings come from measures with an MTRC ratio of greater than 2. These are shown in aggregate.

Exhibit 29 – Residential Sector: Technical Potential Supply Curve – MTRC

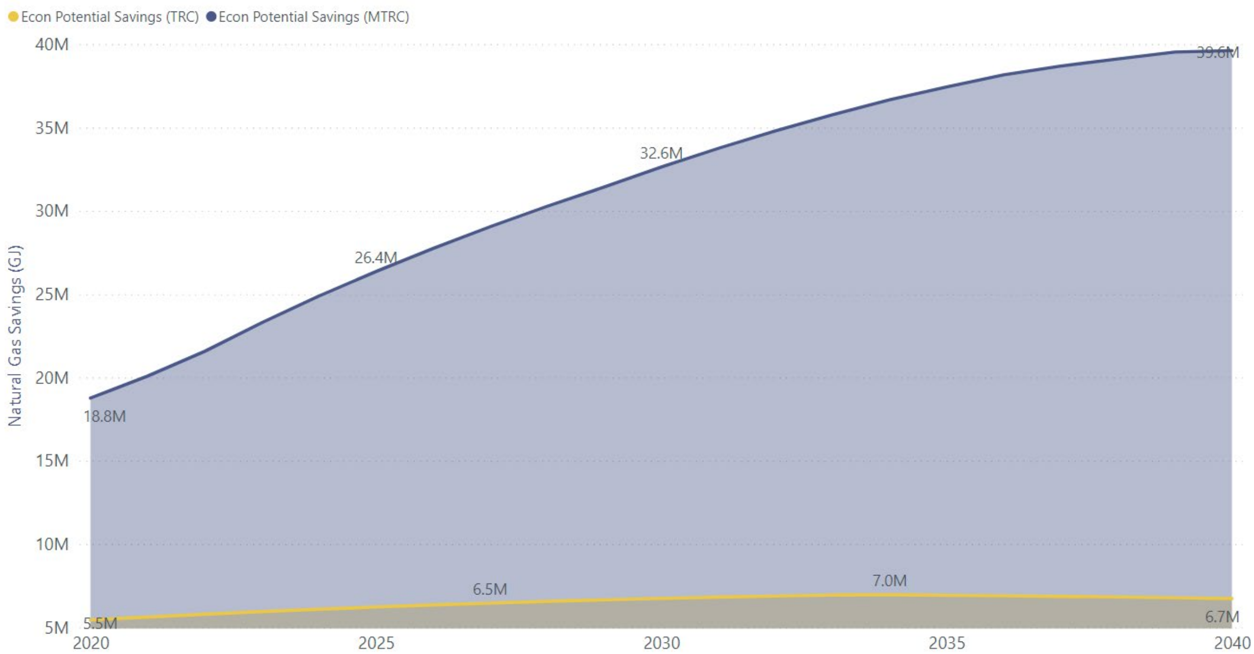


## 4.6 Economic Potential

This section provides the economic potential savings results for the residential sector from 2020 to 2040. We conducted two economic potential assessments: one using a TRC screen that includes measures with a TRC ratio of 1.0 and above, and one using an MTRC screen that includes measures with an MTRC of 1.0 and above. Outputs of both economic models are presented in this section.

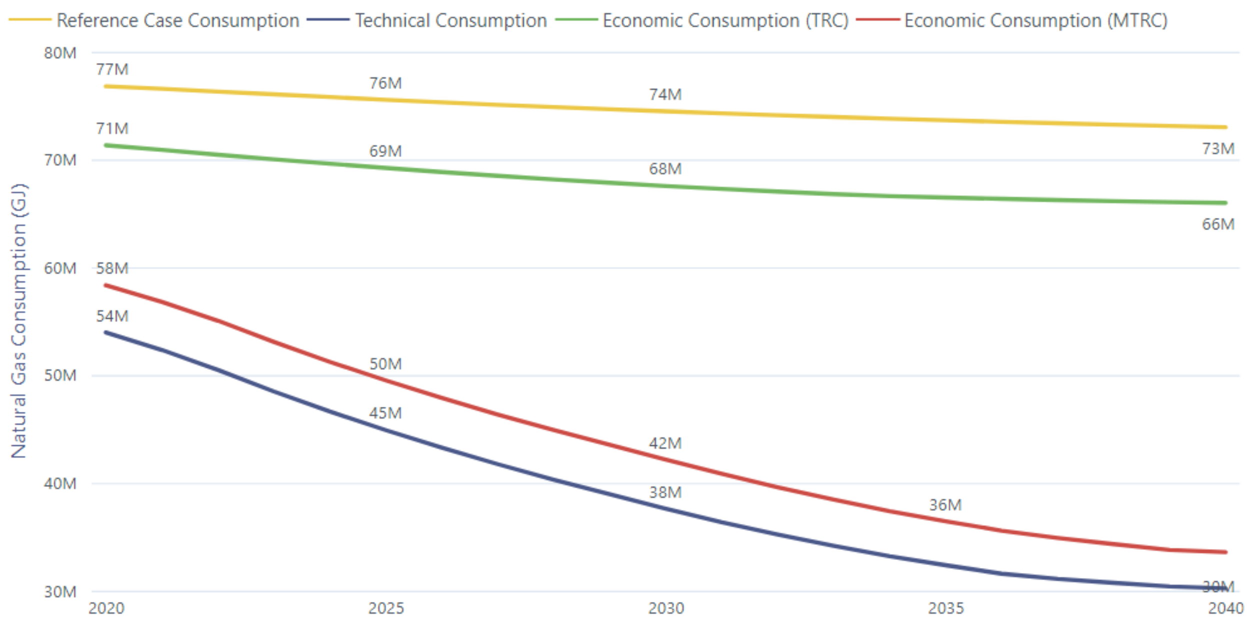
The residential sector economic potential savings with a TRC screen and with an MTRC screen are shown in Exhibit 30. As mentioned earlier, of the 65 measures included in the assessment, only 14 pass the TRC screen whereas 54 measures pass the MTRC screen. Those 40 measures that pass the MTRC but fail the TRC make up the difference between the two economic potential scenarios. This difference in economic potential in 2025 is roughly 20 PJ. In 2025, 24% of the MTRC economic potential comes from measures that pass the TRC as well. By 2040, that ratio is only 17%.

Exhibit 30 – Economic Potential Savings (GJ) – Residential, TRC and MTRC



The forecasted gas consumption under the technical potential, economic potential with a TRC screen, economic potential with an MTRC screen, and reference case scenarios for residential sector are shown in Exhibit 31.

Exhibit 31 – Economic Potential Consumption (GJ) Forecasts – Residential, TRC and MTRC



### *Results by Region*

The TRC and MTRC economic potential savings in 2025 are presented by region in Exhibit 32 and Exhibit 33 respectively. The largest economic potential savings (3 PJ to 14 PJ depending on economic screen) are estimated to occur in the Lower Mainland outside of the City of Vancouver. The percentage of consumption captured by economic potential is uniform across all regions – around 8% under TRC screen and 34% under MTRC.

Exhibit 32 – Economic Potential Savings by Region in 2025 – Residential, TRC

| Region | Ref Case Consumption (GJ) | Economic Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Lower Mainland x Van | 40,757K | 3,303K | 8% |
| Southern Interior | 14,701K | 1,343K | 9% |
| City of Vancouver | 9,007K | 853K | 9% |
| Vancouver Island | 6,280K | 421K | 7% |
| Northern BC | 4,517K | 385K | 9% |
| Whistler | 290K | 26K | 9% |
| **Total** | **75,552K** | **6,331K** | **8%** |

Exhibit 33 – Economic Potential Savings by Region in 2025 – Residential, MTRC

| Region | Ref Case Consumption (GJ) | Economic Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Lower Mainland x Van | 40,757K | 14,230K | 35% |
| Southern Interior | 14,701K | 4,933K | 34% |
| City of Vancouver | 9,007K | 3,150K | 35% |
| Vancouver Island | 6,280K | 2,113K | 34% |
| Northern BC | 4,517K | 1,522K | 34% |
| Whistler | 290K | 87K | 30% |
| **Total** | **75,552K** | **26,034K** | **34%** |

### *Results by Segment and Vintage*

The TRC and MTRC economic potential savings in 2025 are presented by segment and vintage in Exhibit 34 and Exhibit 35 respectively. As expected, older single-family dwellings present the most opportunities for economic potential under both economic screens. However, in the MTRC economic potential, the largest percentage of consumption is captured by the post-2015 vintage. This implies a sizeable potential contribution by Step Code new construction measures.

Exhibit 34 – Economic Potential Savings by Segment and Vintage in 2025 – Residential, TRC

| Segment | Ref Case Consumption (GJ) | Economic Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| **SFD/Duplex** | **67,869K** | **5,854K** | **9%** |
| 1950-1975 | 16,604K | 1,731K | 10% |
| 1976-1985 | 8,892K | 895K | 10% |
| Pre-1950 | 7,885K | 857K | 11% |
| 1986-1995 | 9,572K | 830K | 9% |
| 1996-2005 | 7,606K | 637K | 8% |
| 2006-2015 | 6,144K | 509K | 8% |
| Post-2015 | 11,166K | 395K | 4% |
| **Attached/Row** | **5,783K** | **381K** | **7%** |
| 1986-1995 | 1,367K | 99K | 7% |
| 1996-2005 | 1,115K | 84K | 8% |
| Post-2015 | 1,654K | 69K | 4% |
| 2006-2015 | 619K | 48K | 8% |
| 1976-1985 | 553K | 40K | 7% |
| 1950-1975 | 397K | 33K | 8% |
| Pre-1950 | 77K | 8K | 10% |
| **Mobile/other** | **1,900K** | **97K** | **5%** |
| **Total** | **75,552K** | **6,331K** | **8%** |

Exhibit 35 – Economic Potential Savings by Segment and Vintage in 2025 – Residential, MTRC

| Segment | Ref Case Consumption (GJ) | Economic Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| **SFD/Duplex** | **67,869K** | **23,720K** | **35%** |
| 1950-1975 | 16,604K | 5,541K | 33% |
| Post-2015 | 11,166K | 5,048K | 45% |
| 1986-1995 | 9,572K | 3,142K | 33% |
| 1976-1985 | 8,892K | 2,931K | 33% |
| Pre-1950 | 7,885K | 2,642K | 34% |
| 1996-2005 | 7,606K | 2,463K | 32% |
| 2006-2015 | 6,144K | 1,954K | 32% |
| **Attached/Row** | **5,783K** | **1,853K** | **32%** |
| Post-2015 | 1,654K | 618K | 37% |
| 1986-1995 | 1,367K | 418K | 31% |
| 1996-2005 | 1,115K | 324K | 29% |
| 1976-1985 | 553K | 172K | 31% |
| 2006-2015 | 619K | 171K | 28% |
| 1950-1975 | 397K | 126K | 32% |
| Pre-1950 | 77K | 24K | 32% |
| **Mobile/other** | **1,900K** | **462K** | **24%** |
| **Total** | **75,552K** | **26,034K** | **34%** |

### *Results by End Use*

The TRC and MTRC economic potential savings in 2025 are presented by segment in Exhibit 36 and Exhibit 37 respectively. The largest amounts, in absolute savings, are expected to be captured under the space heating end use (2.7 PJ or 17.5 PJ depending on the economic screen). In terms of the percentage of reference case consumption captured by economic potential, domestic hot water captures the largest share in both economic screens (18% TRC, 51% MTRC). Although small in absolute savings, pool and spa heater end use has an economic potential ratio of 76% savings under the MTRC screen.

Exhibit 36 – Economic Potential Savings by End Use in 2025 – Residential, TRC

| Parent End Use | Ref Case Consumption (GJ) | Economic Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Space Heating | 46,600K | 2,710K | 6% |
| Domestic Hot Water (DHW) | 13,205K | 2,347K | 18% |
| Fireplace | 11,549K | 1,247K | 11% |
| Clothes Dryer | 229K | 13K | 5% |
| Cooking | 1,328K | 11K | 1% |
| Pool & Spa Heaters | 528K | 5K | 1% |
| Other Gas Uses | 2,112K | 0K | 0% |
| **Total** | **75,552K** | **6,331K** | **8%** |

Exhibit 37 – Economic Potential Savings by End Use in 2025 – Residential, MTRC

| Parent End Use | Ref Case Consumption (GJ) | Economic Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Space Heating | 46,600K | 17,569K | 38% |
| Domestic Hot Water (DHW) | 13,205K | 6,784K | 51% |
| Fireplace | 11,549K | 1,248K | 11% |
| Pool & Spa Heaters | 528K | 403K | 76% |
| Clothes Dryer | 229K | 19K | 8% |
| Cooking | 1,328K | 11K | 1% |
| Other Gas Uses | 2,112K | 0K | 0% |
| **Total** | **75,552K** | **26,034K** | **34%** |

The TRC and MTRC economic potential savings in 2040 are presented by end use in Exhibit 38. The difference is drastic – around 32 PJ. This is due to the large number of measures that pass the MTRC but fail the TRC. The biggest difference between the economic screens stem from measures that affect space heating.

Exhibit 38 – Economic Potential Savings by End Use in 2040 – Residential, TRC and MTRC

| Parent End Use | Economic Savings (GJ) - TRC | Economic Savings (GJ) - MTRC | Difference (GJ) |
|---|---|---|---|
| Space Heating | 3,382K | 27,738K | 24,356K |
| Domestic Hot Water (DHW) | 2,009K | 10,226K | 8,218K |
| Pool & Spa Heaters | 3K | 301K | 298K |
| Clothes Dryer | 17K | 28K | 11K |
| Fireplace | 1,312K | 1,313K | 1K |
| Cooking | 8K | 9K | 0K |
| Other Gas Uses | 0K | 0K | 0K |
| **Total** | **6,732K** | **39,615K** | **32,883K** |

*Results by Measure*

The TRC economic potential savings by 2025 broken down by measure are shown in Exhibit 39, sorted by decreasing potential. The savings breakdown by end use is shown in Exhibit 40. Space heating savings make up 42% of the economic potential, domestic hot water 38% and fireplace measures 20% of the savings.

Exhibit 39 – Residential Economic Potential (TRC) – Annual Gas Savings from All TRC-Passing Measures in 2025 (GJ)

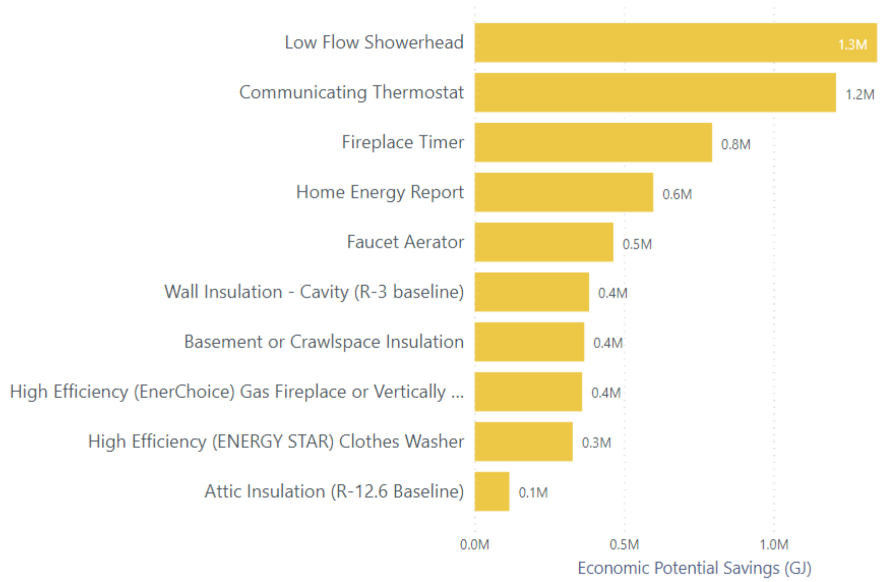
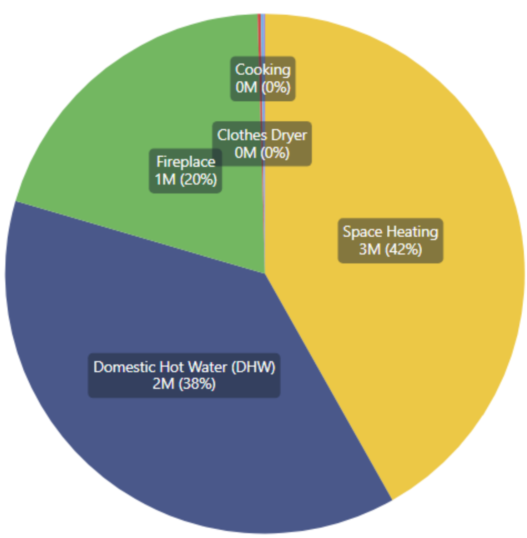



Exhibit 40 – Economic Potential in 2025 (GJ) By End Use – Residential, TRC



The economic potential savings by 2025 broken down by measure (showing only the top 25 measures) are presented in Exhibit 41. The savings breakdown by end use are presented in Exhibit 42. Space heating measures and their savings makes up the majority (68%) of the MTRC economic potential.

Exhibit 41 – Residential Economic Potential (TRC) - Annual Gas Savings from Top 25 MTRC-Passing Measures in 2025 (GJ)

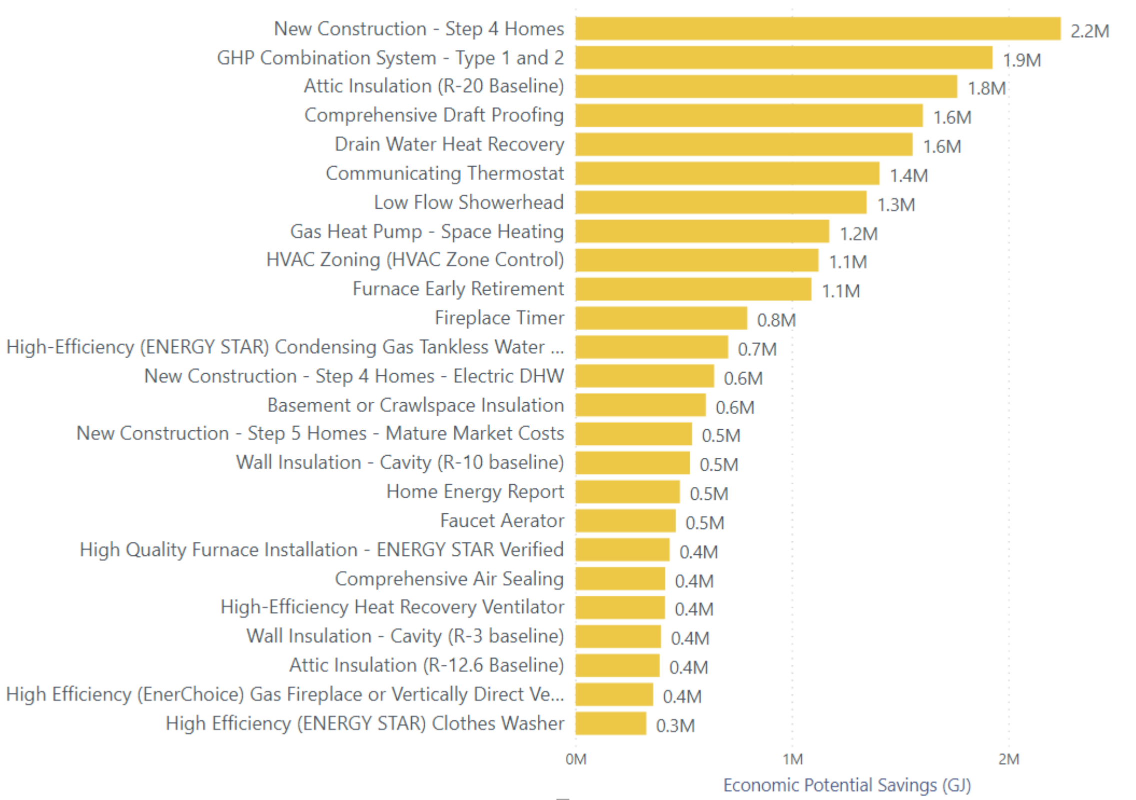
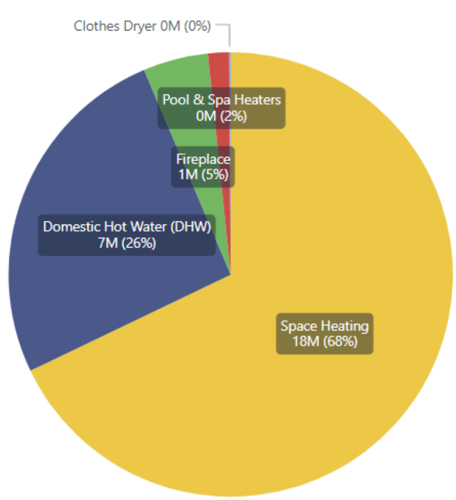



Exhibit 42 – Economic Potential (GJ) in 2025 By End Use – Residential, MTRC



## 4.7 Market Potential

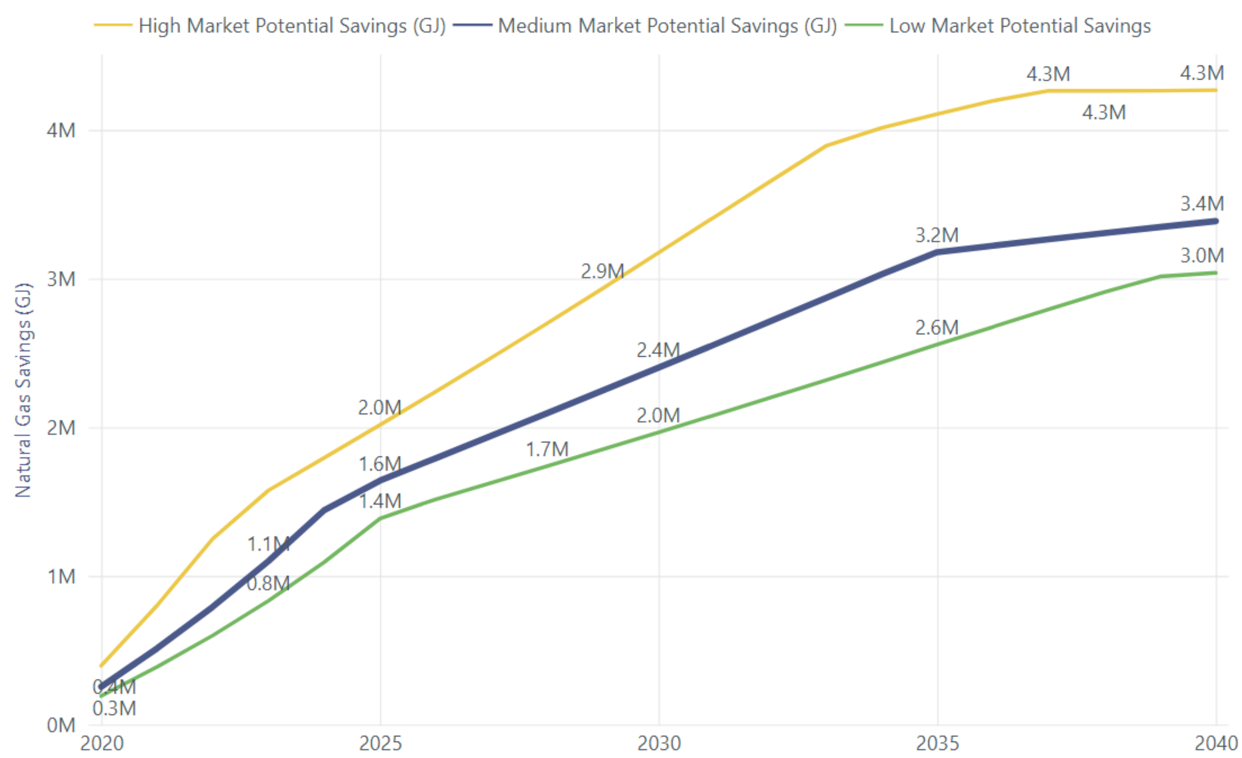
This section provides an overview of the low, medium, and high market potential results for the residential sector.

Low, medium, and high scenarios assume that measure incentive levels will be 25%, 50% and 100% of incremental costs, respectively. For example, assume that a high-efficiency furnace may cost $200 more than a standard furnace, meaning the furnace would have an incremental cost of $200. In the medium scenario, this measure's hypothetical incentive from FortisBC would be $100. The other $100 would be paid by the end user. In all scenarios, the non-incentive program costs are assumed to be 15% of the incentive cost. In the example above, FortisBC's non-incentive spending would be $15. FortisBC's total cost for providing the measure to an end user would be $115.

The market potential savings results, with a TRC screen and with an MTRC screen, are shown in Exhibit 43 and Exhibit 44, respectively. The medium market potential using the MTRC screen is almost three times the market potential using TRC screen.

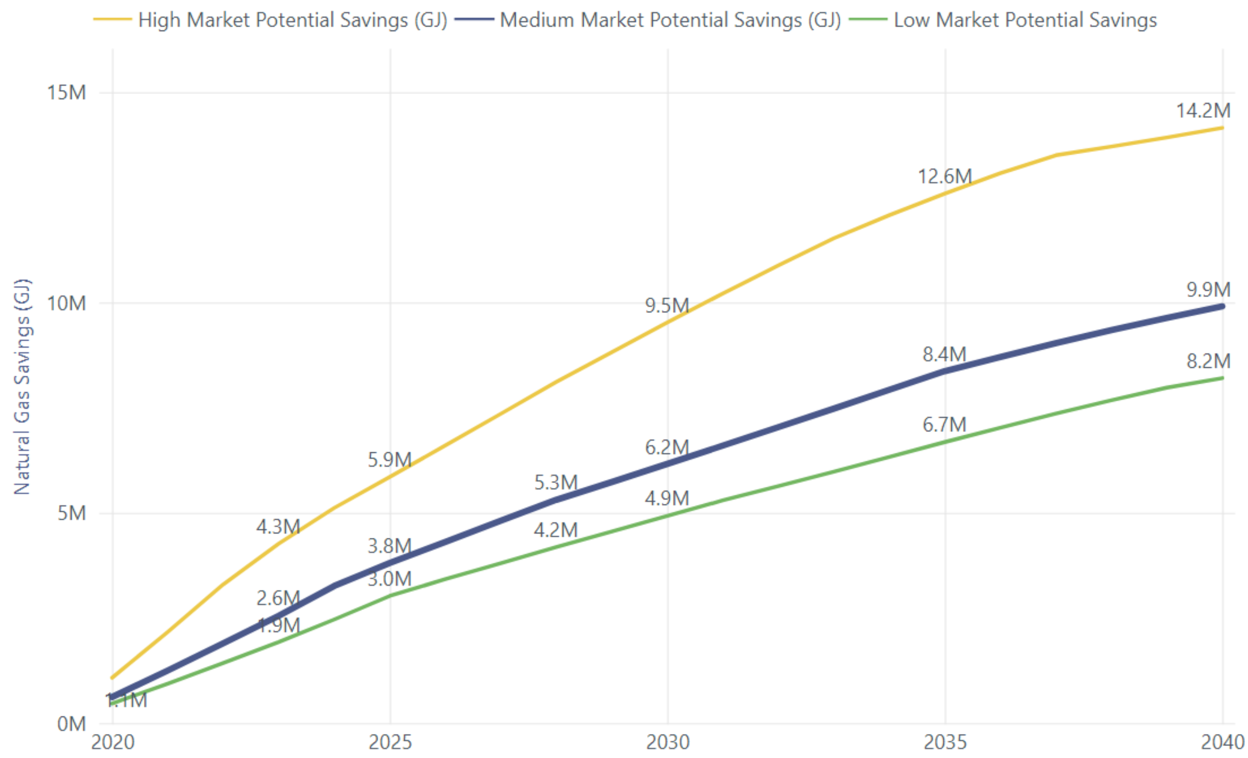
By 2040, the residential low, medium, and high market TRC potential savings are estimated to be 3 PJ, 3.4 PJ, and 4.3 PJ, respectively. By 2040, the low, medium, and high market MTRC potential savings are estimated to be 8.2 PJ, 9.9 PJ, and 14.2 PJ, respectively.

Exhibit 43 – Market Potential Savings (GJ) – Residential, TRC



POSTERITY GROUP

Exhibit 44 – Market Potential Savings (GJ) – Residential, MTRC



The forecasted residential gas consumption under the three market potential scenarios relative to reference case scenario is shown in Exhibit 45 (TRC) and Exhibit 46 (MTRC). The reference consumption is forecasted to drop to 73 PJ, from 77 PJ today. By 2040, the residential low, medium, and high market TRC potential consumption levels are estimated to be 70 PJ, 69.6 PJ, and 69 PJ, respectively. By 2040, the low, medium, and high market MTRC potential consumption levels are estimated to be 65 PJ, 63 PJ, and 59 PJ, respectively.

### Exhibit 45 – Market Potential Consumption (GJ) Forecasts – Residential, TRC

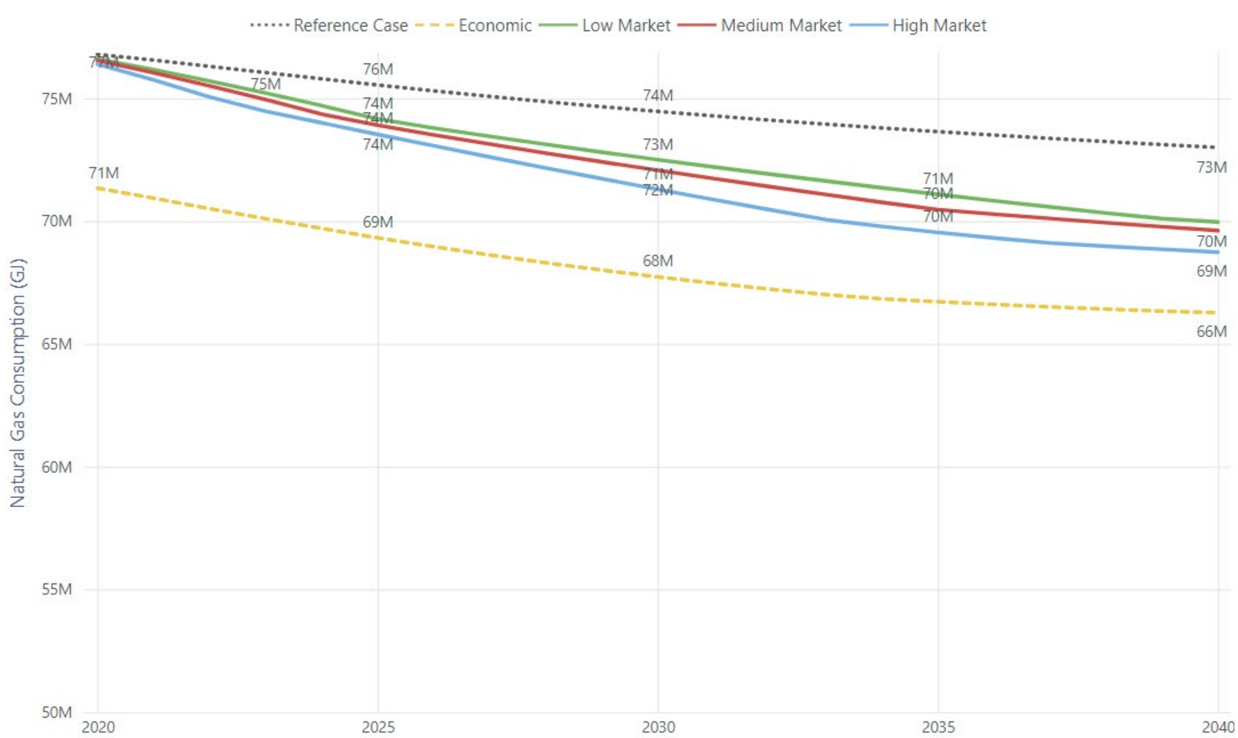
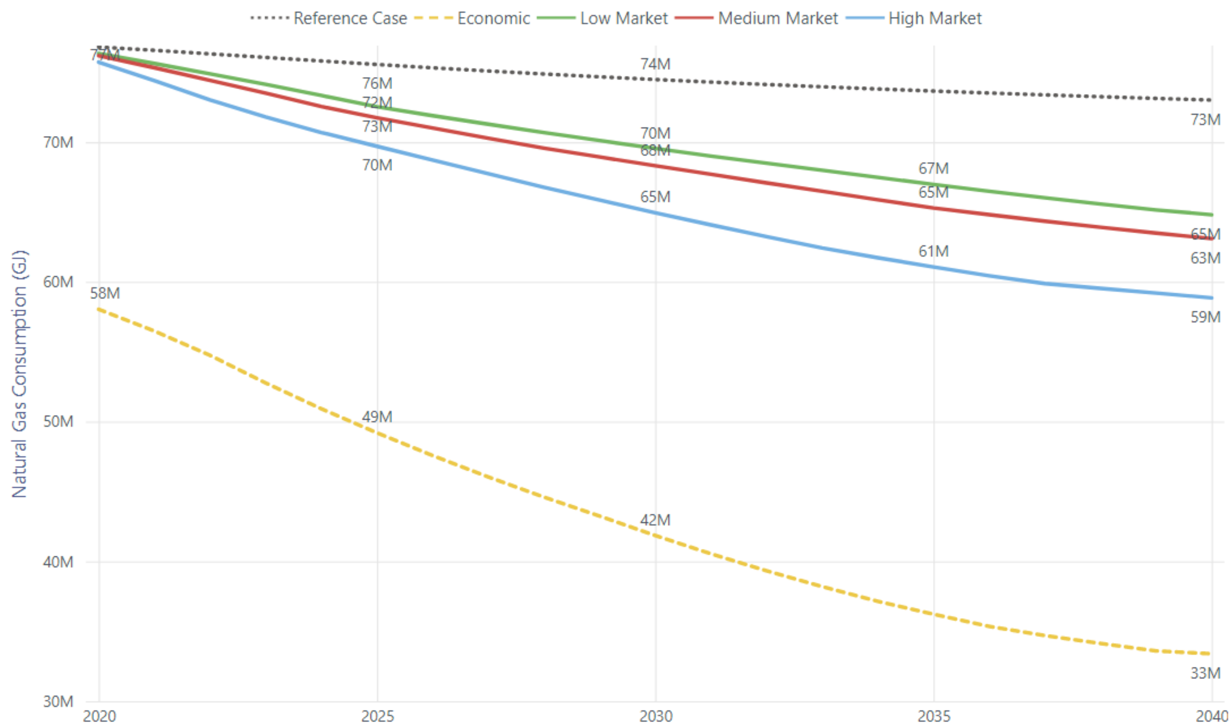


Exhibit 46 – Market Potential Consumption (GJ) Forecasts – Residential, MTRC




The remainder of this section presents detailed results of the medium market potential scenario only. Similarly detailed results of the low and high market potential scenarios can be found on the Power BI dashboard and the Excel workbooks.

### *Results by Region*

The medium market potential savings for 2025 are presented by region in Exhibit 47 and Exhibit 48 using TRC and MTRC screen, respectively. Medium market potential savings in 2025 are estimated to be 2% of reference case consumption in all regions with TRC screen, and 5% with MTRC. The largest portion savings is expected to be in the Lower Mainland x Vancouver region.

Exhibit 47 – Medium Market Potential Savings by Region in 2025 – Residential, TRC

| Region | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Lower Mainland x Van | 40,757K | 876K | 2% |
| Southern Interior | 14,701K | 339K | 2% |
| City of Vancouver | 9,007K | 202K | 2% |
| Vancouver Island | 6,280K | 128K | 2% |
| Northern BC | 4,517K | 92K | 2% |
| Whistler | 290K | 6K | 2% |
| **Total** | **75,552K** | **1,642K** | **2%** |

Exhibit 48 – Medium Market Potential Savings by Region in 2025 – Residential, MTRC

| Region | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Lower Mainland x Van | 40,757K | 2,054K | 5% |
| Southern Interior | 14,701K | 767K | 5% |
| City of Vancouver | 9,007K | 451K | 5% |
| Vancouver Island | 6,280K | 301K | 5% |
| Northern BC | 4,517K | 225K | 5% |
| Whistler | 290K | 12K | 4% |
| **Total** | **75,552K** | **3,810K** | **5%** |

### *Results by Segment and Vintage*

The TRC and MTRC economic potential savings in 2025 are presented by segment and vintage in Exhibit 49 and Exhibit 50 respectively. Single-family dwellings present the most market potential under both economic screens.

Exhibit 49 – Medium Market Potential Savings by Segment and Vintage in 2025 – Residential, TRC

| Segment | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| ⊟ **SFD/Duplex** | **67,869K** | **1,503K** | **2%** |
| 1950-1975 | 16,604K | 427K | 3% |
| 1986-1995 | 9,572K | 233K | 2% |
| 1976-1985 | 8,892K | 215K | 2% |
| Pre-1950 | 7,885K | 199K | 3% |
| 1996-2005 | 7,606K | 187K | 2% |
| 2006-2015 | 6,144K | 152K | 2% |
| Post-2015 | 11,166K | 91K | 1% |
| ⊟ **Attached/Row** | **5,783K** | **108K** | **2%** |
| 1986-1995 | 1,367K | 30K | 2% |
| 1996-2005 | 1,115K | 25K | 2% |
| Post-2015 | 1,654K | 16K | 1% |
| 2006-2015 | 619K | 14K | 2% |
| 1976-1985 | 553K | 12K | 2% |
| 1950-1975 | 397K | 8K | 2% |
| Pre-1950 | 77K | 2K | 2% |
| ⊟ **Mobile/other** | **1,900K** | **31K** | **2%** |
| All | 1,900K | 31K | 2% |
| **Total** | **75,552K** | **1,642K** | **2%** |

Exhibit 50 – Medium Market Potential Savings by Segment and Vintage in 2025 – Residential, MTRC

| Segment | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| **SFD/Duplex** | **67,869K** | **3,472K** | **5%** |
| 1950-1975 | 16,604K | 935K | 6% |
| 1986-1995 | 9,572K | 545K | 6% |
| 1976-1985 | 8,892K | 505K | 6% |
| Pre-1950 | 7,885K | 438K | 6% |
| 1996-2005 | 7,606K | 435K | 6% |
| 2006-2015 | 6,144K | 351K | 6% |
| Post-2015 | 11,166K | 264K | 2% |
| **Attached/Row** | **5,783K** | **262K** | **5%** |
| 1986-1995 | 1,367K | 74K | 5% |
| 1996-2005 | 1,115K | 60K | 5% |
| Post-2015 | 1,654K | 41K | 3% |
| 2006-2015 | 619K | 31K | 5% |
| 1976-1985 | 553K | 30K | 5% |
| 1950-1975 | 397K | 21K | 5% |
| Pre-1950 | 77K | 4K | 5% |
| **Mobile/other** | **1,900K** | **75K** | **4%** |
| All | 1,900K | 75K | 4% |
| **Total** | **75,552K** | **3,810K** | **5%** |

### *Results by End Use*

The TRC and MTRC medium market potential savings in 2025 are presented by segment in Exhibit 51 and Exhibit 52 respectively. In the TRC potential, the largest amount of absolute savings in 2025 are expected to be from domestic hot water (DHW) end use. These savings are roughly 6% of the DHW end use reference case consumption in that year. In the MTRC potential, the largest absolute savings in 2025 come from space heating end use, even though these savings amount to only 4% of the end use reference case consumption. When evaluating percentages, DHW has a larger potential (11% of the end use consumption in that year). Although small in absolute savings, pool and spa heater end use has the potential of capturing 17% savings under the MTRC screen.

Exhibit 51 – Medium Market Potential Savings by End Use in 2025 – Residential, TRC

| Parent End Use | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Domestic Hot Water (DHW) | 13,205K | 757K | 6% |
| Space Heating | 46,600K | 621K | 1% |
| Fireplace | 11,549K | 246K | 2% |
| Cooking | 1,328K | 11K | 1% |
| Pool & Spa Heaters | 528K | 4K | 1% |
| Clothes Dryer | 229K | 2K | 1% |
| Other Gas Uses | 2,112K | 0K | 0% |
| **Total** | **75,552K** | **1,642K** | **2%** |

Exhibit 52 – Medium Market Potential Savings by End Use in 2025 – Residential, MTRC

| Parent End Use | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Space Heating | 46,600K | 1,951K | 4% |
| Domestic Hot Water (DHW) | 13,205K | 1,503K | 11% |
| Fireplace | 11,549K | 252K | 2% |
| Pool & Spa Heaters | 528K | 89K | 17% |
| Cooking | 1,328K | 11K | 1% |
| Clothes Dryer | 229K | 4K | 2% |
| Other Gas Uses | 2,112K | 0K | 0% |
| **Total** | **75,552K** | **3,810K** | **5%** |

The TRC and MTRC medium market potential savings in 2040 are presented by end use in Exhibit 53. MTRC market potential is almost three times the TRC market potential. The biggest difference between the two economic screen scenarios comes from measures that affect space heating.

Exhibit 53 – Medium Market Potential Savings by End Use in 2040 – Residential, TRC and MTRC

| Parent End Use | Medium Potential Savings (GJ) - TRC | Medium Potential Savings (GJ) - MTRC | Difference (GJ) |
|---|---|---|---|
| Space Heating | 1,154K | 5,049K | 3,895K |
| Domestic Hot Water (DHW) | 1,596K | 3,981K | 2,385K |
| Pool & Spa Heaters | 3K | 219K | 216K |
| Fireplace | 625K | 643K | 18K |
| Clothes Dryer | 1K | 9K | 8K |
| Cooking | 8K | 9K | 0K |
| Other Gas Uses | 0K | 0K | 0K |
| **Total** | **3,388K** | **9,910K** | **6,522K** |

### *Results by Measure*

The medium market potential savings in 2025 of the top 15 residential measures are shown in Exhibit 54. The top measures in the TRC medium market potential are shown on the left and top measures in the MTRC scenario are shown on the right. Home energy reports and low flow showerheads top the list in both scenarios. More space heating measures contribute to savings in the MTRC screen, as evident from the measures list and the end use breakdown difference in Exhibit 55. The sixth measure on the MTRC list on the right side of Exhibit 54 is High-Efficiency (ENERGY STAR) condensing Gas Tankless Water Heater.

Exhibit 54 – Medium Market Potential (TRC on Left, MTRC on Right) -
Top 14 Residential Measures in 2025 (GJ)

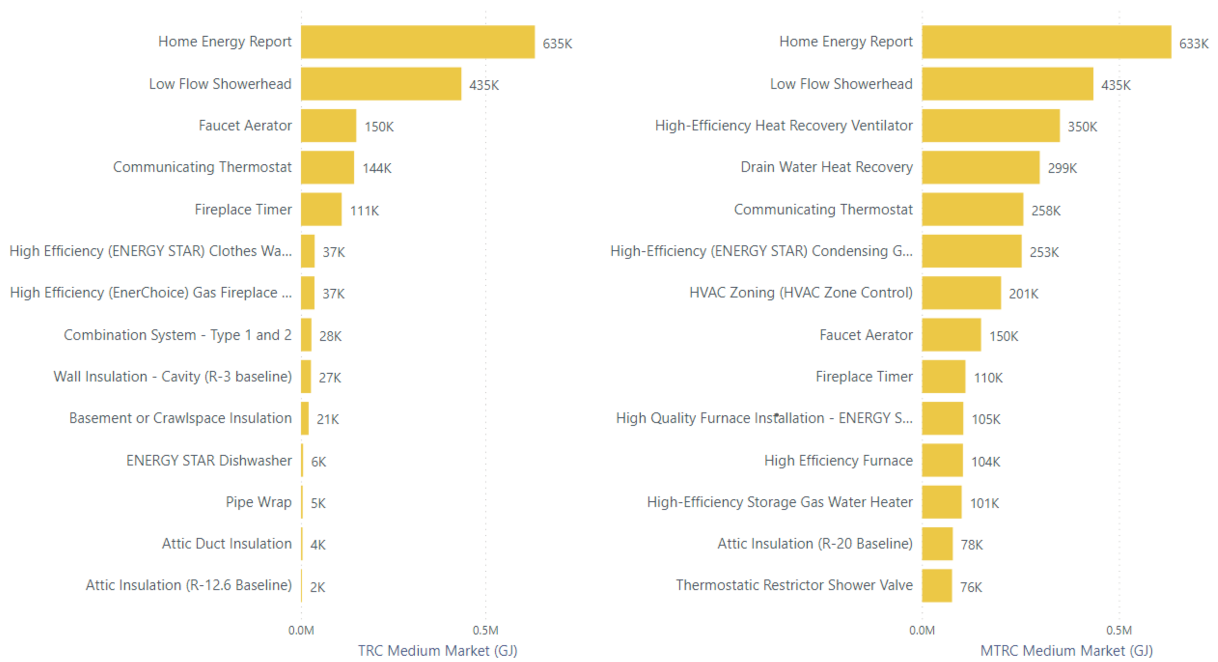
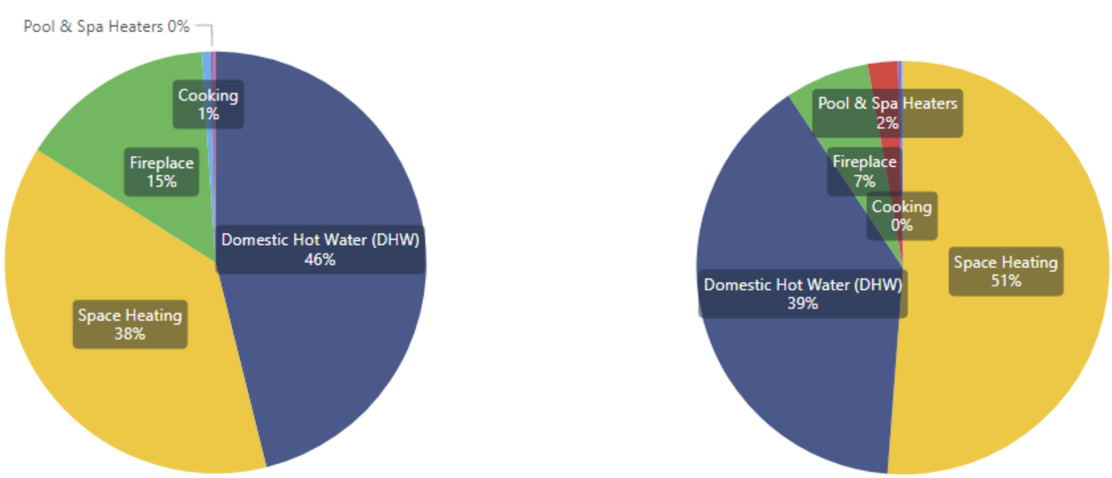



Exhibit 55 – Medium Market Potential (TRC on Left, MTRC on Right) – Savings by End Use in 2025 (%)



### 4.7.1 Incentive and Non-Incentive Spending

The incentive and non-incentive spending required to achieve the medium and high market potential are shown in Exhibit 56 (TRC) and Exhibit 57 (MTRC). Medium and high market incentives are assumed to be 50% and 100% of measures' incremental costs, respectively. In both medium and high scenarios, non-incentive costs are estimated to be 15% of incentive costs. The tables also show the total as well as incremental (that is, savings from new measures installed in a year) savings every year.

**Exhibit 56 – Medium and High Market Incentive Costs and Natural Gas Savings – Residential, TRC**

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $3.5M | $0.5M | $4.0M | 255K | 255K | $12.6M | $1.9M | $14.5M | 397K | 397K |
| 2021 | $3.6M | $0.5M | $4.2M | 513K | 258K | $13.0M | $2.0M | $15.0M | 801K | 405K |
| 2022 | $4.0M | $0.6M | $4.6M | 793K | 280K | $14.6M | $2.2M | $16.8M | 1,251K | 450K |
| 2023 | $4.5M | $0.7M | $5.2M | 1,100K | 307K | $10.9M | $1.6M | $12.6M | 1,576K | 325K |
| 2024 | $5.1M | $0.8M | $5.9M | 1,442K | 342K | $8.1M | $1.2M | $9.3M | 1,794K | 219K |
| 2025 | $3.0M | $0.4M | $3.4M | 1,642K | 199K | $8.3M | $1.2M | $9.5M | 2,016K | 221K |
| 2026 | $2.4M | $0.4M | $2.8M | 1,792K | 151K | $8.4M | $1.3M | $9.7M | 2,240K | 225K |
| 2027 | $2.5M | $0.4M | $2.8M | 1,943K | 151K | $8.6M | $1.3M | $9.9M | 2,468K | 228K |
| 2028 | $2.5M | $0.4M | $2.9M | 2,095K | 152K | $8.8M | $1.3M | $10.1M | 2,700K | 232K |
| 2029 | $2.6M | $0.4M | $3.0M | 2,248K | 153K | $9.0M | $1.3M | $10.3M | 2,935K | 236K |
| 2030 | $2.6M | $0.4M | $3.0M | 2,401K | 154K | $9.2M | $1.4M | $10.6M | 3,175K | 240K |
| 2031 | $2.7M | $0.4M | $3.1M | 2,556K | 155K | $9.1M | $1.4M | $10.5M | 3,414K | 239K |
| 2032 | $2.7M | $0.4M | $3.2M | 2,712K | 156K | $9.1M | $1.4M | $10.5M | 3,653K | 239K |
| 2033 | $2.8M | $0.4M | $3.2M | 2,870K | 157K | $9.1M | $1.4M | $10.5M | 3,893K | 239K |
| 2034 | $2.9M | $0.4M | $3.3M | 3,029K | 159K | $8.0M | $1.2M | $9.2M | 4,015K | 123K |
| 2035 | $2.9M | $0.4M | $3.4M | 3,178K | 149K | $8.0M | $1.2M | $9.2M | 4,107K | 92K |
| 2036 | $2.5M | $0.4M | $2.9M | 3,222K | 43K | $7.8M | $1.2M | $9.0M | 4,196K | 89K |
| 2037 | $2.5M | $0.4M | $2.9M | 3,265K | 43K | $6.7M | $1.0M | $7.7M | 4,265K | 69K |
| 2038 | $2.4M | $0.4M | $2.8M | 3,307K | 42K | $4.3M | $0.6M | $4.9M | 4,264K | -1K |
| 2039 | $2.4M | $0.4M | $2.7M | 3,347K | 41K | $4.3M | $0.6M | $4.9M | 4,265K | 1K |
| 2040 | $2.3M | $0.4M | $2.7M | 3,388K | 40K | $4.4M | $0.7M | $5.1M | 4,268K | 4K |

Exhibit 57 – Medium and High Market Incentive Costs and Natural Gas Savings – Residential, MTRC

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $41.2M | $6.2M | $47.4M | 622K | 622K | $152.3M | $22.8M | $175.1M | 1,080K | 1,080K |
| 2021 | $42.2M | $6.3M | $48.5M | 1,250K | 628K | $155.5M | $23.3M | $178.9M | 2,170K | 1,089K |
| 2022 | $43.1M | $6.5M | $49.6M | 1,897K | 647K | $159.7M | $24.0M | $183.6M | 3,300K | 1,130K |
| 2023 | $44.0M | $6.6M | $50.6M | 2,556K | 659K | $156.9M | $23.5M | $180.4M | 4,267K | 967K |
| 2024 | $45.2M | $6.8M | $51.9M | 3,262K | 706K | $148.8M | $22.3M | $171.1M | 5,117K | 850K |
| 2025 | $43.1M | $6.5M | $49.6M | 3,810K | 548K | $132.1M | $19.8M | $151.9M | 5,855K | 738K |
| 2026 | $43.3M | $6.5M | $49.8M | 4,310K | 500K | $135.8M | $20.4M | $156.2M | 6,601K | 746K |
| 2027 | $44.0M | $6.6M | $50.6M | 4,811K | 501K | $140.0M | $21.0M | $160.9M | 7,355K | 754K |
| 2028 | $44.5M | $6.7M | $51.2M | 5,310K | 499K | $142.9M | $21.4M | $164.3M | 8,112K | 757K |
| 2029 | $36.9M | $5.5M | $42.4M | 5,735K | 424K | $130.6M | $19.6M | $150.2M | 8,822K | 710K |
| 2030 | $38.0M | $5.7M | $43.7M | 6,164K | 429K | $130.4M | $19.6M | $150.0M | 9,529K | 706K |
| 2031 | $39.0M | $5.9M | $44.9M | 6,598K | 434K | $128.0M | $19.2M | $147.2M | 10,214K | 685K |
| 2032 | $40.2M | $6.0M | $46.2M | 7,036K | 438K | $125.9M | $18.9M | $144.8M | 10,879K | 665K |
| 2033 | $41.4M | $6.2M | $47.6M | 7,479K | 443K | $124.4M | $18.7M | $143.0M | 11,527K | 648K |
| 2034 | $42.7M | $6.4M | $49.1M | 7,926K | 448K | $121.6M | $18.2M | $139.9M | 12,077K | 550K |
| 2035 | $44.0M | $6.6M | $50.6M | 8,370K | 443K | $119.1M | $17.9M | $137.0M | 12,589K | 511K |
| 2036 | $41.9M | $6.3M | $48.2M | 8,707K | 337K | $116.2M | $17.4M | $133.6M | 13,076K | 487K |
| 2037 | $41.4M | $6.2M | $47.6M | 9,038K | 331K | $109.0M | $16.4M | $125.4M | 13,502K | 426K |
| 2038 | $39.5M | $5.9M | $45.4M | 9,345K | 307K | $89.6M | $13.4M | $103.0M | 13,710K | 207K |
| 2039 | $37.7M | $5.7M | $43.3M | 9,633K | 289K | $89.6M | $13.4M | $103.1M | 13,923K | 213K |
| 2040 | $36.9M | $5.5M | $42.4M | 9,910K | 276K | $91.9M | $13.8M | $105.7M | 14,153K | 230K |

# 5 Commercial Sector Results

This section presents the commercial sector results and key findings, including:

- Base year (2019) natural gas use
- Reference case consumption forecast (2020 – 2040)
- Energy conservation measures evaluated in this CPR
- Technical potential savings
- Economic potential savings
- Market potential savings and scenarios

## 5.1 Commercial Segments and End Uses

In this CPR, the commercial sector is divided into 17 segments, five energy end uses, and two vintages.

**Exhibit 58 – Definition of Commercial Sector Segments, End Uses, and Vintages**

| | Segments (17) | End Uses[35] (5) | Vintages (2) |
|---|---|---|---|
| *Commercial Sector* | • Apartments – Medium<br>• Apartments – Large<br>• Food Retail<br>• Hospital<br>• Hotel – Medium<br>• Hotel – Large<br>• Non-Food Retail – Medium<br>• Non-Food Retail – Large<br>• Nursing Home<br>• Office – Medium<br>• Office – Large<br>• Other Commercial[36]<br>• Restaurant<br>• School – Medium<br>• School – Large<br>• University/College<br>• Warehouse | • Cooking<br>• Domestic Hot Water<br>• Other[37]<br>• Pools, Spas & Hot tubs<br>• Space Heating | • Existing<br>• New |

35 All-electric end uses, such as clothes washer, lighting or plug loads, are not included in the reported results therefore are excluded from the End Uses row of this table.
36 The “other” segment includes facilities that do not fit into any of the other segments.
37 The “other” end use is a catch all for equipment that account for a small portion of consumption in the sector. In the commercial sector, examples of ‘other’ equipment are patio heaters and laundry dryers.

## 5.2 Base Year Natural Gas Use

This section profiles the base year (2019) natural gas consumption for the commercial sector. Please see Appendix A in the CPR Method Appendices document for how commercial NAICS codes were categorized into segments.

The following exhibits summarize how natural gas is used in the commercial sector by segment[38], end use, and region, respectively.

Natural gas consumption in the commercial sector base year is highest:

- In the apartment (31%), other (19%) and office (11%) segments
- In the space heating (56%) and water heating (31%) end uses
- In the Lower Mainland excluding Vancouver ("Lower Mainland x Vancouver") (48%) and the City of Vancouver (21%) regions

Exhibit 59 – 2019 Commercial Natural Gas Consumption (GJ) by Segment

| Segment | Consumption (GJ) | % |
|---|---|---|
| Apartment | 19,568K | 31% |
| Other | 12,201K | 19% |
| Office | 7,084K | 11% |
| Restaurant | 4,271K | 7% |
| Warehouse | 4,231K | 7% |
| Nonfood Retail | 3,587K | 6% |
| Hospital | 3,067K | 5% |
| Hotel | 2,553K | 4% |
| School | 2,271K | 4% |
| University/College | 1,987K | 3% |
| Nursing Home | 1,665K | 3% |
| Food Retail | 1,453K | 2% |
| **Total** | **63,938K** | **100%** |

38 Several commercial segments are further segmented by size (large or medium/small) including apartment, hotel, nonfood retail, office and school. The "other" segment includes facilities that do not fit into any of the other segments.

Exhibit 60 – 2019 Commercial Natural Gas Consumption (GJ) by End Use

| Parent End Use | Consumption (GJ) | % |
|---|---|---|
| Space heating | 35,556K | 56% |
| Water heating | 19,619K | 31% |
| Food Service | 4,800K | 8% |
| Other | 3,384K | 5% |
| Pools; Spas & Hot Tubs | 579K | 1% |
| **Total** | **63,938K** | **100%** |

Exhibit 61 – 2019 Commercial Natural Gas Consumption (GJ) by Region

| Region | Consumption (GJ) | % |
|---|---|---|
| Lower Mainland x Van | 30,920K | 48% |
| City of Vancouver | 13,507K | 21% |
| Southern Interior | 9,153K | 14% |
| Vancouver Island | 6,881K | 11% |
| Northern BC | 2,809K | 4% |
| Whistler | 667K | 1% |
| **Total** | **63,938K** | **100%** |

### 5.2.1 Accounts

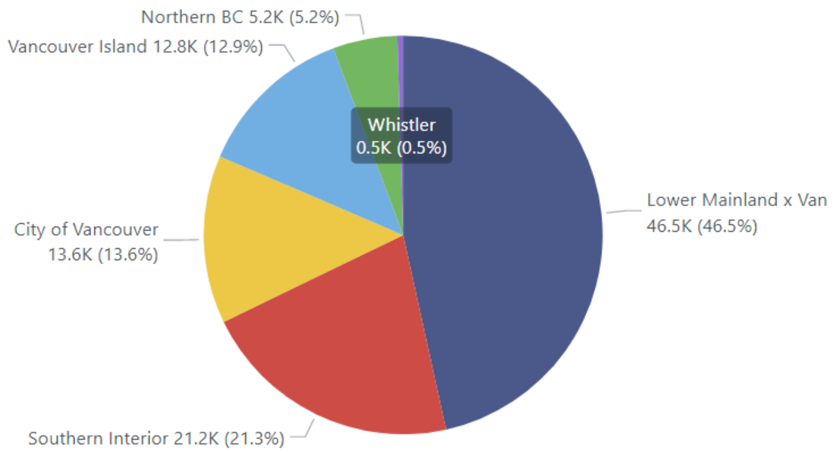
Base year commercial natural gas accounts are presented by segment in Exhibit 62 and by region in Exhibit 63. As shown in these exhibits, in 2019 the greatest number of commercial natural gas accounts were in:

- The other (30%), apartment (27%), office (13%), and nonfood retail (11%) segments
- The Lower Mainland excluding Vancouver region (47% of accounts)

Exhibit 62 – 2019 Commercial Natural Gas Accounts by Segment

| Segment | Accounts | % |
|---|---|---|
| Other | 29,520 | 30% |
| Apartment | 26,813 | 27% |
| Office | 13,359 | 13% |
| Nonfood Retail | 11,211 | 11% |
| Restaurant | 6,701 | 7% |
| Warehouse | 4,289 | 4% |
| Food Retail | 1,857 | 2% |
| School | 1,713 | 2% |
| Hospital | 1,640 | 2% |
| Hotel | 1,534 | 2% |
| Nursing Home | 660 | 1% |
| University/College | 524 | 1% |
| **Total** | **99,821** | **100%** |

Exhibit 63 – 2019 Commercial Natural Gas Accounts by Region




### 5.2.2 Tertiary Load

Tertiary load is the useful energy delivered to an end use. In the context of the CPR, tertiary load is the amount of energy required to be delivered as an end use *service*: heat delivered by a boiler to a square meter of office space, for example. This differs from consumption of natural gas which is impacted by the efficiency of the equipment: in the boiler example, consumption is equal to the tertiary load divided by the seasonal efficiency of the boiler.

### 5.2.3 Unit Energy Consumption

Recall that unit energy consumption (UEC) is the amount of energy used by each end use per unit (a "unit" in the commercial sector is square meter of floor area) and fuel share is the percentage of the energy end use that is supplied by each fuel.

This section presents a sample calculation of UEC for the space heating end use. Along with UEC values is *unit tertiary load*, which is the average tertiary load, by end use, per square meter, and *stock average efficiency*, which is the average efficiency of equipment serving the tertiary load for that end use. These values are included in the table because UEC by end use is calculated by dividing unit tertiary load with stock average efficiency. Values are presented for one segment, region and end use as an example.

Exhibit 64 presents unit tertiary load, stock average efficiency and UEC values for space heating in large offices in the Lower Mainland excluding Vancouver region.

**Exhibit 64 – 2019 Space Heating UEC values by End Use, Large Offices in the Lower Mainland**

| | Unit Tertiary Load ($GJ/m^2.yr.$) | Stock Average Efficiency (%) | UEC ($GJ/m^2.yr.$) |
|---|---|---|---|
| Space heating | 0.3 | 80% | 0.3 |

### 5.2.4 Average Natural Gas Use per Building

The following exhibit presents average annual natural gas consumption per $m^2$ for space heating. Included in the exhibit is:

- UEC: the amount of energy used by each end use per unit. The "unit" in commercial sector is square meter of floor area.
- Fuel Share: the percentage of the energy end use that is supplied by each fuel (in this case, natural gas).
- Saturation: reflects the extent to which an end use is present in a region, and segment.

Average annual gas consumption per unit is calculated by multiplying these three variables together; therefore, they are included in the table below. Values are presented for one segment, region and end use as an example.

Exhibit 65 presents average annual gas use for space heating per large office in the Lower Mainland excluding Vancouver ("LML") region.

**Exhibit 65 – 2019 Average Annual Space Heating Gas Use Per $m^2$, Large Offices, LML**

| | UEC | Fuel Share | Saturation | Average Annual Gas Use ($GJ/m^2.yr.$) |
|---|---|---|---|---|
| Space heating | 0.3 | 75% | 100% | 0.25 |

## 5.3 Reference Case Natural Gas Use

This section profiles the reference case forecast (2020-2040) natural gas consumption for the commercial sector.

Overall gas consumption in the commercial sector is forecasted to increase over time: consumption in 2040 is expected to be approximately 26% higher than consumption in 2020, with an average annual increase of about 1% from 2020 to 2040. Consumption patterns from 2019 base year are expected to persist throughout the reference case. Natural gas is expected to continue to be used largely in apartments, other and office segments (as shown in Exhibit 66), for space heating (Exhibit 67) and in the Lower Mainland excluding Vancouver region (Exhibit 68).

The forecasted increase in commercial gas consumption can be explained by the following trends:

- There is a forecasted increase in the number of commercial accounts, as seen in Exhibit 69. The growth in accounts is somewhat counterbalanced by a decrease in usage per square meter. However, the decrease in usage per square meter is less than 0.5% per year on average while the increase in floor area due to account growth is more than 1.5% per year. The net result is consumption is forecasted to increase by about 1% per year.
- FortisBC has observed ongoing growth in commercial accounts in recent years with little change in usage per customer. The growth we have estimated is somewhat less than the historical trend, because of our assumed improvement in efficiency. We expect growth in commercial consumption to be further reduced by the future Step Code changes.

Exhibit 66 – 2020 vs 2040 Commercial Gas Consumption Forecast (GJ) by Segment

| Segment | 2020 | 2040 | Change % |
|---|---|---|---|
| Apartment | 19,968K | 24,618K | 23% |
| Other | 12,440K | 15,991K | 29% |
| Office | 7,205K | 9,086K | 26% |
| Restaurant | 4,373K | 5,743K | 31% |
| Nonfood Retail | 3,634K | 4,701K | 29% |
| Warehouse | 4,215K | 4,639K | 10% |
| Hotel | 2,540K | 3,628K | 43% |
| Hospital | 3,082K | 3,437K | 12% |
| School | 2,320K | 3,319K | 43% |
| Nursing Home | 1,713K | 2,608K | 52% |
| Food Retail | 1,478K | 2,194K | 48% |
| University/College | 1,986K | 2,009K | 1% |
| **Total** | **64,953K** | **81,973K** | **26%** |

Space heating and water heating end uses are expected to grow slower than other end uses, as shown in Exhibit 67. This also implies a slight decline in their ratio to overall building consumption by 2040. This decline is largely driven by:

- Improved new construction practices and more stringent equipment performance standards.
- Natural replacement of space heating and water heating equipment at the end of life. It is assumed that 50% of those replacing such equipment would adopt space heating equipment that was 85% efficient and water heating equipment that was 80% efficient. As a result, the average consumption per square meter for these two end uses was assumed to be declining slightly with time.

Exhibit 67 – 2020 vs 2040 Commercial Gas Consumption Forecast (GJ) by End Use

| Parent End Use | 2020 | 2040 | Change % |
|---|---|---|---|
| Space heating | 36,063K | 45,300K | 26% |
| Water heating | 19,948K | 24,552K | 23% |
| Food Service | 4,907K | 6,780K | 38% |
| Other | 3,448K | 4,557K | 32% |
| Pools; Spas & Hot Tubs | 587K | 784K | 34% |
| **Total** | **64,953K** | **81,973K** | **26%** |

Exhibit 68 – 2020 vs 2040 Commercial Gas Consumption Forecast (GJ) by Region

| Region | 2020 | 2040 | Change % |
|---|---|---|---|
| Lower Mainland x Van | 31,574K | 39,777K | 26% |
| City of Vancouver | 13,746K | 16,815K | 22% |
| Southern Interior | 9,274K | 13,076K | 41% |
| Vancouver Island | 6,877K | 7,429K | 8% |
| Northern BC | 2,834K | 3,975K | 40% |
| Whistler | 648K | 901K | 39% |
| **Total** | **64,953K** | **81,973K** | **26%** |

Exhibit 69 – 2020 vs 2040 Commercial Gas Accounts Forecast by Segment

| Segment | 2020 | 2040 | Change % |
|---|---|---|---|
| Other | 29,862 | 37,176 | 24% |
| Apartment | 27,174 | 33,437 | 23% |
| Office | 13,492 | 16,116 | 19% |
| Nonfood Retail | 11,320 | 13,503 | 19% |
| Restaurant | 6,777 | 8,329 | 23% |
| Warehouse | 4,330 | 5,168 | 19% |
| Food Retail | 1,880 | 2,346 | 25% |
| School | 1,740 | 2,319 | 33% |
| Hotel | 1,556 | 2,010 | 29% |
| Hospital | 1,656 | 1,973 | 19% |
| Nursing Home | 672 | 971 | 44% |
| University/College | 529 | 662 | 25% |
| **Total** | **100,988** | **124,010** | **23%** |

### 5.3.1 Commercial Reference Case Natural Gas Use: Existing versus New Buildings

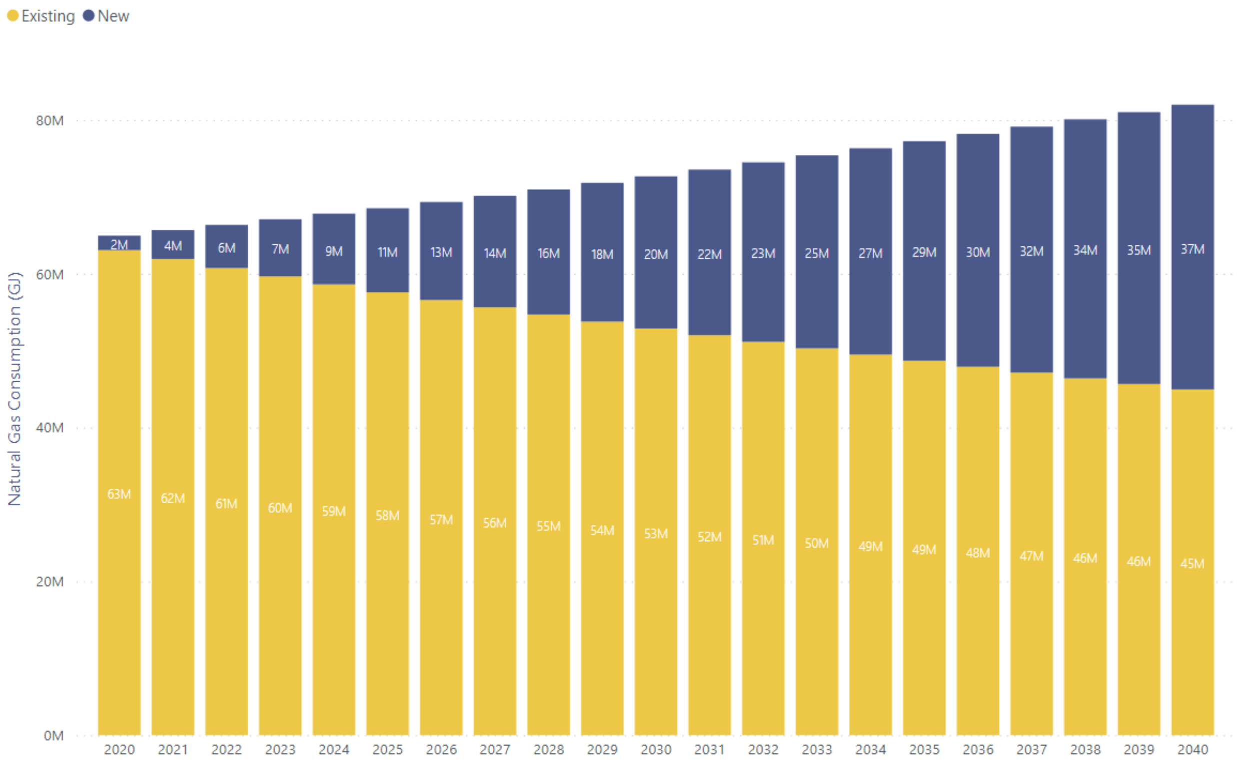
This section compares the consumption in existing versus new commercial facilities in the reference case forecast. Estimated new construction rates are drawn from rate-class level estimates developed by FEI and are applied by segment. Demolition rates are estimated at approximately 2% of floor area per year and held constant across segments. It is assumed that existing commercial buildings that are demolition are replaced by newly constructed buildings. This results in a forecasted commercial gas account increase of 23% by 2040, as shown in Exhibit 70.

In 2020, natural gas consumption from new buildings was roughly two million GJ, or 3% of the total commercial sector consumption. By 2040, new buildings are forecasted to use 37 million GJ (45% of total sector), as shown in Exhibit 71.

Exhibit 70 – 2020 vs 2040 Commercial Gas Accounts Forecast by Existing and New Vintage

| Existing/New | 2020 | 2040 | Change % |
|---|---|---|---|
| Existing | 97,844 | 65,843 | -33% |
| New | 3,144 | 58,167 | 1,750% |
| **Total** | **100,988** | **124,010** | **23%** |

Exhibit 71 – 2020 vs 2040 Commercial Gas Consumption Forecast (GJ) by Existing and New Vintage



## 5.4 Measure Assessment

### 5.4.1 List of Measures

The list of commercial measures that were included in this CPR are presented in Exhibit 72. The measures are divided into categories by end use and measure type.

Please see the MS Excel file entitled "Com_Measure Analysis Workbook" for a description of each measure and a full analysis.

Measures were classified in five measure type categories:

- Building Envelope
- Equipment
- Controls
- Energy Management (including behavioral measures)
- New Construction – all new construction measures were placed in a separate category

New construction measures are analyzed using a whole-building approach, represented by the Step 2 - Step 4 BC Energy Step Code measures listed below. See Appendix O of the CPR Appendices document for the modelling approach used to assess these measures.

Exhibit 72 – Commercial Sector Conservation and Energy Management Measures

| | |
|---|---|
| **Appliances – Equipment** | **New Construction** |
| Demand Control Kitchen Ventilation<br>Efficient Pre-Rinse Spray Valve<br>Efficient Commercial Cooking Equipment<br>ENERGY STAR Dishwasher<br>ENERGY STAR Clothes washer | Step 2 Level-of-Performance<br>Step 3 Level-of-Performance<br>Step 4 Level-of-Performance |
| **Pool & Spa Heaters – Equipment** | **Space Heating – Equipment** |
| Indoor Pool Cover<br>Outdoor Pool Cover<br>Solar Water Pool Heating | Advanced BAS<br>Advanced Thermostats<br>Air Curtains<br>Condensing Boiler – Early/ROB<br>Condensing MUAs – Early/ROB<br>Condensing Unit Heaters<br>Destratification Fans<br>Dock Door Seals |

**Space Heating – Envelope**

Deep Energy Retrofits[39]
High-Performance Air Sealing
High-Performance Window Upgrade
Low-e Window Film
Panelized Retrofit
Roof Insulation
Wall Insulation

Electric Air-to-Water Heat Pump with Existing Gas Furnace or Boiler Backup (Dual-Fuel Measure)
Electric Air-to-Water Heat Pump with New Gas Furnace or Boiler Backup (Dual-Fuel Measure)
Energy Recovery Ventilators
Gas Boiler/Furnace Tune-Up
Hydronic Additives
Heat Recovery – Waste Heat Chiller
Heat Recovery Ventilator
Infrared Heaters
Residential-Style Condensing Furnace – Early/ROB
Reverse Flow Heat Recovery Ventilator
Strip Curtains
Vertical Direct Vent Fireplaces

**Controls**

Advanced Remote Terminal Unit (RTU) Controls
Boiler Combustion Controls
Boiler Cycling Controls
Boiler Zoning Controls
DHW Recirculation Controls
Hotel Occupancy Controls
Return Water Temperature Optimization

**Space Heating & Water Heating - Equipment**

Gas Heat Pumps – Combination Systems

**Water Heating - Equipment**

Condensing DHW – On-Demand
Condensing DHW – Storage
Condensing DHW Supply Boilers
DHW Tank Insulation
Drain Water Heat Recovery
Faucet Aerators
Low-Flow Showerhead
Pipe Insulation
Solar DHW Preheat
Thermostatic Shower Restriction Valve

**Energy Management and Other**

Building Energy Report
Comprehensive Recommissioning
Heat Recovery – Health Care Sterilizers
Multi-Unit Gas Submetering
Occupant Behaviour
Refrigeration Waste Heat Recovery
Rink De-Aerator
Solar Air Preheating
Steam to Hot Water Conversion

[39] Note that analysis that forms the technical, economic and market potential is based on individual measures rather than on “packages of measures” or program delivery approaches. Measures packaged in comprehensive programs such as FortisBC’s Rental Apartment Efficiency program, Social Housing Retrofit Support program and deep energy retrofits were assessed within this analysis individually but not also collectively as a program package.

### 5.4.2 Results

Exhibit 73 shows measure-level results for the commercial sector in order of decreasing cost effectiveness. Measures were assessed based on their replacement type: **retrofit** (immediate replacement at full cost), **replace on burnout** (end of life replacement at incremental cost), or **new construction** (immediate installation at incremental cost).

The TRC and MTRC are presented at the measure-level and exclude program costs and free ridership.

Key findings of the measure assessment for the commercial sector include:

- Of the 71 measures included in the assessment, 46 pass the TRC screen and 69 pass the MTRC screen.
- New Construction Step 2 and 3 pass the TRC screen and Step 4 does not.
- Gas heat pumps (Combination type) pass the TRC.
- Aerosol-applied air sealing passes TRC screen, with significant potential for energy savings in existing buildings (especially MURBs).

Exhibit 73 – Commercial Sector Measures with Average TRC and MTRC Results

| # | Measure | Measure Type | Replacement Type | TRC | MTRC |
|---|---|---|---|---|---|
| 1 | ESTAR Dishwasher | Equipment | ROB | 10 | 10 |
| 2 | Boiler Cycling Controls | Equipment | RET | 6.9 | 34.5 |
| 3 | Steam Trap | Equipment | RET | 5.3 | 28.1 |
| 4 | DHW Tank Insulation | Equipment | RET | 5.5 | 27.9 |
| 5 | Efficient Cook Equipment | Equipment | ROB | 5 | 25.1 |
| 6 | DC Kitchen Vent | Energy Management | RET | 4.9 | 24.6 |
| 7 | Faucet Aerators | Equipment | RET | 4.4 | 22.3 |
| 8 | Boiler Zoning Controls | Equipment | RET | 6 | 20.8 |
| 9 | Occupant Behaviour | Energy Management | RET | 3.6 | 20 |
| 10 | BoilerFurnace Tune-Up | Equipment | RET | 3.6 | 19.4 |
| 11 | Efficient Pre-Rinse Spray | Equipment | RET | 3.6 | 19 |
| 12 | Refrigeration Heat Recovery | Equipment | RET | 3.1 | 15.3 |
| 13 | Low Flow Showerhead | Equipment | RET | 2.8 | 14.5 |
| 14 | Dock Door Seal | Equipment | RET | 2.9 | 13.7 |
| 15 | Lower Boiler Return Temp | Equipment | RET | 2.5 | 11.9 |
| 16 | Condensing Storage DHW | Equipment | ROB | 2.1 | 10.6 |
| 17 | Condensing Boiler (Early) | Equipment | RET | 2 | 10.6 |
| 18 | Direct Vent Fireplace | Equipment | ROB | 2.1 | 10.2 |
| 19 | Advanced Thermostat | Energy Management | RET | 3.8 | 9.5 |
| 20 | Air Curtain | Building Envelope | RET | 1.9 | 9.4 |
| 21 | Strip Curtains | Equipment | RET | 1.8 | 9.4 |
| 22 | Pipe Insulation | Equipment | RET | 1.9 | 9.3 |
| 23 | Condensing Boiler (ROB) | Equipment | ROB | 1.9 | 9 |
| 24 | Air Sealing | Building Envelope | ROB | 1.7 | 7.8 |

| | | | | | |
|---|---|---|---|---|---|
| 25 | Condensing On-Demand DHW | Equipment | ROB | 1.6 | 7.8 |
| 26 | Business Energy Report | Energy Management | RET | 1.8 | 7 |
| 27 | Condensing Make Up Air (ROB) | Equipment | ROB | 1.4 | 6.9 |
| 28 | Condensing Unit Heater | Equipment | RET | 1.4 | 6.9 |
| 29 | Solar Preheat | Equipment | RET | 1.5 | 6.9 |
| 30 | Recirculation Demand Control | Controls | RET | 1.4 | 6.6 |
| 31 | Reverse Flow Energy Recovery Ventilator | Equipment | ROB | 1.3 | 6.5 |
| 32 | Infrared Heaters | Equipment | RET | 1.4 | 6.3 |
| 33 | Boiler Combustion Controlss | Equipment | RET | 1.2 | 5.9 |
| 34 | Passive Drain Water Heat Recovery (DWHR) | Equipment | RET | 1.1 | 5.3 |
| 35 | Gas Heat Pumps - Combination | Equipment | ROB | 1 | 5.1 |
| 36 | Condensing Supply Boiler | Equipment | ROB | 1.1 | 5 |
| 37 | Heating Loop Additive | Equipment | ROB | 0.9 | 5 |
| 38 | Comprehensive Recommissioning (RCx) | Energy Management | RET | 1.4 | 4.5 |
| 39 | HRV | Equipment | ROB | 0.9 | 4.3 |
| 40 | NC Step 2 - Res | New Construction | NEW | 1.9 | 4.3 |
| 41 | NC Step 2 - Com | New Construction | NEW | 2.1 | 4.3 |
| 42 | NC Step 2 - Non-Step | New Construction | NEW | 2.1 | 4.2 |
| 43 | Hotel Controls | Equipment | RET | 2 | 4.1 |
| 44 | Steam to Hot Water | Energy Management | RET | 0.8 | 3.9 |
| 45 | Heat Recovery Chiller | Equipment | ROB | 0.8 | 3.9 |
| 46 | ERV | Equipment | ROB | 0.8 | 3.9 |
| 47 | NC Step 3 - Non-Step | New Construction | NEW | 1.4 | 3.3 |
| 48 | ESTAR Clothes Washer | Equipment | ROB | 0.7 | 3.3 |
| 49 | Window Film | Building Envelope | RET | 2.2 | 3.3 |
| 50 | NC Step 3 - Res | New Construction | NEW | 1.3 | 3.2 |
| 51 | NC Step 3 - Com | New Construction | NEW | 1.4 | 3.2 |
| 52 | Dual-Fuel-Electric Retrofit | Equipment | RET | 0.6 | 3.1 |
| 53 | Vortex De-Aerators | Equipment | RET | 0.6 | 3 |
| 54 | Dual-Fuel-Electric ROB | Equipment | RET | 0.6 | 2.9 |
| 55 | Indoor Pool Cover | Equipment | RET | 0.5 | 2.8 |
| 56 | Destratification | Equipment | RET | 0.6 | 2.7 |
| 57 | Advanced Building Automation System (BAS) | Equipment | RET | 0.5 | 2.3 |
| 58 | Condensing Make Up Air (Early) | Equipment | RET | 0.4 | 2.2 |
| 59 | RTU Controls | Equipment | RET | 1.2 | 2.2 |
| 60 | Roof Insulation | Building Envelope | ROB | 0.5 | 2.2 |
| 61 | Residential Furnace (ROB) | Equipment | ROB | 0.4 | 2.1 |
| 62 | Window Upgrade | Building Envelope | ROB | 0.4 | 2.1 |

| | | | | | |
|---|---|---|---|---|---|
| 63 | NC Step 4 - Non-Step | New Construction | NEW | 0.7 | 1.7 |
| 64 | Residential Furnace (Early) | Equipment | RET | 0.3 | 1.7 |
| 65 | NC Step 4 - Res | New Construction | NEW | 0.6 | 1.6 |
| 66 | Sterilizer Heat Recovery | Equipment | RET | 0.3 | 1.5 |
| 67 | Solar Water Pool | Equipment | RET | 0.3 | 1.2 |
| 68 | Submetering | Equipment | RET | 0.2 | 1.2 |
| 69 | Thermostat Shower Valve | Equipment | RET | 0.2 | 1 |
| 70 | Solar DHW Preheat | Energy Management | RET | 0.2 | 0.8 |
| 71 | Wall Insulation | Building Envelope | ROB | 0.2 | 0.8 |

## 5.5 Technical Potential

This section provides an overview of the technical potential savings results for the commercial sector. Overall results are presented below, followed by measure level results and supply curves for the TRC and MTRC results.

As shown in Exhibit 74, the majority of the commercial technical potential (24 PJ) would be available in 2021 and would increase to 35 PJ in 2040. This indicates that a lot of the available potential (around 11 PJ) would come from replace on burnout measures over the next two decades. The forecasted natural gas consumption is included for reference.

Exhibit 74 – Commercial Technical Potential Savings (GJ)

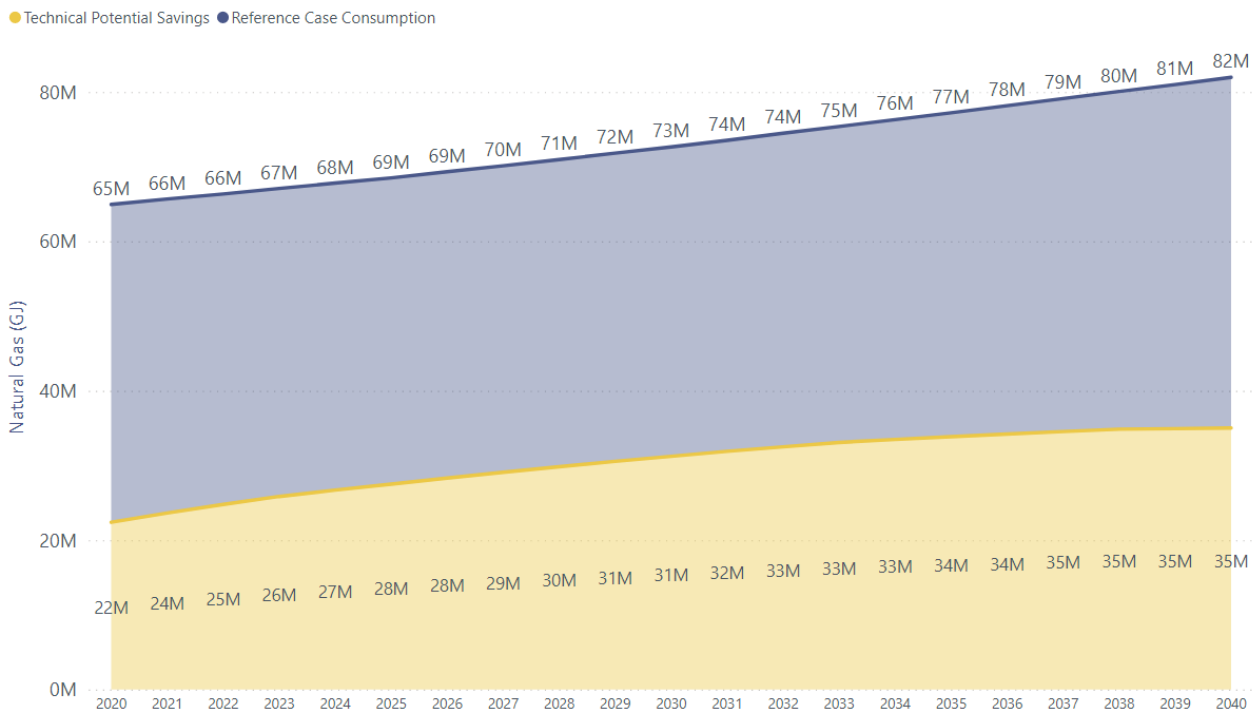
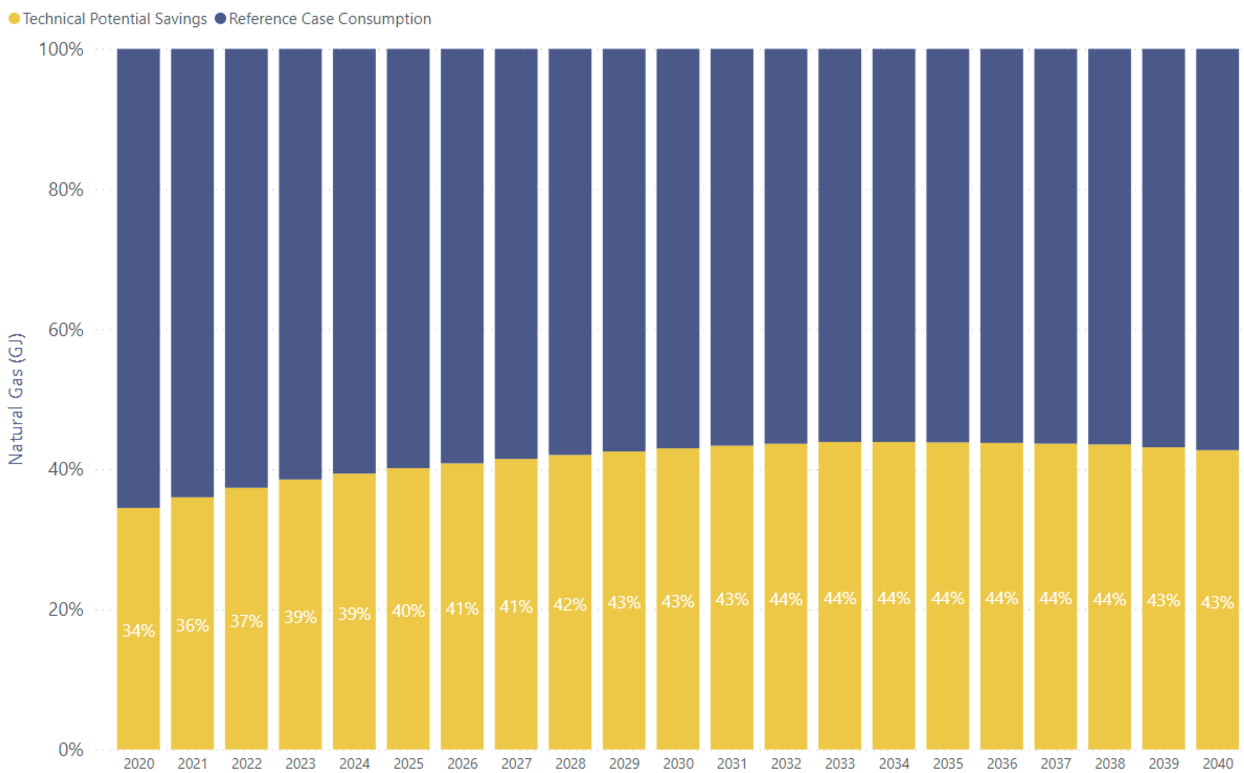


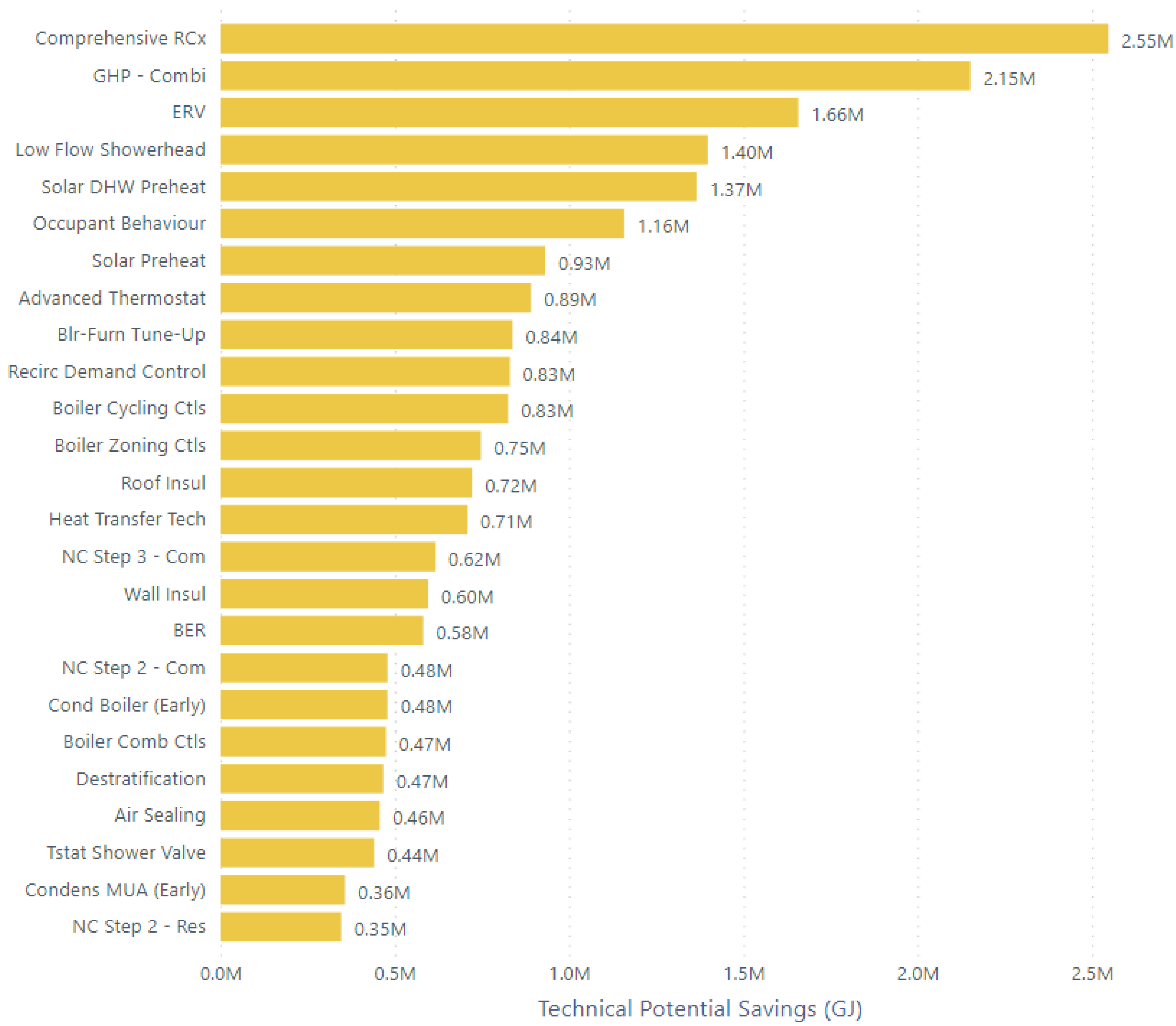
Exhibit 75 – Technical Savings Potential as a Percent of Commercial Reference Case Consumption (%)




As shown in Exhibit 75, the technical potential savings is about 36% of commercial reference case consumption in 2021 and increases to 43% by 2040, further indicating a fairly balance mix of potential from both retrofit and replace on burnout measures.

The technical potential savings in 2025 broken down by measure (only the top 25 measures are shown) are presented in Exhibit 76. From the top 5 measures that are expected to contribute the majority of the technical potential savings, only Solar DHW Preheat does not pass the TRC test. This means that the rest (the top 4) will also be expected to contribute largely to economic potential savings, as described in the following section.

Exhibit 76 – Technical Potential - Top 25 Commercial Measures in 2025 (GJ)

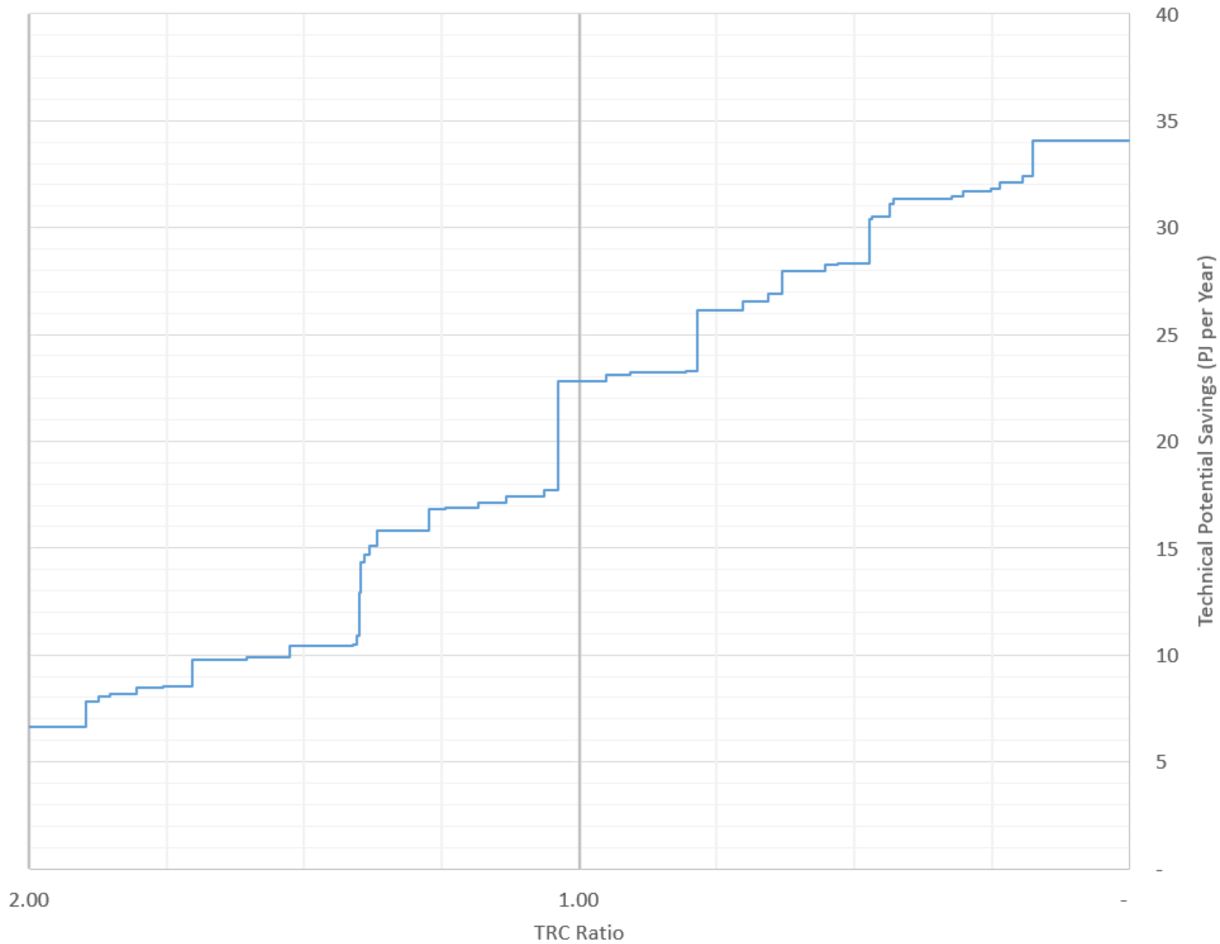


The cumulative commercial sector technical potential savings in 2040 are presented in Exhibit 77 as a supply curve, with measures ordered by decreasing TRC ratio from left to right.

As shown, approximately 68% of the commercial sector technical potential savings (approximately 23 of 34 PJ) comes from measures with a TRC of 1.0 or higher.

Approximately 7 PJ of savings come from measures with a TRC ratio of greater than 7. These are shown in aggregate.

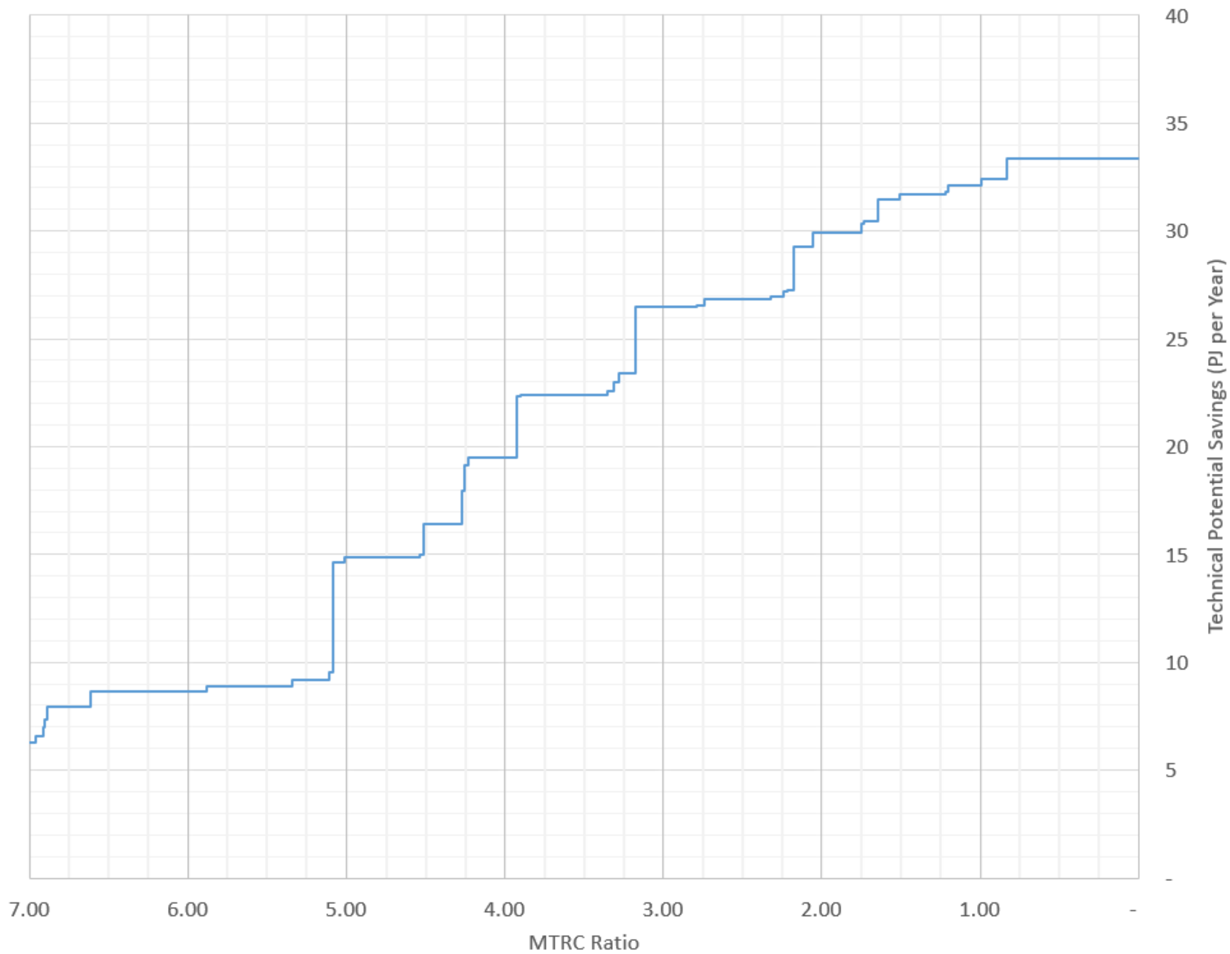
Exhibit 77 – Commercial Sector: Technical Potential Gas Supply Curve in 2040 – TRC Ratio



Similar to Exhibit 77, the cumulative commercial sector technical potential savings in 2040 are presented in Exhibit 78 as a supply curve, with measures ordered by decreasing MTRC ratio from left to right.

As shown, approximately 95% of the commercial sector technical potential savings (approximately 32 of 34 PJ) by 2040, comes from measures with an MTRC of 1.0 or higher. Approximately 6 PJ of savings come from measures with an MTRC ratio of greater than 7. These are shown in aggregate.

Exhibit 78 – Commercial Sector: Technical Potential Supply Curve – MTRC Ratio

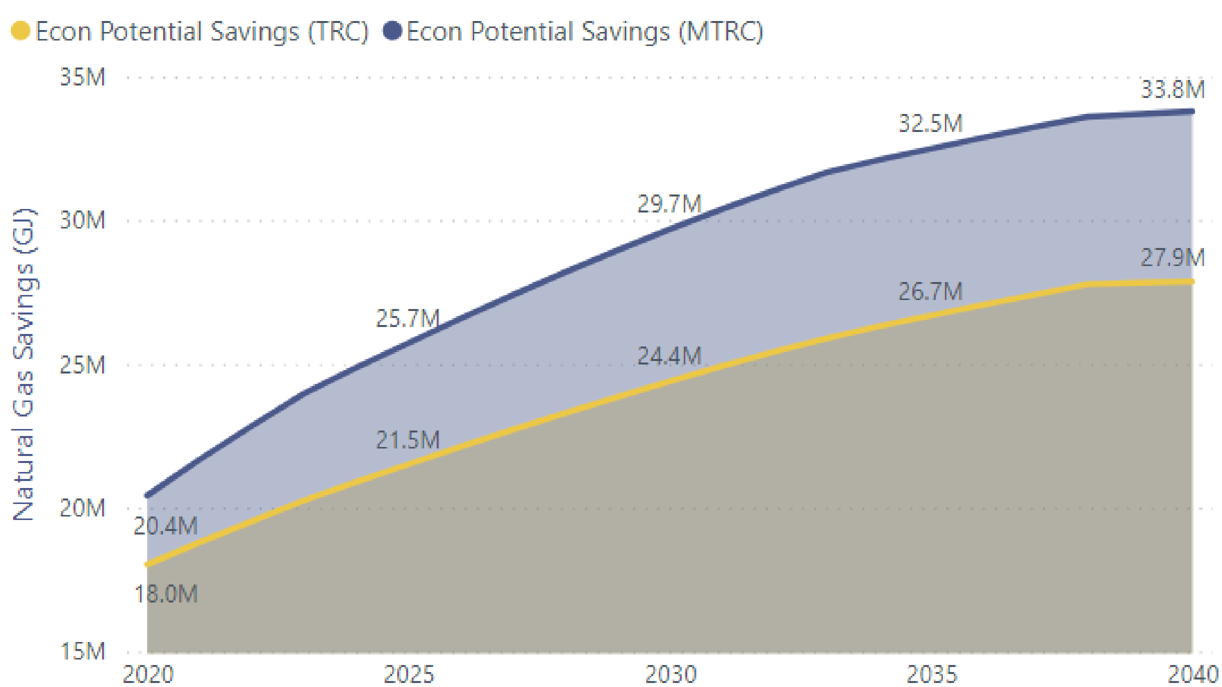


## 5.6 Economic Potential

This section provides the economic potential savings results for the commercial sector from 2020 to 2040. We conducted two economic potential assessments: one using a TRC Screen that includes measures with a TRC ratio of 1 and above, and one using an MTRC screen that includes measures with an MTRC of 1 and above. Outputs of both economic models are presented in this section.

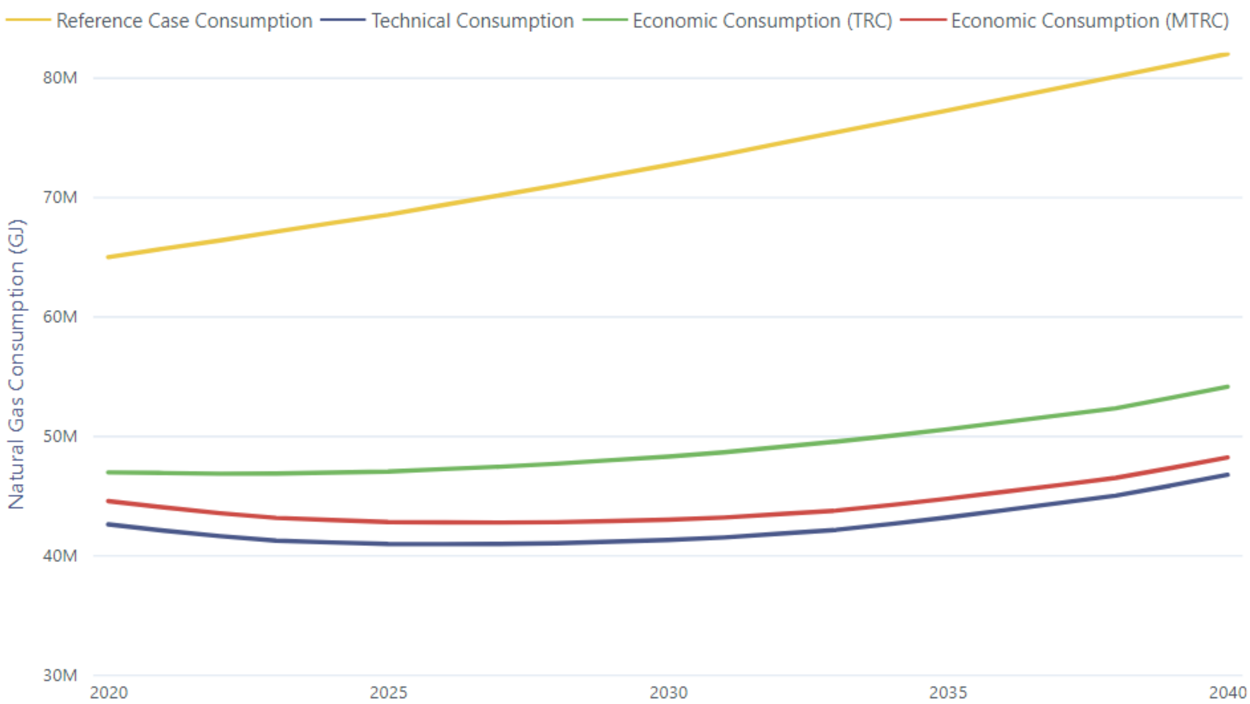
The commercial sector economic potential savings with a TRC screen and with an MTRC screen are shown in Exhibit 79. As mentioned earlier, of the 72 measures included in the assessment, 52 pass the TRC screen and 70 pass the MTRC screen. The 18 measures that that pass the MTRC but fail the TRC make up the difference between the two economic potential scenarios. The difference in economic potential in 2025 is around 4.2 PJ. Another way to look at it that the 84% of the MTRC economic potential comes from measures that pass the TRC as well.

Exhibit 79 – Economic Potential Savings (GJ) – Commercial, TRC and MTRC



The forecasted gas consumption under the technical potential, economic potential with a TRC screen, economic potential with an MTRC screen, and reference case scenarios for the commercial sector are shown in Exhibit 80. The slight uptick at the beginning of the curves is due to the implementation of the retrofit measures. The rest of the curves follow the shape of the reference case curve, as the replace on burnout measures are implemented at equipment end of life.

Exhibit 80 – Economic Potential Consumption (GJ) Forecasts – Commercial, TRC and MTRC



### *Results by Region*

The TRC and MTRC economic potential savings in 2025 are presented by region in Exhibit 81 and Exhibit 82 respectively. The largest economic potential savings (10 PJ to 12.6 PJ depending on economic screen) are estimated to occur in the Lower Mainland outside of the City of Vancouver. Although small in absolute savings, the largest percentage of savings is expected to be captured in northern BC (more than 39% of reference case consumption).

Exhibit 81 – Economic Potential Savings by Region in 2025 – Commercial, TRC

| Region | Consumption (GJ) | Economic Potential Savings (GJ) | Economic % |
|---|---|---|---|
| Lower Mainland x Van | 33,493K | 10,254K | 31% |
| City of Vancouver | 14,237K | 4,418K | 31% |
| Southern Interior | 10,124K | 3,322K | 33% |
| Vancouver Island | 6,863K | 2,146K | 31% |
| Northern BC | 3,082K | 1,200K | 39% |
| Whistler | 713K | 171K | 24% |
| **Total** | **68,513K** | **21,511K** | **31%** |

Exhibit 82 – Economic Potential Savings by Region in 2025 – Commercial, MTRC

| Region | Consumption (GJ) | Economic Potential Savings (GJ) | Economic % |
|---|---|---|---|
| Lower Mainland x Van | 33,493K | 12,634K | 38% |
| City of Vancouver | 14,237K | 5,268K | 37% |
| Southern Interior | 10,124K | 3,866K | 38% |
| Vancouver Island | 6,863K | 2,470K | 36% |
| Northern BC | 3,082K | 1,287K | 42% |
| Whistler | 713K | 206K | 29% |
| **Total** | **68,513K** | **25,731K** | **38%** |

### *Results by Segment*

The TRC and MTRC economic potential savings in 2025 are presented by segment in Exhibit 83 and Exhibit 84 respectively. The largest amounts of savings are expected to occur in apartments, other, and office segments. In both economic scenarios, the highest percentage of savings are expected to be captured offices, schools, university colleges.

Exhibit 83 – Economic Potential Savings by Segment in 2025 – Commercial, TRC

| Segment | Consumption (GJ) | Economic Potential Savings (GJ) | Economic % |
|---|---|---|---|
| Apartment | 20,961K | 6,496K | 31% |
| Other | 13,284K | 3,713K | 28% |
| Office | 7,633K | 3,047K | 40% |
| Warehouse | 4,241K | 1,361K | 32% |
| Hospital | 3,167K | 1,198K | 38% |
| Nonfood Retail | 3,888K | 1,124K | 29% |
| School | 2,549K | 1,039K | 41% |
| Hotel | 2,800K | 872K | 31% |
| Restaurant | 4,666K | 859K | 18% |
| University/College | 1,752K | 692K | 40% |
| Nursing Home | 1,940K | 585K | 30% |
| Food Retail | 1,633K | 525K | 32% |
| **Total** | **68,513K** | **21,511K** | **31%** |

Exhibit 84 – Economic Potential Savings by Segment in 2025 – Commercial, MTRC

| Segment | Consumption (GJ) | Economic Potential Savings (GJ) | Economic % |
|---|---|---|---|
| Apartment | 20,961K | 7,683K | 37% |
| Other | 13,284K | 4,306K | 32% |
| Office | 7,633K | 3,710K | 49% |
| Warehouse | 4,241K | 1,935K | 46% |
| Hospital | 3,167K | 1,382K | 44% |
| Nonfood Retail | 3,888K | 1,273K | 33% |
| School | 2,549K | 1,268K | 50% |
| Hotel | 2,800K | 1,038K | 37% |
| Restaurant | 4,666K | 989K | 21% |
| University/College | 1,752K | 879K | 50% |
| Nursing Home | 1,940K | 718K | 37% |
| Food Retail | 1,633K | 551K | 34% |
| **Total** | **68,513K** | **25,731K** | **38%** |

### *Results by End Use*

The TRC and MTRC economic potential savings in 2025 are presented by segment in Exhibit 85 and Exhibit 86 respectively. The largest amounts, in absolute savings, as well as the highest percentage of savings relative to reference case consumption, are expected to be captured under the space heating end use (40% to 49% depending on the economic scenario).

Exhibit 85 – Economic Potential Savings by End Use in 2025 – Commercial, TRC

| Parent End Use | Consumption (GJ) | Economic Potential Savings (GJ) | Economic % |
|---|---|---|---|
| Space Heating | 37,973K | 15,088K | 40% |
| Water heating | 20,913K | 6,218K | 30% |
| Food Service | 5,322K | 205K | 4% |
| Other | 3,674K | 0K | 0% |
| Pools; Spas & Hot Tubs | 632K | 0K | 0% |
| **Total** | **68,513K** | **21,511K** | **31%** |

Exhibit 86 – Economic Potential Savings by End Use in 2025 – Commercial, MTRC

| Parent End Use | Consumption (GJ) | Economic Potential Savings (GJ) | Economic % |
|---|---|---|---|
| Space Heating | 37,973K | 18,543K | 49% |
| Water heating | 20,913K | 6,707K | 32% |
| Pools; Spas & Hot Tubs | 632K | 274K | 43% |
| Food Service | 5,322K | 205K | 4% |
| Other | 3,674K | 0K | 0% |
| **Total** | **68,513K** | **25,731K** | **38%** |

The TRC and MTRC economic potential savings in 2040 are presented by end use in Exhibit 87. The difference of almost 6 PJ is mostly a result of more space heating measures being included in the MTRC scenario. A small but interesting change is the pools, spas, and hot tubs end use, which contributed no savings under the TRC scenario, but has 219K GJ of economic potential under the MTRC.

Exhibit 87 – Economic Potential Savings by End Use in 2040 – Commercial, TRC and MTRC

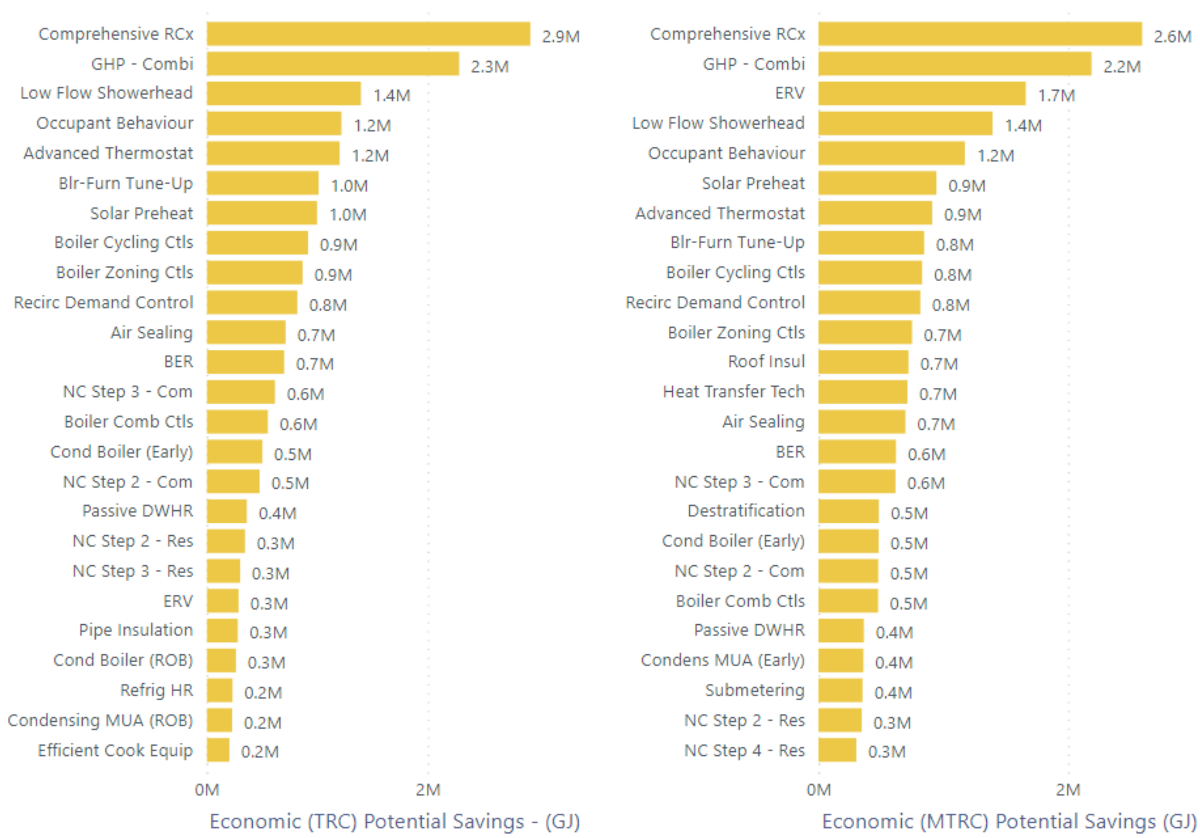
| Parent End Use | Economic Savings (GJ) - TRC | Economic Savings (GJ) - MTRC | Difference (GJ) |
|---|---|---|---|
| Space Heating | 19,735K | 24,646K | 4,910K |
| Water heating | 7,822K | 8,609K | 787K |
| Food Service | 313K | 313K | 0K |
| Pools; Spas & Hot Tubs | 0K | 219K | 219K |
| Other | 0K | 0K | 0K |
| **Total** | **27,870K** | **33,786K** | **5,916K** |

#### *Results by Measure*

The economic potential savings in 2025 broken down by measure (only the top 25 measures are shown) are presented in Exhibit 88. The top measures in the TRC economic potential are shown on the left and on the MTRC scenario is shown on the right. Comprehensive recommissioning and combination gas heat pumps top the list in both scenarios. The MTRC scenario list on the right is almost similar to the top technical potential measures presented in Exhibit 76.

The main differences between the TRC and MTRC list are that the energy recovery ventilators (ERVs) become one of the top measures under MTRC. Other notable additions to the MTRC scenario include heat transfer technologies and roof insulation measures.

Exhibit 88 – Economic Potential (TRC on Left, MTRC on Right) - Top 25 Commercial Measures in 2025 (GJ)



## 5.7 Market Potential

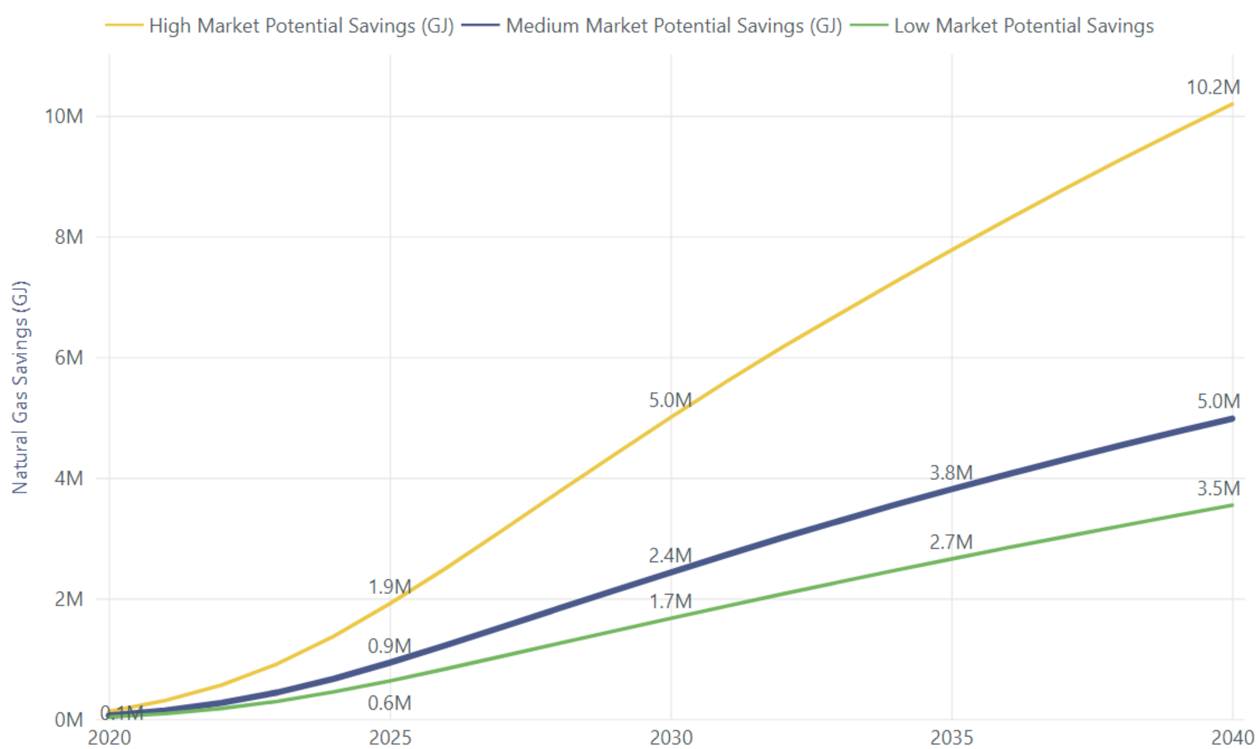
This section provides an overview of the low, medium, and high market potential results for the commercial sector.

Low, medium, and high scenarios assume that measure incentive levels will be 25%, 50% and 100% of incremental costs, respectively. For example, assume that a high-efficiency furnace may cost $200 more than a standard furnace, meaning the furnace would have an incremental cost of $200. In the medium scenario, this measure's hypothetical incentive from FortisBC would be $100. The other $100 would be paid by the end user. In all scenarios, the non-incentive program costs are assumed to be 15% of the incentive cost. In the example above, FortisBC's non-incentive spending would be $15. FortisBC's total cost for providing the measure to an end user would be $115.

The market potential savings results, with a TRC screen and with an MTRC screen, are shown in Exhibit 89 and Exhibit 90, respectively. The medium, or realistic, market potential scenarios under both economic screens are close, as the majority of the measures pass both screens.

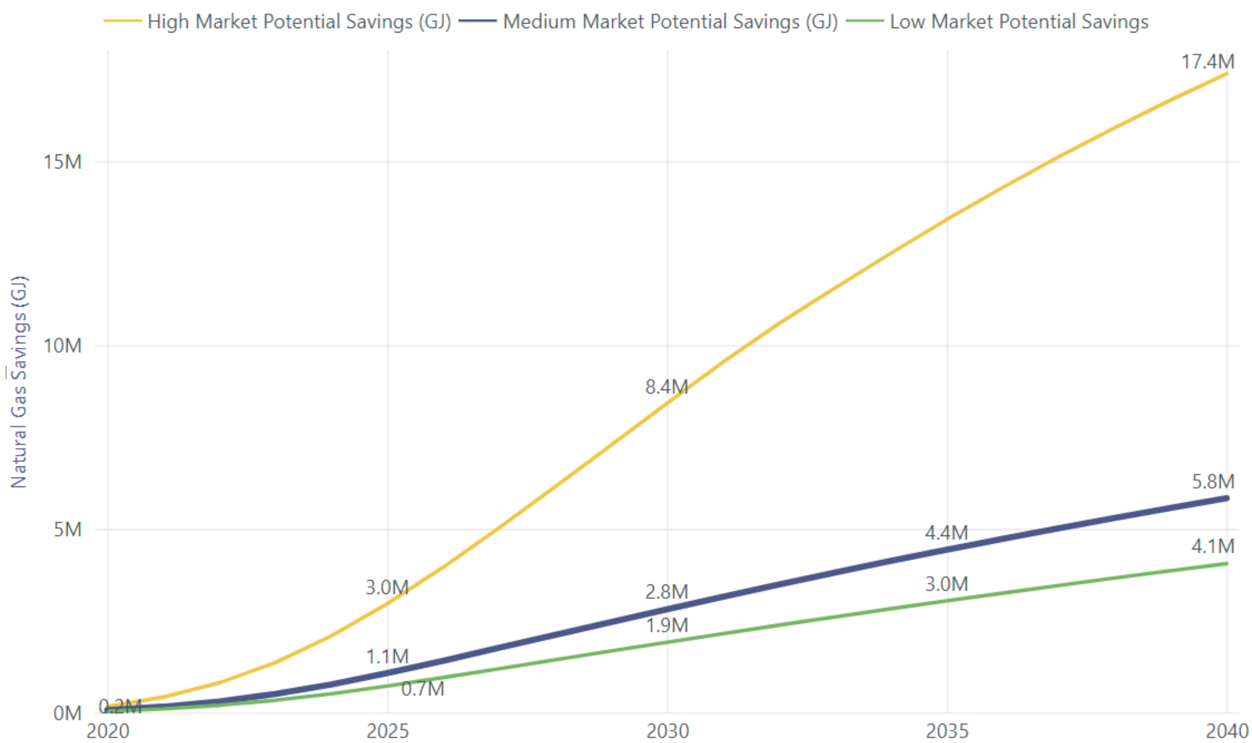
By 2040, the commercial low, medium, and high market TRC potential savings are estimated to be 3.5 PJ, 5 PJ, and 10.2 PJ, respectively.

Exhibit 89 – Market Potential Savings (GJ) – Commercial, TRC



By 2040, the commercial low, medium, and high market MTRC potential savings are estimated to be 4.1 PJ, 5.8 PJ, and 17.4 PJ, respectively.

Exhibit 90 – Market Potential Savings (GJ) – Commercial, MTRC




The high market potential scenario is much higher than the medium market potential in the MTRC scenario. By 2040, the difference in potential between the medium and high market MTRC scenarios is 11.6 PJ. In this case, gas heat pumps (GHPs) are a major factor contributing to the difference:

- For all measures, medium and high scenarios assume that measure incentive levels will be 50% and 100% of incremental costs, respectively.
- In addition to this, gas heat pumps were given different adoption curves in the two scenarios.
- In the medium market scenario, GHPs are modeled as an innovative technology with no current market penetration and low forecasted growth.
- In the high scenario, they are modeled as an innovative technology with no current market penetration, but with high forecasted growth, especially in the second half of the study period (2030-2040).

The difference in MTRC medium and high potential scenarios by 2040, broken down by measure, is shown in Exhibit 91. Only the top 10 measures that contribute to the difference are presented. Gas heat pumps top the list by a sizeable margin, but New Construction Step Code measures and energy recovery ventilators also influence the difference. For comparison, Exhibit 92 shows the difference in TRC medium and high potential scenarios - the absence of gas heat pumps is noticeable here.

### Exhibit 91 – Top 10 Commercial Measures Contributing to Difference in Medium and High Market Potential Scenarios (Using MTRC Screen) by 2040

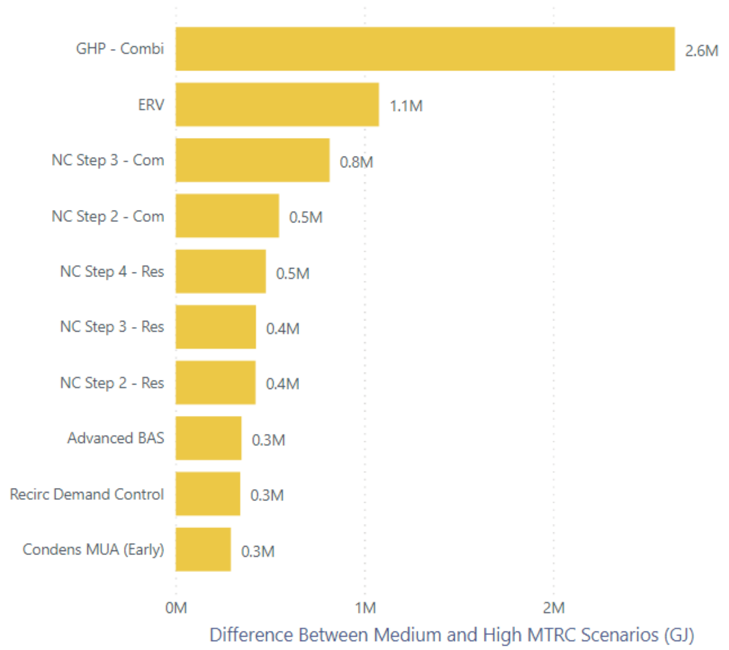
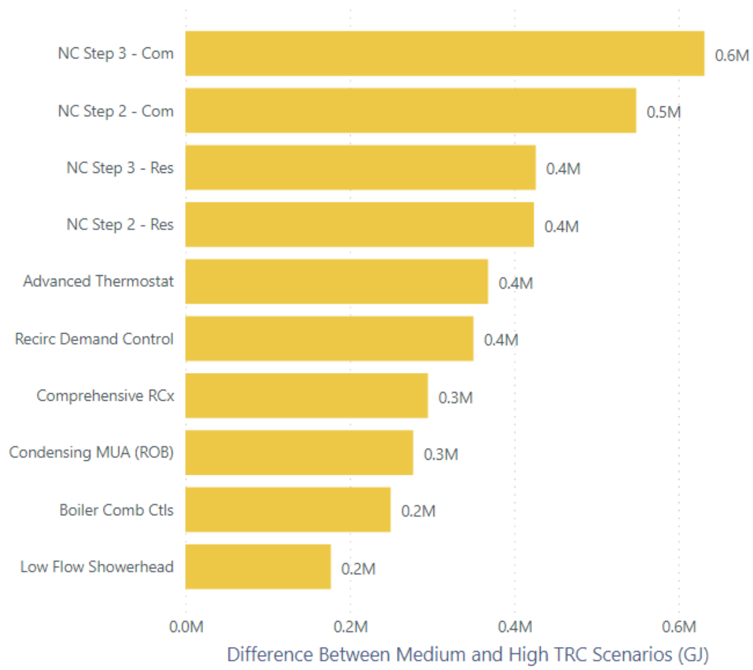
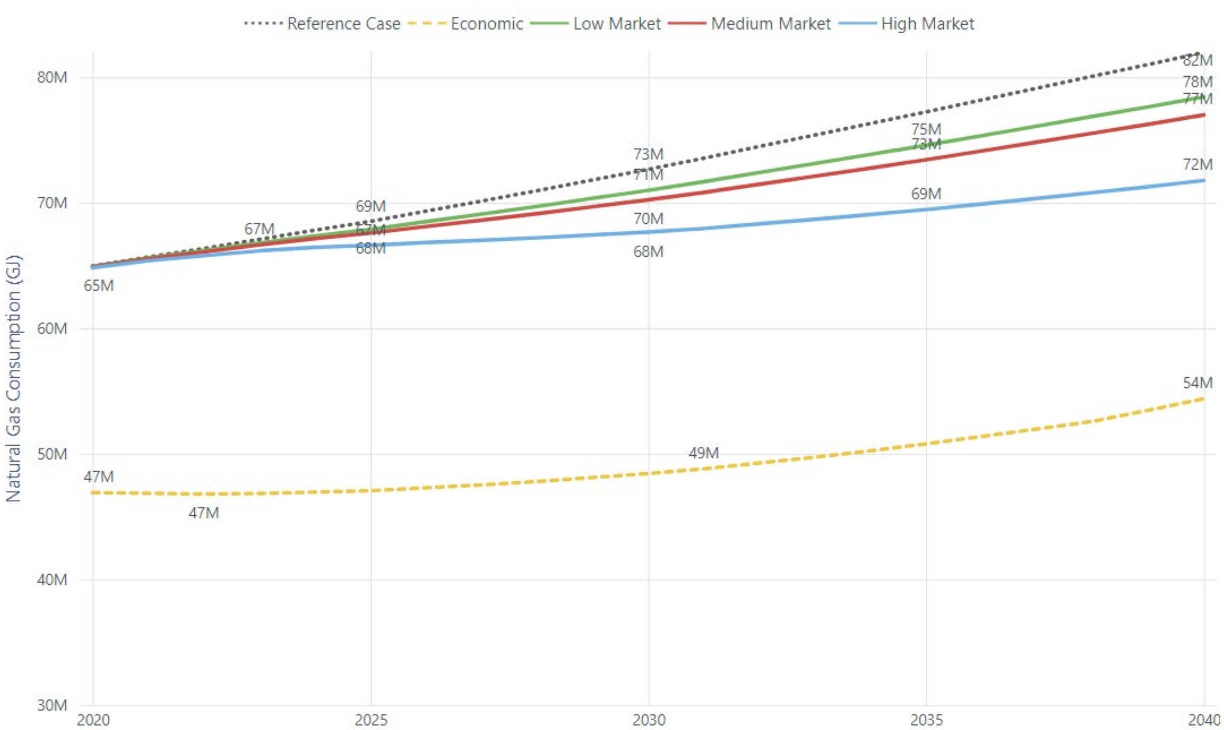


Exhibit 92 – Top 10 Commercial Measures Contributing to Difference in Medium and High Market Potential Scenarios (Using TRC Screen) by 2040

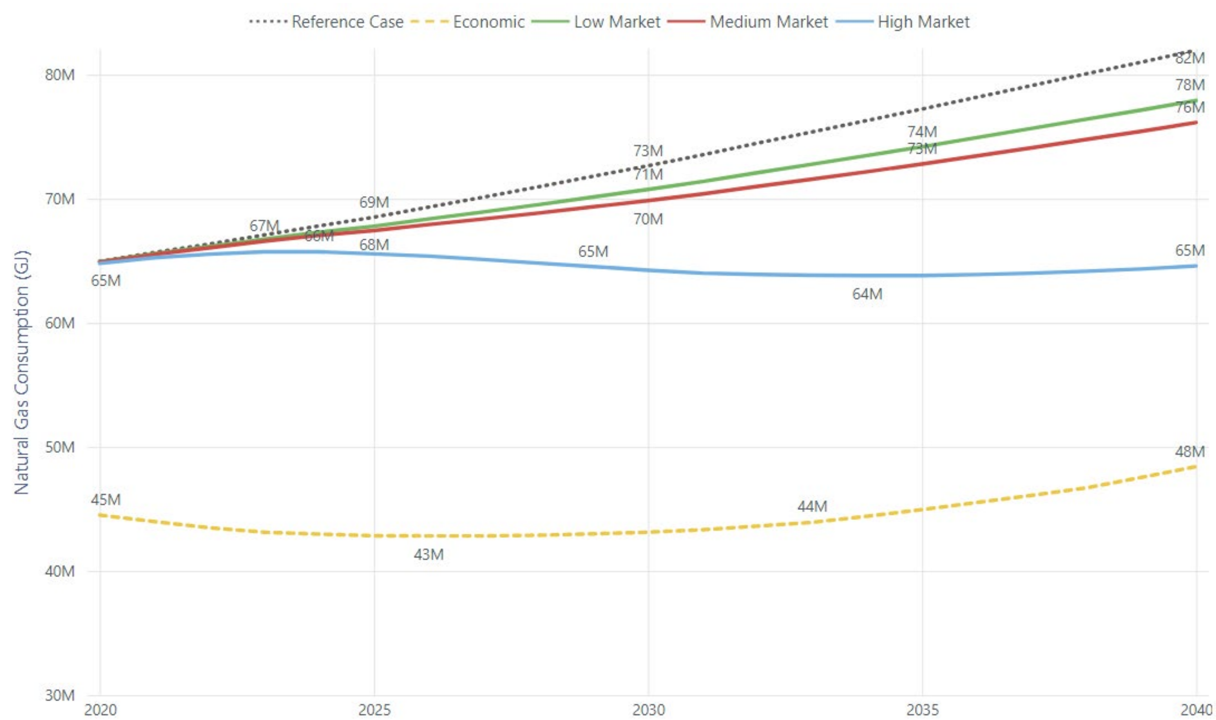


The forecasted gas consumption under the three market potential scenarios relative to reference case scenario for the commercial sector are shown in Exhibit 93 (TRC) and Exhibit 94 (MTRC). By 2040, the commercial low, medium, and high market TRC potential consumption levels are estimated to be 78 PJ, 77 PJ, and 72 PJ, respectively, while reference consumption is forecasted to reach 82 PJ. By 2040, the commercial low, medium, and high market MTRC potential consumption levels are estimated to be 78 PJ, 76 PJ, and 65 PJ, respectively, while reference consumption is forecasted to reach 82 PJ.

### Exhibit 93 – Commercial Market Potential Consumption (GJ) Forecasts – Commercial, TRC



### Exhibit 94 – Commercial Market Potential Consumption (GJ) Forecasts – Commercial, MTRC




The remainder of this section presents detailed results of the medium market potential scenario only. Similarly detailed results of the low and high market potential scenarios can be found on the Power BI dashboard and the Excel workbooks.

#### *Results by Region*

The medium market potential savings for 2025 are presented by region in Exhibit 95 and Exhibit 96 using TRC and MTRC screen, respectively. Medium market potential savings for 2025 are estimated to be between 1% and 2% of reference case consumption in all regions in both medium market scenarios.

### Exhibit 95 – Medium Market Potential Savings by Region in 2025 – Commercial, TRC

| Region | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Lower Mainland x Van | 33,493K | 425K | 1% |
| City of Vancouver | 14,237K | 184K | 1% |
| Southern Interior | 10,124K | 178K | 2% |
| Vancouver Island | 6,863K | 103K | 2% |
| Northern BC | 3,082K | 71K | 2% |
| Whistler | 713K | 7K | 1% |
| **Total** | **68,513K** | **969K** | **1%** |

Exhibit 96 – Medium Market Potential Savings by Region in 2025 – Commercial, MTRC

| Region | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Lower Mainland x Van | 33,493K | 498K | 1% |
| City of Vancouver | 14,237K | 219K | 2% |
| Southern Interior | 10,124K | 192K | 2% |
| Vancouver Island | 6,863K | 113K | 2% |
| Northern BC | 3,082K | 69K | 2% |
| Whistler | 713K | 7K | 1% |
| **Total** | **68,513K** | **1,099K** | **2%** |

### *Results by Segment*

The medium market potential savings for 2025 are presented by segment in Exhibit 97 and Exhibit 98 using TRC and MTRC screen, respectively. The largest amounts of medium market potential savings are estimated to occur in apartments, other, and office segments.

Exhibit 97 – Medium Market Potential Savings by Segment in 2025 – Commercial, TRC

| Segment | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Apartment | 20,961K | 222K | 1% |
| Other | 13,284K | 152K | 1% |
| Office | 7,633K | 137K | 2% |
| Restaurant | 4,666K | 98K | 2% |
| Warehouse | 4,241K | 76K | 2% |
| Hospital | 3,167K | 65K | 2% |
| Nonfood Retail | 3,888K | 46K | 1% |
| School | 2,549K | 46K | 2% |
| Food Retail | 1,633K | 39K | 2% |
| University/College | 1,752K | 36K | 2% |
| Hotel | 2,800K | 31K | 1% |
| Nursing Home | 1,940K | 22K | 1% |
| **Total** | **68,513K** | **969K** | **1%** |

Exhibit 98 – Medium Market Potential Savings by Segment in 2025 – Commercial, MTRC

| Segment | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Apartment | 20,961K | 276K | 1% |
| Other | 13,284K | 166K | 1% |
| Office | 7,633K | 157K | 2% |
| Restaurant | 4,666K | 102K | 2% |
| Warehouse | 4,241K | 86K | 2% |
| Hospital | 3,167K | 67K | 2% |
| School | 2,549K | 51K | 2% |
| Nonfood Retail | 3,888K | 48K | 1% |
| University/College | 1,752K | 42K | 2% |
| Food Retail | 1,633K | 40K | 2% |
| Hotel | 2,800K | 37K | 1% |
| Nursing Home | 1,940K | 26K | 1% |
| **Total** | **68,513K** | **1,099K** | **2%** |

### *Results by End Use*

The medium market potential savings for 2025 are presented by segment in Exhibit 99 and Exhibit 100 using TRC and MTRC screen, respectively. More than two thirds of the savings come from the space heating end use.

Exhibit 99 – Medium Market Potential Savings by End Use in 2025 – Commercial, TRC

| Parent End Use | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Space Heating | 37,973K | 652K | 2% |
| Water heating | 20,913K | 257K | 1% |
| Food Service | 5,322K | 60K | 1% |
| Other | 3,674K | 0K | 0% |
| Pools; Spas & Hot Tubs | 632K | 0K | 0% |
| **Total** | **68,513K** | **969K** | **1%** |

Exhibit 100 – Medium Market Potential Savings by End Use in 2025 – Commercial, MTRC

| Parent End Use | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Space Heating | 37,973K | 776K | 2% |
| Water heating | 20,913K | 260K | 1% |
| Food Service | 5,322K | 60K | 1% |
| Pools; Spas & Hot Tubs | 632K | 3K | 0% |
| Other | 3,674K | 0K | 0% |
| **Total** | **68,513K** | **1,099K** | **2%** |

The TRC and MTRC medium market potential savings for 2040 are presented by end use in Exhibit 101. The scenarios under both economic screens are close, with a difference of 704 TJ, as the majority of the measures pass both screens.

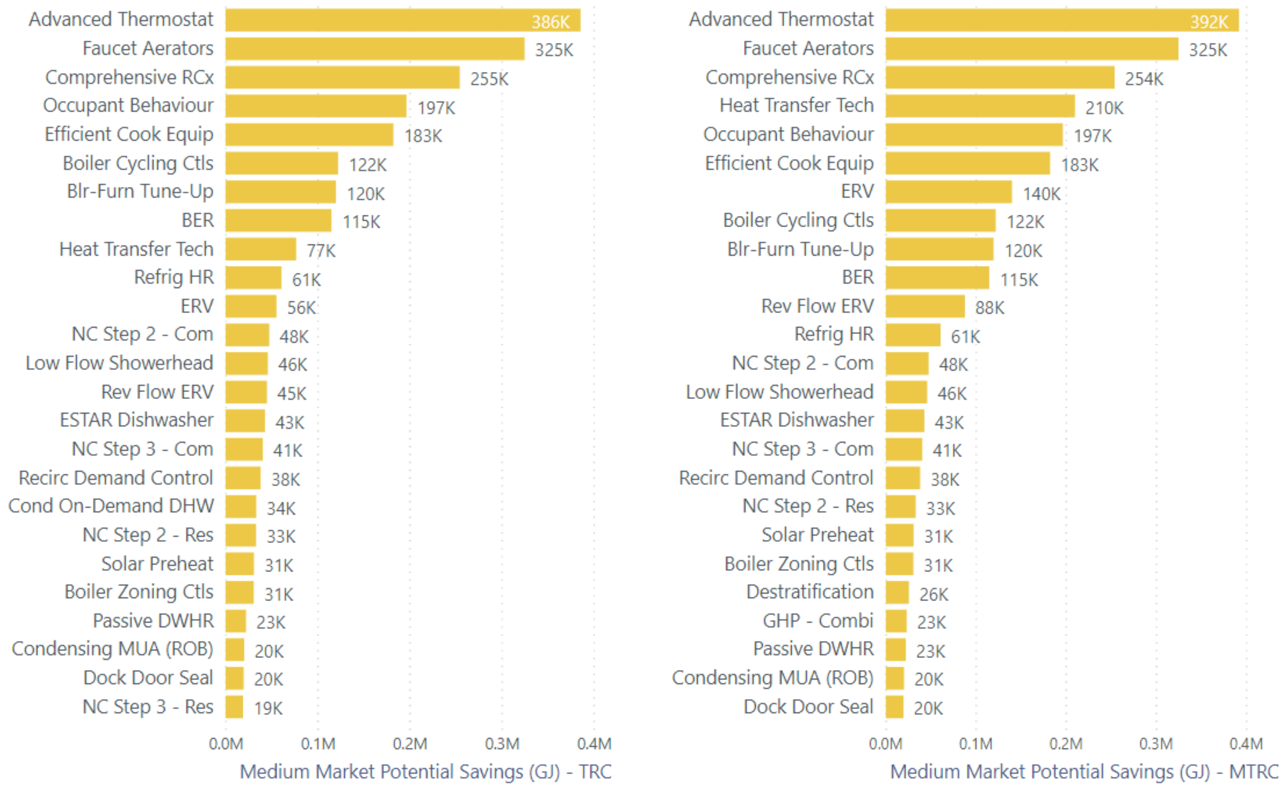
Exhibit 101 – Medium Market Potential Savings by End Use in 2040 – Commercial, TRC and MTRC

| Parent End Use | Medium Potential Savings (GJ) - TRC | Medium Potential Savings (GJ) - MTRC | Difference (GJ) |
|---|---|---|---|
| Space Heating | 3,702K | 4,466K | 764K |
| Water heating | 1,072K | 1,147K | 75K |
| Pools; Spas & Hot Tubs | 0K | 13K | 13K |
| Other | 0K | 0K | 0K |
| Food Service | 207K | 207K | 0K |
| **Total** | **4,981K** | **5,833K** | **852K** |

## *Results by Measure*

The medium market potential savings by 2025 of the top 25 commercial measures are shown in Exhibit 102, sorted by decreasing potential. The top measures in the TRC medium market potential are shown on the left and the top measures in the MTRC scenario are shown on the right. Advanced thermostats, faucet aerators, and comprehensive recommissioning (RCx) top the list in both scenarios. Occupant behavior measures, efficient cooking equipment, and heat transfer technologies have large potential in both scenarios as well. A major change in this top-measures list when compared with the economic potential list is the relatively small contribution of energy recovery ventilators (ERV) and gas heat pumps (GHP Combi).

Exhibit 102 – Medium Market Potential (TRC on Left, MTRC on Right) - Gas Savings from Top 25 Commercial Measures in 2025 (GJ)



### 5.7.1 Incentive and Non-Incentive Spending

The incentive and non-incentive spending required to achieve the medium and high market potential are shown in Exhibit 103 (TRC) and Exhibit 104 (MTRC). Medium and high market incentives are assumed to be 50% and 100% of measures' incremental costs, respectively. In both medium and high scenarios, non-incentive costs are estimated to be 15% of incentive costs. The tables also show the total as well as incremental (that is, savings from new measures installed in a year) savings every year.

**Exhibit 103 – Medium and High Market Incentive Costs and Natural Gas Savings – Commercial, TRC**

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $1.0M | $0.1M | $1.1M | 57K | 57K | $5.9M | $0.9M | $6.8M | 124K | 124K |
| 2021 | $1.6M | $0.2M | $1.9M | 142K | 85K | $9.9M | $1.5M | $11.4M | 306K | 183K |
| 2022 | $2.6M | $0.4M | $3.0M | 267K | 125K | $15.7M | $2.4M | $18.0M | 563K | 256K |
| 2023 | $3.9M | $0.6M | $4.5M | 441K | 174K | $24.1M | $3.6M | $27.7M | 914K | 352K |
| 2024 | $5.4M | $0.8M | $6.2M | 667K | 226K | $34.1M | $5.1M | $39.2M | 1,370K | 456K |
| 2025 | $6.8M | $1.0M | $7.8M | 934K | 267K | $43.9M | $6.6M | $50.5M | 1,912K | 542K |
| 2026 | $8.1M | $1.2M | $9.3M | 1,223K | 289K | $53.2M | $8.0M | $61.2M | 2,501K | 589K |
| 2027 | $8.9M | $1.3M | $10.2M | 1,526K | 302K | $59.1M | $8.9M | $68.0M | 3,124K | 623K |
| 2028 | $9.5M | $1.4M | $10.9M | 1,830K | 304K | $63.7M | $9.6M | $73.2M | 3,757K | 633K |
| 2029 | $9.7M | $1.5M | $11.2M | 2,132K | 302K | $65.4M | $9.8M | $75.2M | 4,384K | 627K |
| 2030 | $9.9M | $1.5M | $11.4M | 2,430K | 298K | $66.3M | $9.9M | $76.3M | 4,999K | 615K |
| 2031 | $9.9M | $1.5M | $11.4M | 2,723K | 293K | $67.0M | $10.0M | $77.0M | 5,597K | 599K |
| 2032 | $10.1M | $1.5M | $11.7M | 3,009K | 286K | $67.7M | $10.2M | $77.9M | 6,170K | 572K |
| 2033 | $9.7M | $1.5M | $11.2M | 3,285K | 276K | $64.9M | $9.7M | $74.6M | 6,712K | 542K |
| 2034 | $9.9M | $1.5M | $11.4M | 3,555K | 270K | $65.9M | $9.9M | $75.8M | 7,249K | 537K |
| 2035 | $9.6M | $1.4M | $11.1M | 3,810K | 255K | $64.6M | $9.7M | $74.2M | 7,773K | 524K |
| 2036 | $9.5M | $1.4M | $11.0M | 4,058K | 248K | $63.5M | $9.5M | $73.0M | 8,283K | 510K |
| 2037 | $9.5M | $1.4M | $11.0M | 4,298K | 240K | $64.0M | $9.6M | $73.6M | 8,782K | 498K |
| 2038 | $9.5M | $1.4M | $10.9M | 4,534K | 237K | $62.0M | $9.3M | $71.2M | 9,269K | 488K |
| 2039 | $9.1M | $1.4M | $10.5M | 4,760K | 226K | $58.1M | $8.7M | $66.8M | 9,735K | 466K |
| 2040 | $9.2M | $1.4M | $10.6M | 4,981K | 221K | $59.2M | $8.9M | $68.0M | 10,197K | 462K |

Exhibit 104 – Medium and High Market Incentive Costs and Natural Gas Savings – Commercial, MTRC

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $1.2M | $0.2M | $1.4M | 62K | 62K | $10.8M | $1.6M | $12.4M | 160K | 160K |
| 2021 | $2.1M | $0.3M | $2.4M | 159K | 97K | $20.1M | $3.0M | $23.1M | 422K | 262K |
| 2022 | $3.4M | $0.5M | $3.9M | 303K | 144K | $32.7M | $4.9M | $37.6M | 810K | 388K |
| 2023 | $5.1M | $0.8M | $5.8M | 505K | 201K | $49.6M | $7.4M | $57.1M | 1,359K | 549K |
| 2024 | $6.9M | $1.0M | $7.9M | 767K | 262K | $70.0M | $10.5M | $80.5M | 2,083K | 724K |
| 2025 | $8.6M | $1.3M | $9.9M | 1,075K | 309K | $89.6M | $13.4M | $103.1M | 2,961K | 879K |
| 2026 | $10.3M | $1.5M | $11.8M | 1,412K | 336K | $109.6M | $16.4M | $126.0M | 3,954K | 993K |
| 2027 | $11.3M | $1.7M | $13.0M | 1,762K | 351K | $122.4M | $18.4M | $140.7M | 5,027K | 1,072K |
| 2028 | $12.1M | $1.8M | $13.9M | 2,115K | 352K | $132.5M | $19.9M | $152.3M | 6,143K | 1,116K |
| 2029 | $12.4M | $1.9M | $14.2M | 2,465K | 350K | $137.1M | $20.6M | $157.6M | 7,280K | 1,137K |
| 2030 | $12.6M | $1.9M | $14.5M | 2,811K | 345K | $140.6M | $21.1M | $161.6M | 8,419K | 1,139K |
| 2031 | $12.7M | $1.9M | $14.6M | 3,151K | 340K | $140.9M | $21.1M | $162.0M | 9,541K | 1,122K |
| 2032 | $12.9M | $1.9M | $14.9M | 3,485K | 335K | $142.3M | $21.3M | $163.7M | 10,589K | 1,049K |
| 2033 | $12.5M | $1.9M | $14.4M | 3,810K | 325K | $135.8M | $20.4M | $156.2M | 11,557K | 968K |
| 2034 | $12.6M | $1.9M | $14.5M | 4,130K | 319K | $135.8M | $20.4M | $156.1M | 12,504K | 946K |
| 2035 | $12.3M | $1.8M | $14.2M | 4,431K | 302K | $133.0M | $19.9M | $152.9M | 13,422K | 918K |
| 2036 | $12.3M | $1.8M | $14.1M | 4,726K | 295K | $131.3M | $19.7M | $151.0M | 14,292K | 870K |
| 2037 | $12.2M | $1.8M | $14.1M | 5,014K | 288K | $129.9M | $19.5M | $149.4M | 15,127K | 836K |
| 2038 | $12.2M | $1.8M | $14.0M | 5,297K | 283K | $124.3M | $18.6M | $143.0M | 15,918K | 790K |
| 2039 | $11.9M | $1.8M | $13.7M | 5,568K | 271K | $118.5M | $17.8M | $136.3M | 16,673K | 755K |
| 2040 | $12.0M | $1.8M | $13.8M | 5,833K | 266K | $116.1M | $17.4M | $133.5M | 17,391K | 718K |

# 6 Industrial Sector Results

This section presents the industrial sector results and key findings, including:

- Base year (2019) natural gas use
- Reference case consumption forecast (2020 – 2040)
- Energy conservation measures evaluated in this CPR
- Technical potential savings
- Economic potential savings
- Market potential savings and scenarios

## 6.1 Industrial Segments and End Uses

In this CPR, the industrial sector is divided into 12 segments, 12 energy end uses, and two vintages.

| | Segments | End Uses | Vintages |
|---|---|---|---|
| *Industrial Sector* | • Agriculture (includes greenhouses[40])<br>• Chemical<br>• District energy providers<br>• Fabricated Metal<br>• Food & Beverage<br>• Other Manufacturing (includes transportation[41] and other industrial)<br>• Mining<br>• Non-metallic Mineral (includes cement)<br>• Pulp & Paper – Kraft<br>• Pulp & Paper – TMP<br>• Utilities<br>• Wood Products | • Direct-fired heating<br>• Direct Consumption of Gas in Process[42]<br>• Heat Treating<br>• Kilns<br>• On-Site Power Generation[13]<br>• Other[12]<br>• Ovens<br>• Petrochemical Refining and Process Heating<br>• Process Boilers<br>• Product Drying<br>• Space Heating [includes HVAC air heating and HVAC boilers]<br>• Water heaters | • Existing<br>• New |

40 Cannabis has been included in agriculture segment since there is not enough data at FEI to create a cannabis-specific forecast.
41 In the 2015 CPR, 'transportation' pertained to facilities that supported the transportation sector.
42 No CPR measures are applied to this end use; included for accounting purposes only.

## 6.2 Base Year Natural Gas Use

Base year (2019) industrial natural gas use is presented by segment in Exhibit 105, by end use in Exhibit 106, and by region in Exhibit 107.

Natural gas consumption in the industrial sector base year is highest:

- In the pulp and paper – kraft (31%), agriculture (13%), wood products (12%), and mining (12%) segments
- In the process boilers (36%), product drying (26%), and direct-fired heating (16%) end uses
- In the Lower Mainland excluding the Vancouver (33%), Northern BC (24%), and Southern Interior (26%) regions

Exhibit 105 – 2019 Industrial Natural Gas Consumption (GJ) by Segment[43]

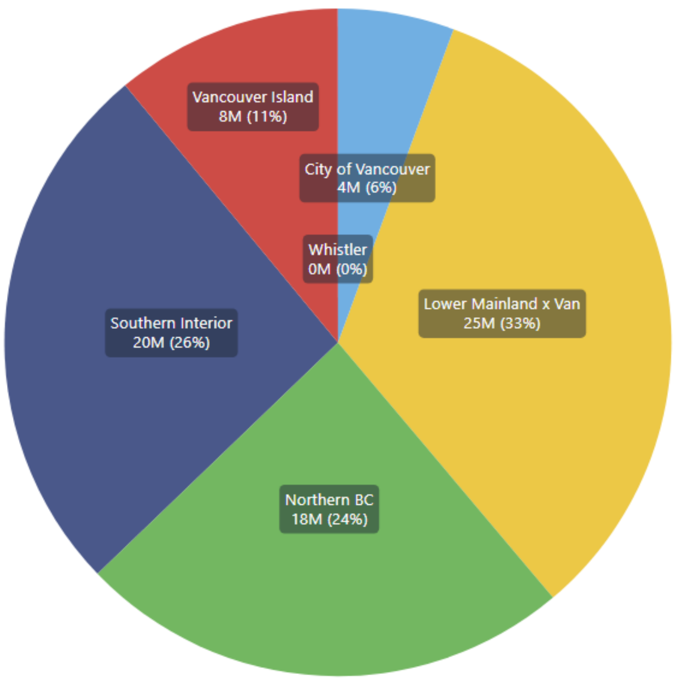
| Segment | Natural Gas Consumption (GJ) | % |
|---|---|---|
| Pulp & Paper - Kraft | 23,480K | 31% |
| Agriculture | 9,662K | 13% |
| Wood Products | 8,936K | 12% |
| Mining | 8,843K | 12% |
| Non-metallic Mineral | 4,657K | 6% |
| Food & Beverage | 4,548K | 6% |
| Manufacturing | 4,291K | 6% |
| Chemical | 4,014K | 5% |
| Pulp & Paper - TMP | 2,923K | 4% |
| District Energy | 2,555K | 3% |
| Utilities | 851K | 1% |
| Fabricated Metal | 526K | 1% |
| **Total** | **75,286K** | **100%** |

43 Please see Appendix B for how industrial sector NAICS codes were mapped into segments.

Exhibit 106 – 2019 Industrial Natural Gas Consumption (GJ) by End Use

| Parent End Use | Natural Gas Consumption (GJ) | % |
|---|---|---|
| Process Boilers | 27,045K | 36% |
| Product Drying | 19,465K | 26% |
| Direct-fired Heating | 11,817K | 16% |
| Space Heating | 5,737K | 8% |
| Kilns | 3,626K | 5% |
| Direct Gas Use | 1,553K | 2% |
| Petrochem Refining | 1,407K | 2% |
| Other | 1,209K | 2% |
| Ovens | 1,110K | 1% |
| On-Site Generation | 851K | 1% |
| Water Heaters | 823K | 1% |
| Heat Treating | 644K | 1% |
| **Total** | **75,286K** | **100%** |

Exhibit 107 – 2019 Industrial Natural Gas Consumption (GJ) by Region



### 6.2.1 Accounts

Base year industrial natural gas accounts are presented by segment in Exhibit 108 and by region in Exhibit 109. As shown in these exhibits, in 2019 the greatest number of industrial natural gas accounts were in:

- The manufacturing (37%), agriculture (21%), and food & beverage (13%) segments
- The Lower Mainland excluding Vancouver region (68%)

Exhibit 108 – 2019 Industrial Accounts by Segment

| Segment | Accounts | % |
|---|---|---|
| Manufacturing | 3,354 | 37% |
| Agriculture | 1,930 | 21% |
| Food & Beverage | 1,164 | 13% |
| Fabricated Metal | 744 | 8% |
| Wood Products | 701 | 8% |
| Chemical | 437 | 5% |
| Non-metallic Mineral | 247 | 3% |
| Utilities | 201 | 2% |
| Mining | 125 | 1% |
| Pulp & Paper - TMP | 76 | 1% |
| Pulp & Paper - Kraft | 26 | 0% |
| District Energy | 18 | 0% |
| **Total** | **9,023** | **100%** |

Exhibit 109 – 2019 Industrial Accounts by Region

| Region | Accounts | % |
|---|---|---|
| Lower Mainland x Van | 6,138 | 68% |
| Southern Interior | 1,501 | 17% |
| City of Vancouver | 680 | 8% |
| Northern BC | 452 | 5% |
| Vancouver Island | 247 | 3% |
| Whistler | 5 | 0% |
| **Total** | **9,023** | **100%** |

### 6.2.2 Tertiary Load

Tertiary load is the useful energy delivered to an end use. In the context of the CPR, tertiary load is the amount energy required to be delivered as an end use *service*: heat delivered by a furnace to a house, for example. This differs from consumption of natural gas which is impacted by the efficiency of the equipment: in the furnace example, consumption is equal to the tertiary load divided by seasonal efficiency of furnaces. Exhibit 110 provides 2019 tertiary load values.

### 6.2.3 Unit Energy Consumption

As explained in Exhibit 3, unit energy consumption (UEC) is the amount of energy used by each end use per unit. Defining "units" is challenging in the industrial sector. In the residential sector, consumption is typically analyzed per dwelling while in the commercial sector, consumption is analyzed per unit of floor area. In the industrial sector, consumption per unit of production capacity (kg of product, for example) would seem to be a useful approach. Unfortunately, the concept becomes inoperable when many different industries are included in the analysis. Nonetheless, it is desirable to have a way of representing growth in industries that is independent of changes in energy consumption caused by changes in fuel share or equipment efficiency. Therefore, 'units' in the industrial sector is used as a proxy of production capacity of different types of plants. The base year consumption is used as a proxy for the production capacity of different types of plants in each region and rate class.

Along with UEC values is *unit tertiary load*, which is the average tertiary load used by each end use in a dwelling, and *stock average efficiency*, which is the average efficiency of equipment serving the tertiary load for that end use. These values are included in the table because UEC by end use is calculated by dividing unit tertiary load with stock average efficiency.

Unlike the residential or commercial sectors, the end uses in the industrial sector are not common across the segments; rather, some end uses are specific to some segments. For example, the 'on-site generation' end use is only present in the 'utilities' segment. For the purposes of this report, UEC values are shown for one segment and region only, therefore UEC values are included only for the end uses that are present in that segment.

Unit tertiary load, stock average efficiency and UEC values for the pulp & paper – kraft segment in the Northern BC ("NBC") region are presented in Exhibit 110. This combination of segment and region was selected as the example because it A) is a significant consumer of gas, and B) has enough accounts to ensure consumption from one account cannot be determined through the information presented in this report, thereby protecting customer privacy.

**Exhibit 110 – 2019 UEC Values by End Use, Pulp & Paper-Kraft Segment in Northern British Columbia**

| | Unit Tertiary Load (GJ/unit/yr) | Stock Average Efficiency (%) | UEC |
|---|---|---|---|
| Space Heating | 0.02 | 0.62 | 0.03 |
| Direct-fired Heating | 0.38 | 1.00 | 0.38 |
| Kilns | 0.08 | 0.79 | 0.10 |
| Product Drying | 0.02 | 0.88 | 0.03 |
| Process Boilers | 0.34 | 0.67 | 0.51 |

### 6.2.4 Average Natural Gas Use per Account

Details on natural gas consumption per account by end use are provided in Exhibit 111 for an average Pulp & Paper – Kraft account in the Northern BC region. The following information is included in this exhibit:

- UEC: The amount of energy used by each end use per unit (a "unit" in the industrial sector is based on production capacity. Please see Section 6.2.3 for a discussion of a "unit" in the industrial sector.
- Fuel Share: The percentage of the energy end use that is supplied by each fuel (in this case, natural gas).
- Saturation: The extent to which an end use is present in a region, rate class and segment. In the industrial sector, saturation is either 100% or 0% because end uses are either used in a segment or are not.

Average annual gas consumption per unit would be calculated by multiplying these three variables. Similar to the UEC values presented in Section 6.2.3, only the end uses that are present in the segment and region are included.

**Exhibit 111 – 2019 Average Annual Gas Use per Account by End Use, Pulp & Paper - Kraft Account in Northern British Columbia**

| | UEC | Fuel Share | Saturation | Average Annual Gas Use (GJ/Yr) |
|---|---|---|---|---|
| Space Heating | 0.03 | 80% | 100% | 0.03 |
| Direct-fired Heating | 0.38 | 100% | 100% | 0.38 |
| Kilns | 0.10 | 93% | 100% | 0.10 |
| Product Drying | 0.03 | 93% | 100% | 0.02 |
| Process Boilers | 0.51 | 93% | 100% | 0.47 |
| TOTAL | | | | 1.00[44] |

44 Recall that "units" in the industrial sector is production capacity. In the base year, by definition, one industrial building unit uses 1 GJ, because base year consumption is the 'unit' for the base year.

## 6.3 Reference Case Natural Gas Use

This section profiles the reference case forecast (2020-2040) natural gas consumption for the industrial sector. The industrial production forecast, developed by FEI through survey of industrial customers, covers from 2020 to 2025. The first five-year period of the reference case forecast (2020 to 2025) incorporates how individual respondents expect their volume to change, and this five-year trend is extrapolated beyond 2025.

Reference case industrial natural gas consumption is presented by region in Exhibit 112, by segment in Exhibit 113, and by end use in Exhibit 114. These exhibits illustrate the following trends in consumption over the reference case:

- Overall gas consumption is forecasted to increase by approximately 7% between 2020 and 2040, but this increase is not evenly split between the regions, segments, or end uses. Some regions, segments, and end uses are forecasted to experience significant increases, while others are forecasted to remain stable or decrease.
- As shown in Exhibit 112, natural gas use in the Whistler region is forecasted to increase by 98%, while gas use in the Northern BC and Vancouver Island regions will remain relatively flat or decrease (1% decrease and 1% increase, respectively).
- As shown in Exhibit 113, natural gas use in the fabricated metal segment is forecasted increase by 39%, while gas use is forecasted to decrease in the non-metallic mineral and the pulp & paper – kraft segments (6% and 2% decrease, respectively).
- As shown in Exhibit 114, natural gas use in the heat-treating end use is forecasted increase by 28%, while gas use is forecasted to decrease by 4% in the kiln end use.
- Despite the differences in forecasted natural gas use, the same regions, segments and end uses as in the base year are expected to account for the largest shares of natural gas use in the industrial sector.

Exhibit 112 – 2020 vs 2040 Industrial Gas Consumption (GJ) by Region

| Region | 2020 | 2040 | Change |
|---|---|---|---|
| Lower Mainland x Van | 28,463K | 31,860K | 12% |
| Southern Interior | 19,039K | 20,907K | 10% |
| Northern BC | 18,892K | 18,647K | -1% |
| Vancouver Island | 8,235K | 8,308K | 1% |
| City of Vancouver | 5,701K | 6,511K | 14% |
| Whistler | 7K | 13K | 98% |
| **Total** | **80,335K** | **86,246K** | **7%** |

Exhibit 113 – 2020 vs 2040 Industrial Gas Consumption (GJ) by Segment

| Segment | 2020 | 2040 | Change |
|---|---|---|---|
| Pulp & Paper - Kraft | 23,871K | 23,487K | -2% |
| Agriculture | 11,527K | 13,858K | 20% |
| Wood Products | 9,960K | 10,288K | 3% |
| Mining | 8,058K | 8,861K | 10% |
| Manufacturing | 4,577K | 5,418K | 18% |
| Food & Beverage | 4,696K | 5,247K | 12% |
| Non-metallic Mineral | 5,132K | 4,819K | -6% |
| District Energy | 4,044K | 4,657K | 15% |
| Chemical | 3,798K | 4,578K | 21% |
| Pulp & Paper - TMP | 3,316K | 3,341K | 1% |
| Utilities | 780K | 890K | 14% |
| Fabricated Metal | 577K | 802K | 39% |
| **Total** | **80,335K** | **86,246K** | **7%** |

Exhibit 114 – 2020 vs 2040 Industrial Gas Consumption (GJ) by End Use

| Parent End Use | 2020 | 2040 | Change |
|---|---|---|---|
| Process Boilers | 30,437K | 32,987K | 8% |
| Product Drying | 19,680K | 20,658K | 5% |
| Direct-fired Heating | 12,556K | 12,760K | 2% |
| Space Heating | 6,179K | 7,184K | 16% |
| Kilns | 3,864K | 3,698K | -4% |
| Direct Gas Use | 1,458K | 1,778K | 22% |
| Petrochem Refining | 1,311K | 1,606K | 23% |
| Other | 1,306K | 1,548K | 19% |
| Ovens | 1,169K | 1,250K | 7% |
| Water Heaters | 904K | 1,004K | 11% |
| On-Site Generation | 780K | 890K | 14% |
| Heat Treating | 691K | 883K | 28% |
| **Total** | **80,335K** | **86,246K** | **7%** |

## 6.4 Measure Assessment

### 6.4.1 List of Measures

The list of industrial measures is presented in Exhibit 115 by industrial end uses.

Please see the MS Excel file entitled "Ind_Measure Analysis Workbook" for a description of each measure and a full analysis.

Measures were classified in four measure type categories:

- Building Envelope
- Equipment
- Controls
- Energy Management (including behavioral measures)

**Exhibit 115 – Industrial Sector Conservation and Energy Management Measures**

| Process Boiler | Space Heating |
|---|---|
| Air Compressor Heat Recovery | Advanced Thermostat |
| Boiler Right-Sizing | Air Comp Heat Recovery |
| Condensing Boiler | Air Curtains |
| Direct Contact Hot Water Heater | Condensing Make Up Air Units |
| Economizer | Condensing Unit Heaters |
| Heat Recovery Systems | Destratification Fans |
| Improved Condensate Return | HE Rooftop Unit Controls |
| Pipe Insulation | HE Rooftop Units |
| Process Boiler Load Control | HVAC Boiler Tune-up |
| Process Boiler $O_2$ Control | HVAC Ventilation Optimization |
| Steam to Hot Water Conversion (District Energy) | Loading Dock Seals |
| Steam Traps | Solar Walls |
| Tank Insulation | |
| Venturi Steam Traps | |
| **Other** | **Greenhouse** |
| Combustion Testing | Greenhouse Curtains |
| Energy Management | Greenhouse Envelope |
| High-Efficiency Burners | Integrated Greenhouse Controls |
| High-Efficiency Dryers | |
| High-Efficiency Furnaces | |
| High-Efficiency Kilns | |
| High-Efficiency Ovens | |
| Process Control | |
| Regenerative Catalytic Oxidizer | |
| Veneer Dryers | |
| Warm Mix Asphalt | |

### 6.4.2 Results

Exhibit 116 shows measure-level results for the industrial sector in order of decreasing cost effectiveness. Measures were assessed based on their replacement type: **retrofit** (immediate replacement at full cost) or **replace on burnout** (end of life replacement at incremental cost).

The TRC and MTRC are presented at the measure-level and exclude program costs and free ridership.

Some key findings of the measure assessment for the industrial sector include:

- Of the 39 measures included in the assessment, 34 pass the TRC screen and 38 pass the MTRC screen.
- The most attractive equipment replacement measure is boiler right-sizing, with a TRC of 167.7. This measure involves replacing an oversized boiler at equipment end of life, with a smaller, right-sized boiler. The measure TRC is exceptionally high because the incremental measure cost is either negligible or may even be negative in some cases.
- The most attractive energy management measure is process control, which has the potential for significant energy savings at a moderate capital cost.
- The most attractive building envelope measure is the greenhouse envelope measure (#7), which, as shown in Exhibit 115, only applies to the greenhouse end use. The most attractive building envelope measure that applies to the space heating end use is the air curtain measure (#14).
- Several measures that were included on the original list of measures were excluded from the analysis or modified. Please see the file called "Measure List Modifications.xlsx" for a list of changes.

**Exhibit 116 – Industrial Sector Measures with Average TRC and MTRC Results**

| # | Measure | Measure Type | Replacement Type | TRC | MTRC |
|---|---|---|---|---|---|
| 1 | Boiler Right-Sizing[45] | Equipment | ROB | 167.7 | 791.5 |
| 2 | Process Control | Energy Management | RET | 50.4 | 258.4 |
| 3 | Furnace RET | Equipment | RET | 11.7 | 56.6 |
| 4 | Combustion Testing | Energy Management | RET | 10.3 | 54.6 |
| 5 | Energy Management | Energy Management | RET | 10 | 54.3 |
| 6 | Tank Insulation | Equipment | RET | 10 | 50.9 |
| 7 | Greenhouse Envelope | Building Envelope | RET | 9.3 | 47.6 |
| 8 | Regenerative Catalytic Oxidizer | Energy Management | RET | 7.9 | 39.3 |

45 For the boiler right-sizing measure the incremental cost is negligible. A cost of $1,000 was used for this measure for the purposes of calculating the payback and TRC, to compare with other measures.

| | | | | | |
|---|---|---|---|---|---|
| 9 | Integrated Greenhouse Environmental Controls | Energy Management | RET | 6.8 | 34 |
| 10 | Replace Steam Traps | Equipment | RET | 5.3 | 28.1 |
| 11 | Condensing Boiler | Equipment | ROB | 5.7 | 26.9 |
| 12 | Pipe Insulation | Energy Management | RET | 4.8 | 24 |
| 13 | High Efficiency Dryers | Equipment | ROB | 4.7 | 22.9 |
| 14 | Air Curtain | Building Envelope | RET | 4.1 | 20.5 |
| 15 | Boiler Tune-Up | Energy Management | RET | 3.8 | 20.3 |
| 16 | Condensing MAU Unit | Equipment | ROB | 4.1 | 19.7 |
| 17 | High Efficiency Ovens | Equipment | ROB | 3.8 | 18.9 |
| 18 | High Efficiency Burners | Equipment | RET | 3.8 | 18.9 |
| 19 | Direct Contact Hot Water Heater | Equipment | ROB | 2.9 | 14 |
| 20 | Process Boiler Load Control | Controls | RET | 2.7 | 13.7 |
| 21 | Heat Recovery Systems | Energy Management | RET | 2.5 | 12.4 |
| 22 | HVAC Ventilation Optimization | Energy Management | RET | 2.3 | 12.4 |
| 23 | Advanced Veneer Dryer | Equipment | ROB | 2.3 | 11.3 |
| 24 | Condensing Unit Heaters | Equipment | ROB | 2.1 | 10.5 |
| 25 | Improved Condensate Return (Retrofit) | Energy Management | RET | 2 | 10 |
| 26 | Venturi Steam Trap | Equipment | RET | 1.8 | 9.3 |
| 27 | Air Compressor Heat Recovery (Process Heating) | Equipment | ROB | 1.7 | 8.7 |
| 28 | Economizer | Equipment | RET | 1.7 | 8.5 |
| 29 | Advanced Thermostats | Energy Management | RET | 2 | 7.4 |
| 30 | Greenhouse Curtains | Building Envelope | RET | 1.4 | 7.4 |
| 31 | Air Compressor Heat Recovery (Space Heating) | Equipment | ROB | 1.5 | 7.2 |
| 32 | Solar Wall | Energy Management | RET | 1.4 | 6.4 |
| 33 | HVAC Boiler Tune Up | Energy Management | RET | 1.1 | 6.1 |
| 34 | Loading Dock Seals | Building Envelope | RET | 1.2 | 5.9 |
| 35 | High Efficiency Kilns | Equipment | ROB | 0.9 | 4.3 |
| 36 | High Efficiency RTU Controls | Energy Management | RET | 0.9 | 3.9 |
| 37 | Destratification Fan | Energy Management | RET | 0.7 | 3.3 |
| 38 | Steam to Hot Water Conversion (District Energy) | Energy Management | RET | 0.5 | 2.5 |
| 39 | Warm Mix Asphalt | Energy Management | ROB | 0.1 | 0.5 |

## 6.5 Technical Potential

This section provides an overview of the technical potential savings results for the industrial sector. Overall results are presented below, followed by measure level results and supply curves for the TRC and MTRC results.

As shown in Exhibit 117, the majority of the industrial technical potential (15 PJ) would be available in 2021 and would increase slowly until reaching 19 PJ in 2040, indicating most of the available potential would be from retrofit measures as opposed to replace on burnout measures. The forecasted industrial natural gas consumption for the industrial sector is included for reference.

**Exhibit 117 – Industrial Technical Potential Savings (GJ)**

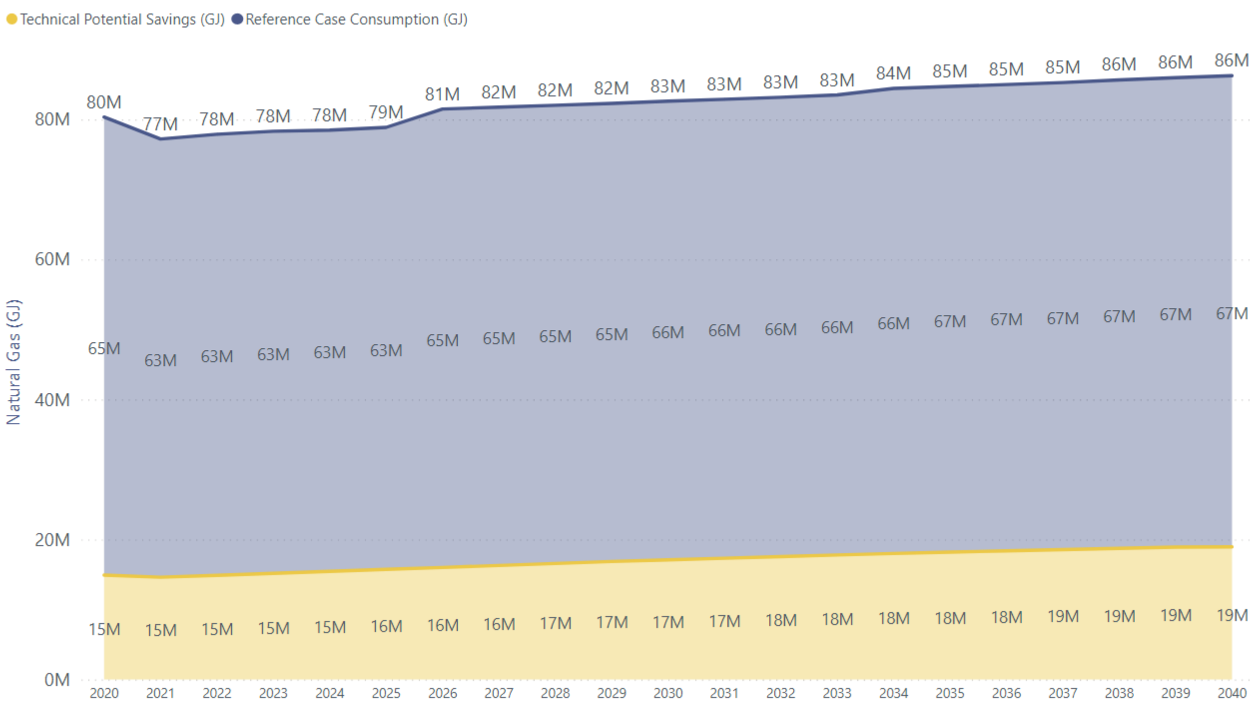
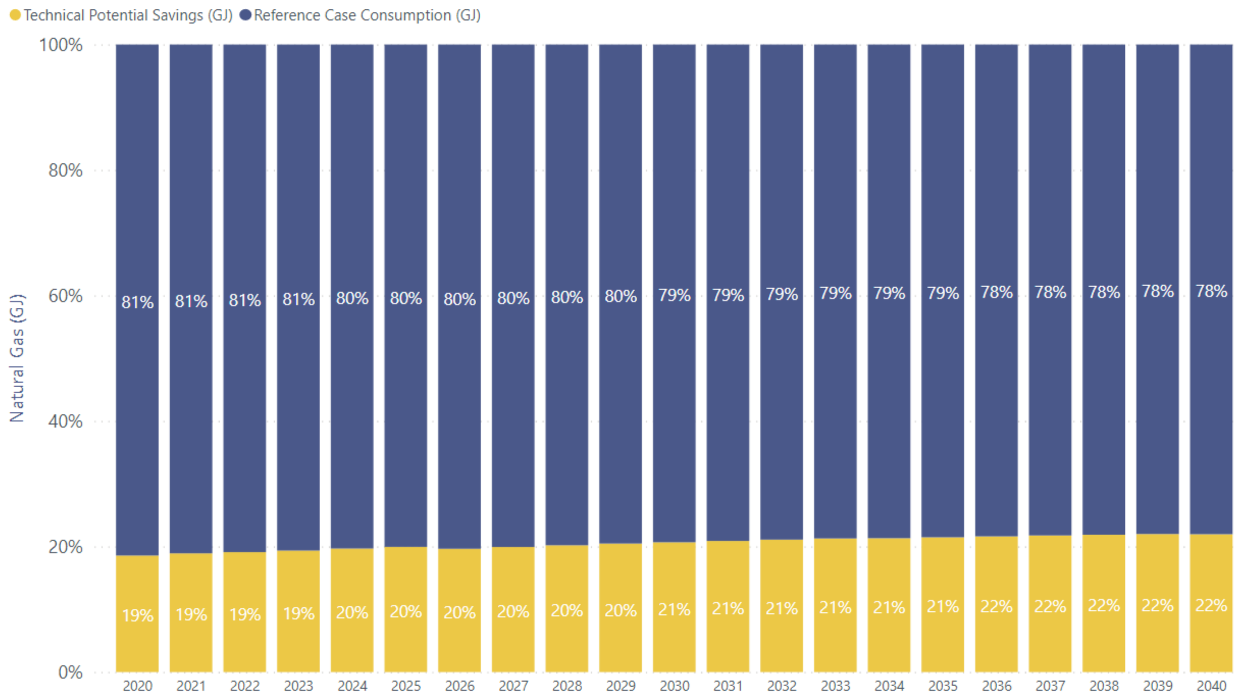


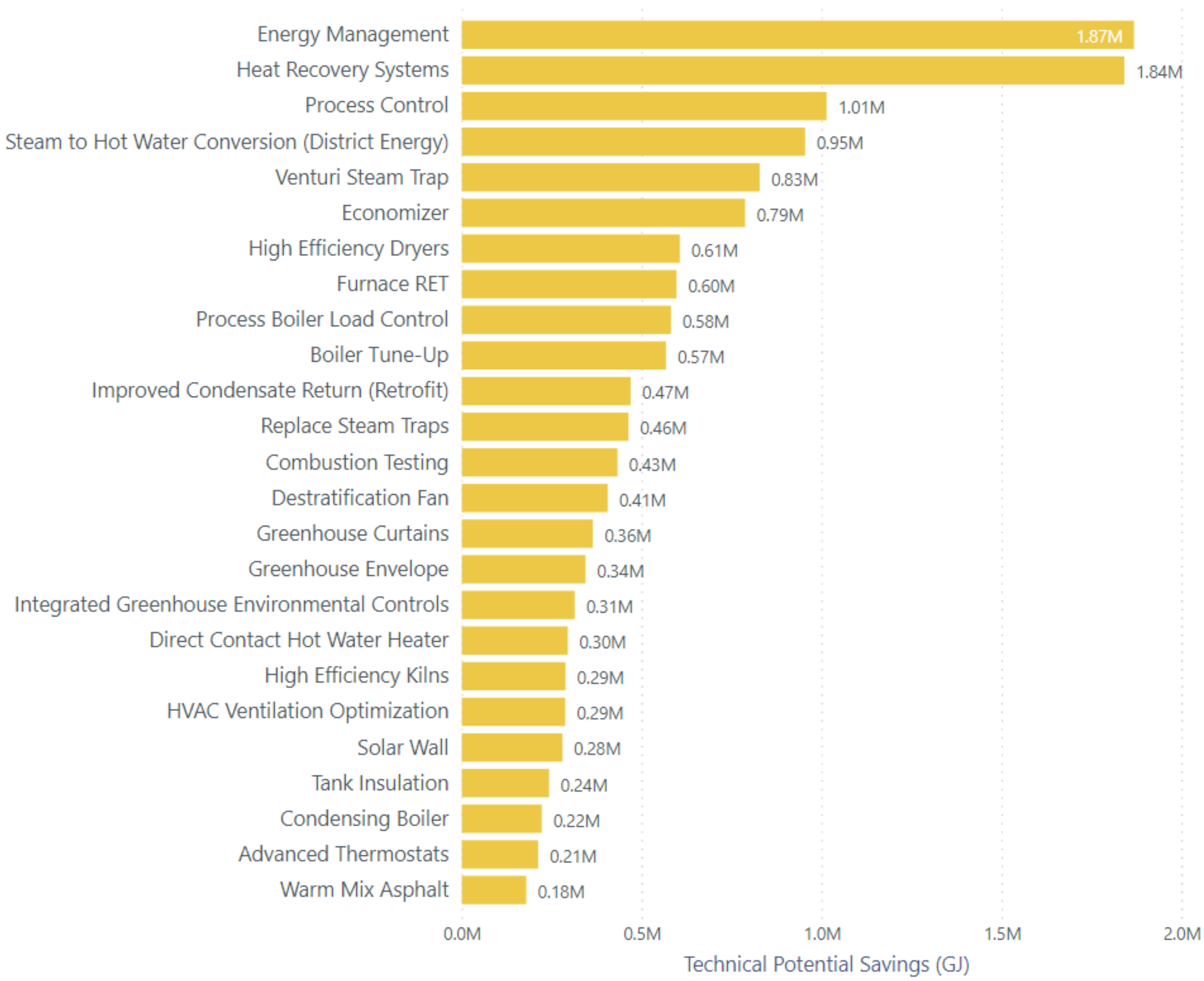
Exhibit 118 – Technical Potential Savings as a Percent of Industrial Reference Case Consumption (%)




As shown in Exhibit 118, the technical potential savings is about 19% of industrial reference case consumption in 2021 and increases to 22% by 2040, further indicating that most of the available potential would be from retrofit measures as opposed to replace on burnout measures.

The technical potential savings in 2025 broken down by measure (only the top 25 measures are shown) are presented in Exhibit 119. The top three measures (energy management, heat recovery systems, and process control) are expected to contribute substantially to technical potential savings (approximately 1.9 PJ, 1.8 PJ, and 1 PJ by 2025). As was shown in Exhibit 116, all three measures pass the TRC test, so they will also be expected to contribute to economic potential savings, as described in the following section. From the five measures that pass the MTRC but fail the TRC, Steam to Hot Water Conversion is the only one that has a large technical potential (#4 on the list below).

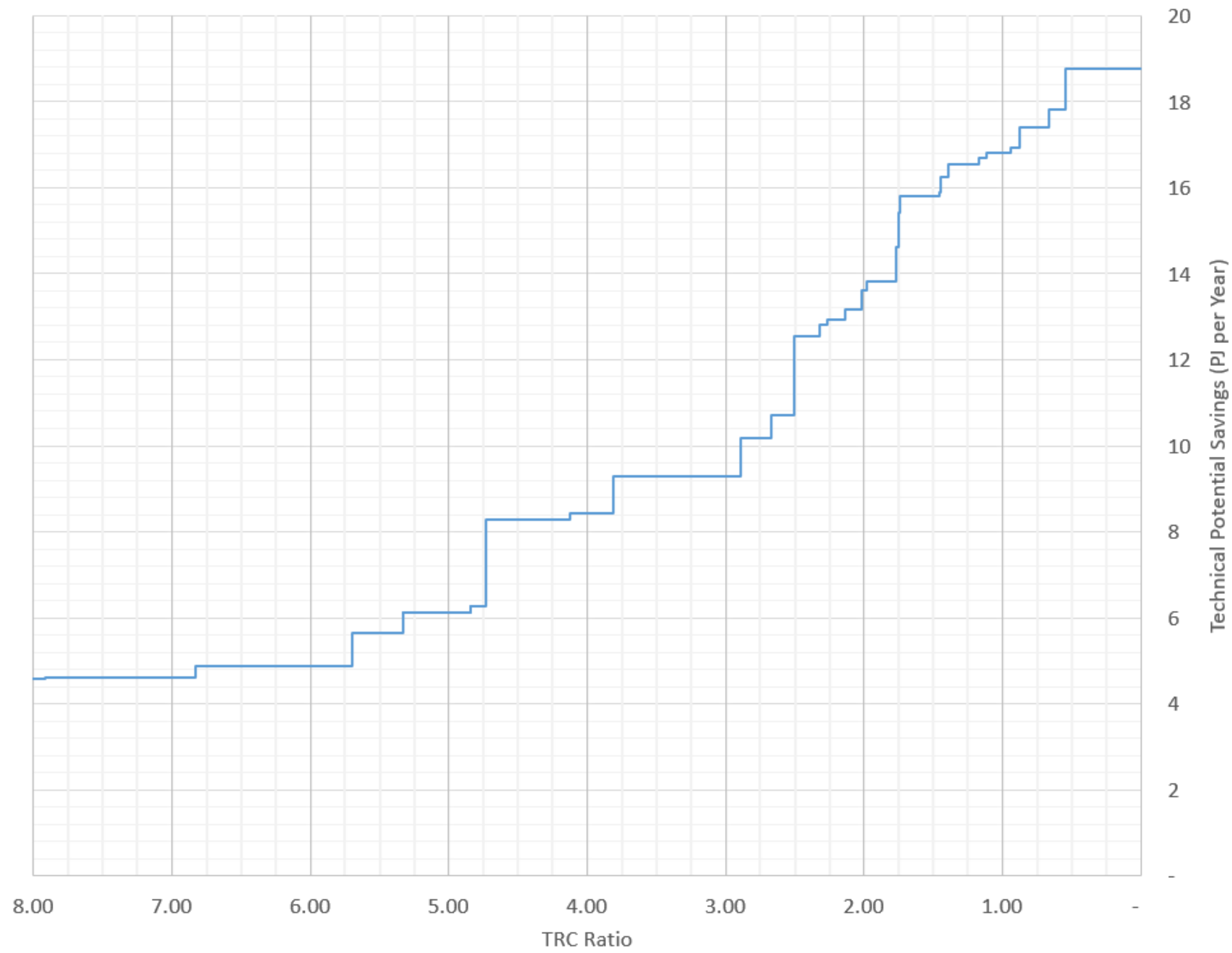
Exhibit 119 – Technical Potential – Top 25 Industrial Measures in 2025 (GJ)



The cumulative industrial sector technical potential savings in 2040 are presented in Exhibit 120 as a supply curve, with measures ordered by decreasing TRC ratio from left to right.

As shown, roughly 90% (17 out of 19 PJ) of the industrial sector technical potential savings by 2040 come from measures with a TRC of 1.0 or higher. Approximately 5 PJ of savings come from measures with a TRC ratio of greater than 8. These are shown in aggregate.

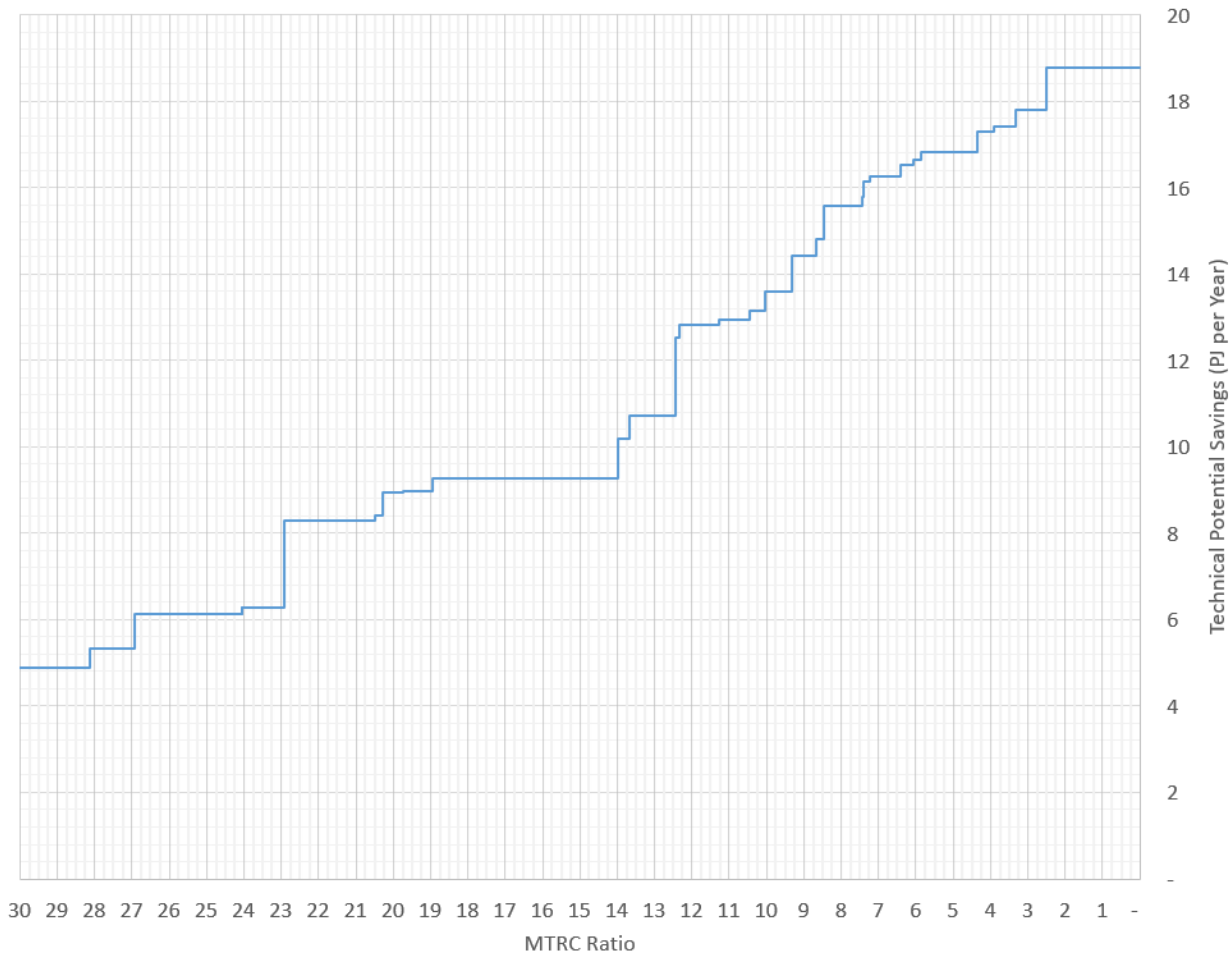
Exhibit 120 – Industrial Sector: Technical Potential Supply Curve, 2040 – TRC



Similar to Exhibit 120, the cumulative Industrial sector technical potential savings in 2040 are presented in Exhibit 121 as a supply curve, with measures ordered by decreasing MTRC ratio from left to right.

As shown, all of the industrial sector technical potential savings (approximately 19 PJ) by 2040, comes from measures with an MTRC of 1.0 or higher. Approximately 5 PJ of savings come from measures with an MTRC ratio of greater than 30. These are shown in aggregate.

Exhibit 121 – Industrial Sector: Technical Potential Supply Curve, 2040 – MTRC

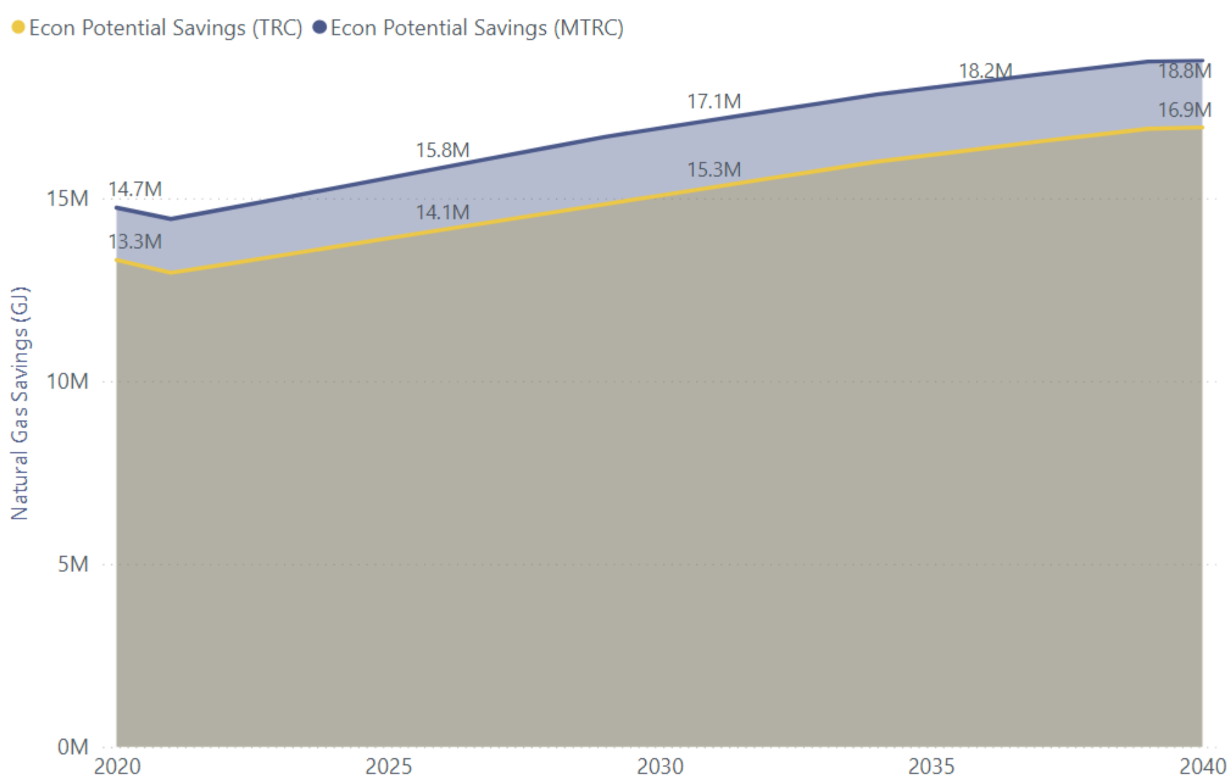


## 6.6 Economic Potential

This section provides an overview of the economic potential savings results. As was noted in section 6.3.2, 34 of the 39 measures examined have a TRC ratio over 1.0, so the difference between TRC and MTRC economic potential results for the Industrial sector is small.

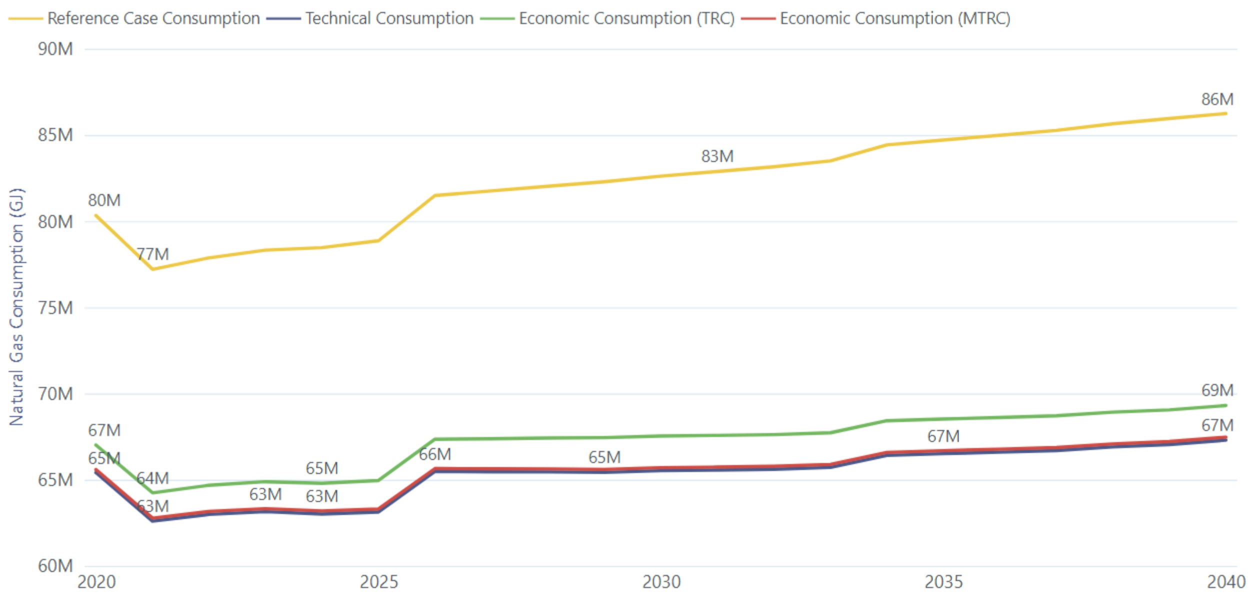
The industrial sector economic potential savings with a TRC screen and with an MTRC screen are shown in Exhibit 122. Although only four measures fail the TRC but pass the MTRC, the economic potential savings with an MTRC screen are roughly 1.7 PJ higher than with the TRC screen in 2025. This is mainly because one of those measures, steam to hot water conversion (district energy), represents the fifth largest technical potential (1 PJ) in 2025, as shown in Exhibit 119. Another way to look at it that the 92% of the MTRC economic potential comes from measures that pass the TRC as well.

Exhibit 122 – Economic Potential Savings (GJ) - Industrial, TRC and MTRC Screen



The forecasted gas consumption under the technical potential, economic potential with a TRC screen, economic potential with an MTRC screen, and reference case scenarios for the industrial sector are shown in Exhibit 123. The rapid decrease in technical and economic potential consumption in 2021 is a result of the implementation of the retrofit measures. The rest of the potential curve follows the shape of the reference case curve, as the replace on burnout measures are implemented at equipment end of life.

Exhibit 123 – Economic Potential Consumption (GJ) Forecasts – Industrial, TRC and MTRC




### *Results by Region*

The economic potential savings in 2025 are presented by region in Exhibit 124 (TRC) and Exhibit 125 (MTRC). The highest level of economic potential savings (21% or 23% depending on the economic screen) is estimated to occur in the Lower Mainland outside of the City of Vancouver.

Exhibit 124 – Economic Potential Savings by Region in 2025 – Industrial, TRC

| Region | Ref Case Consumption (GJ) | Economic Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Lower Mainland x Van | 28,893K | 6,029K | 21% |
| Southern Interior | 19,995K | 2,936K | 15% |
| Northern BC | 15,774K | 2,793K | 18% |
| Vancouver Island | 8,407K | 1,669K | 20% |
| City of Vancouver | 5,788K | 477K | 8% |
| Whistler | 7K | 0K | 1% |
| **Total** | **78,864K** | **13,904K** | **18%** |

Exhibit 125 – Economic Potential Savings by Region in 2025 – Industrial, MTRC

| Region | Ref Case Consumption (GJ) | Economic Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Lower Mainland x Van | 28,893K | 6,576K | 23% |
| Southern Interior | 19,995K | 3,056K | 15% |
| Northern BC | 15,774K | 2,887K | 18% |
| Vancouver Island | 8,407K | 1,698K | 20% |
| City of Vancouver | 5,788K | 1,339K | 23% |
| Whistler | 7K | 2K | 37% |
| **Total** | **78,864K** | **15,558K** | **20%** |

### *Results by Segment*

The economic potential savings in 2025 are presented by segment in Exhibit 126 (TRC) and Exhibit 127 (MTRC). The highest percentages of economic potential savings are estimated to occur in the agriculture, food & beverage, and fabricated metals segments. The largest absolute economic potential savings are estimated to occur in the pulp & paper – kraft segment.

Exhibit 126 – Economic Potential Savings by Segment in 2025 – Industrial, TRC

| Segment | Ref Case Consumption (GJ) | Economic Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Pulp & Paper - Kraft | 20,542K | 4,153K | 20% |
| Agriculture | 11,951K | 3,503K | 29% |
| Food & Beverage | 4,966K | 1,368K | 28% |
| Mining | 9,044K | 1,121K | 12% |
| Wood Products | 10,195K | 988K | 10% |
| Manufacturing | 4,877K | 917K | 19% |
| Pulp & Paper - TMP | 3,291K | 764K | 23% |
| Non-metallic Mineral | 4,856K | 563K | 12% |
| Chemical | 3,627K | 350K | 10% |
| Fabricated Metal | 643K | 176K | 27% |
| District Energy | 4,029K | 0K | 0% |
| Utilities | 842K | 0K | 0% |
| **Total** | **78,864K** | **13,904K** | **18%** |

Exhibit 127 – Economic Potential Savings by Segment in 2025 – Industrial, MTRC

| Segment | Ref Case Consumption (GJ) | Economic Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Pulp & Paper - Kraft | 20,542K | 4,300K | 21% |
| Agriculture | 11,951K | 3,610K | 30% |
| Food & Beverage | 4,966K | 1,408K | 28% |
| Mining | 9,044K | 1,137K | 13% |
| Manufacturing | 4,877K | 1,086K | 22% |
| Wood Products | 10,195K | 1,008K | 10% |
| District Energy | 4,029K | 954K | 24% |
| Pulp & Paper - TMP | 3,291K | 770K | 23% |
| Non-metallic Mineral | 4,856K | 740K | 15% |
| Chemical | 3,627K | 359K | 10% |
| Fabricated Metal | 643K | 185K | 29% |
| Utilities | 842K | 0K | 0% |
| **Total** | **78,864K** | **15,558K** | **20%** |

### *Results by End Use*

The economic potential savings in 2025 are presented by end use in Exhibit 128 (TRC) and Exhibit 129 (MTRC). The highest percentages of economic potential savings are estimated to occur in the process boilers, space heating, and heat treating end uses.

Approximately two-thirds of the savings are attributable to the largest end uses: process boilers (distributed across all segments except utilities).

Exhibit 128 – Economic Potential Savings by End Use in 2025 – Industrial, TRC

| Parent End Use | Ref Case Consumption (GJ) | Economic Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Process Boilers | 29,383K | 8,353K | 28% |
| Product Drying | 20,665K | 1,951K | 9% |
| Space Heating | 6,400K | 1,540K | 24% |
| Direct-fired Heating | 11,270K | 1,348K | 12% |
| Kilns | 3,428K | 241K | 7% |
| Heat Treating | 755K | 158K | 21% |
| Ovens | 1,204K | 155K | 13% |
| Petrochem Refining | 1,219K | 86K | 7% |
| Other | 1,382K | 47K | 3% |
| Water Heaters | 942K | 25K | 3% |
| Direct Gas Use | 1,376K | 0K | 0% |
| On-Site Generation | 842K | 0K | 0% |
| **Total** | **78,864K** | **13,904K** | **18%** |

Exhibit 129 – Economic Potential Savings by End Use in 2025 – Industrial, MTRC

| Parent End Use | Ref Case Consumption (GJ) | Economic Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Process Boilers | 29,383K | 9,307K | 32% |
| Space Heating | 6,400K | 1,959K | 31% |
| Product Drying | 20,665K | 1,951K | 9% |
| Direct-fired Heating | 11,270K | 1,348K | 12% |
| Kilns | 3,428K | 521K | 15% |
| Heat Treating | 755K | 158K | 21% |
| Ovens | 1,204K | 155K | 13% |
| Petrochem Refining | 1,219K | 86K | 7% |
| Other | 1,382K | 47K | 3% |
| Water Heaters | 942K | 25K | 3% |
| Direct Gas Use | 1,376K | 0K | 0% |
| On-Site Generation | 842K | 0K | 0% |
| **Total** | **78,864K** | **15,558K** | **20%** |

The TRC and MTRC economic potential savings for 2040 are presented by end use in Exhibit 130. As only four measures pass the MTRC but not the TRC screen, most savings totals are the same, except for the process boilers end use (954 TJ higher in MTRC), the kilns end use (467 TJ higher in MTRC), and the space heating end use (416 TJ higher in MTRC).

Exhibit 130 – Economic Potential Savings by End Use in 2040 – Industrial, TRC and MTRC

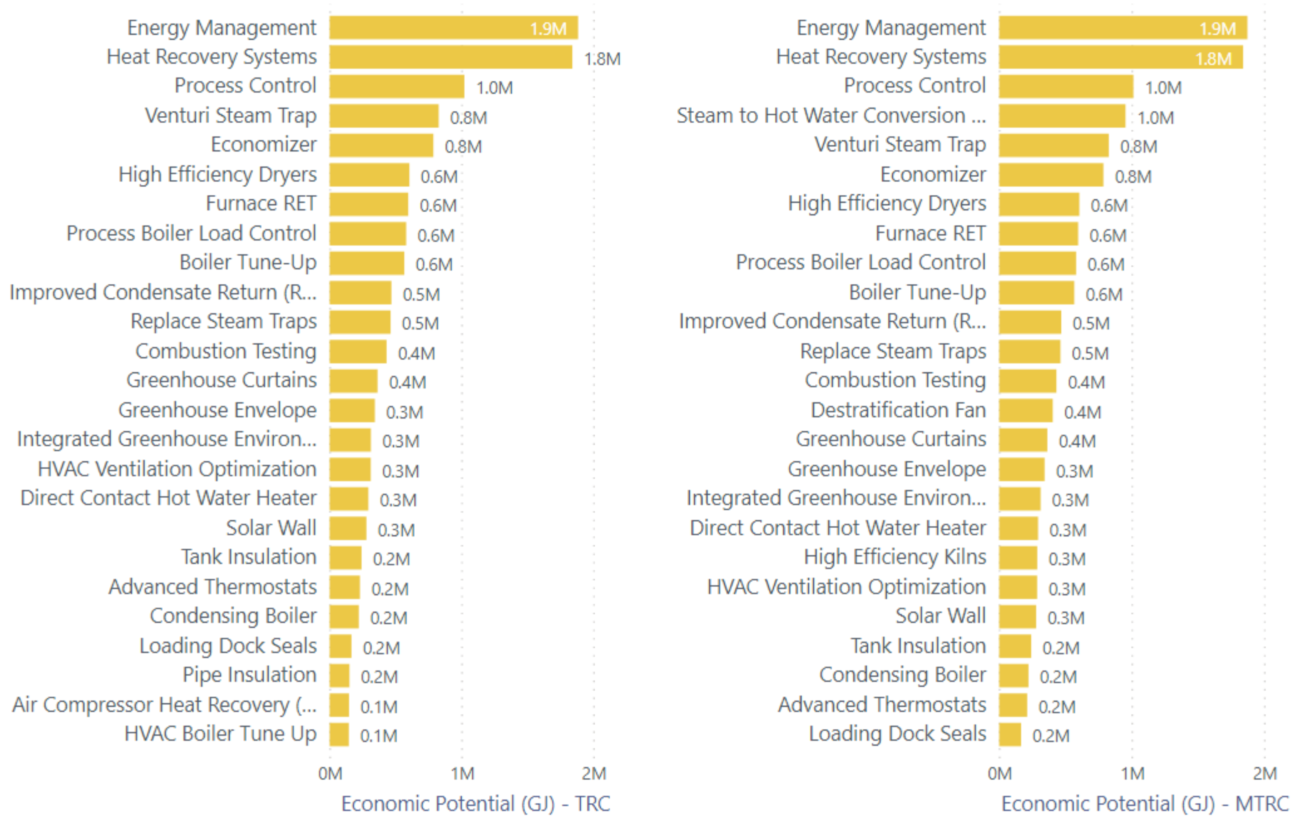
| Parent End Use | Economic Savings (GJ) - TRC | Economic Savings (GJ) - MTRC | Difference (GJ) |
|---|---|---|---|
| Process Boilers | 9,715K | 10,669K | 954K |
| Kilns | 241K | 708K | 467K |
| Space Heating | 1,712K | 2,127K | 416K |
| Direct Gas Use | 0K | 0K | 0K |
| Direct-fired Heating | 1,348K | 1,348K | 0K |
| Heat Treating | 158K | 158K | 0K |
| On-Site Generation | 0K | 0K | 0K |
| Other | 47K | 47K | 0K |
| Ovens | 269K | 269K | 0K |
| Petrochem Refining | 86K | 86K | 0K |
| Product Drying | 3,338K | 3,338K | 0K |
| Water Heaters | 25K | 25K | 0K |
| **Total** | **16,938K** | **18,775K** | **1,836K** |

*Results by Measure*

The economic potential savings in 2025 broken down by measure (only the top 25 measures are shown) are shown in Exhibit 131. The top measures in the TRC economic potential are shown on the left and the top measures in the MTRC scenario are shown on the right. As in the technical potential scenario, the top three measures (energy management, heat recovery systems, and process control) are expected to contribute substantially to economic potential savings (approximately 1.9 PJ, 1.8 PJ, and 1 PJ by 2025).

The main difference between the two lists is the large contribution of steam to hot water conversion (district energy) measure in the MTRC economic potential. Destratification fans and high efficiency kilns are the other two MTRC-only measures that appear on the list on the right.

Exhibit 131 – Economic Potential (TRC on Left, MTRC on Right) - Top 25 Industrial Measures in 2025 (GJ)



## 6.7 Market Potential

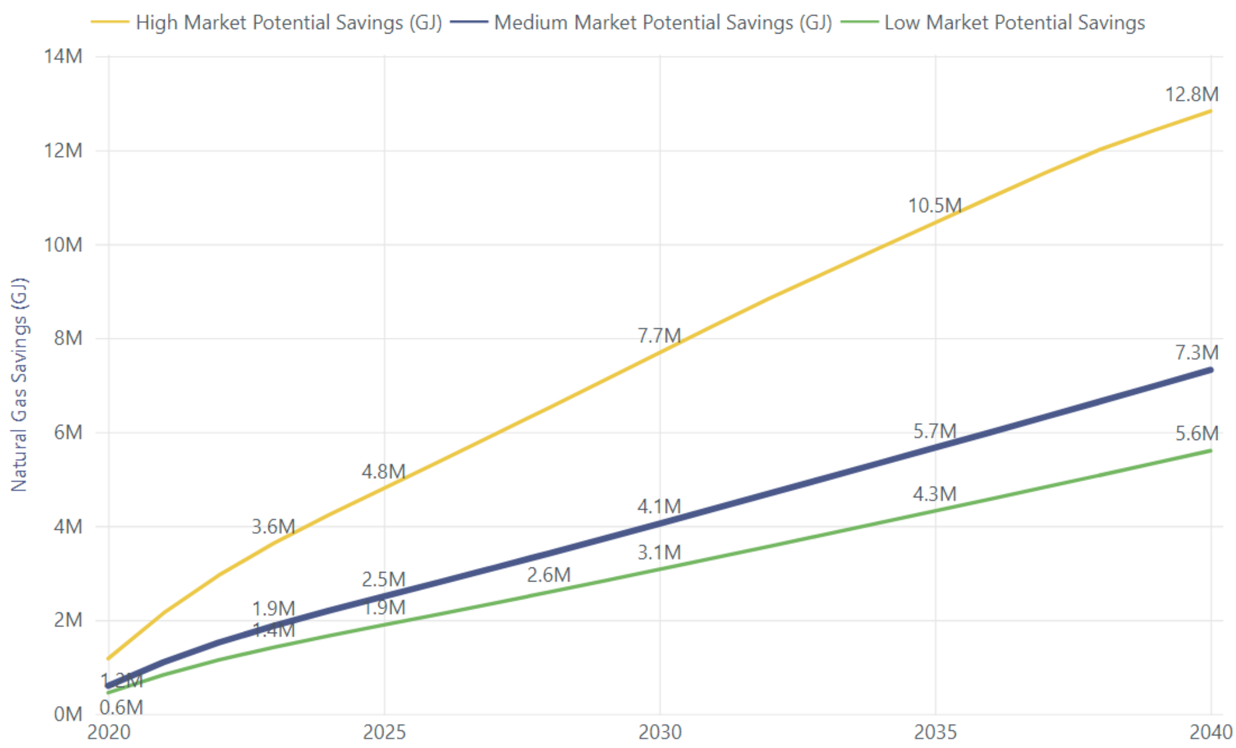
This section provides an overview of the low, medium, and high market potential results for the industrial sector.

Low, medium, and high scenarios assume that measure incentive levels will be 25%, 50% and 100% of incremental costs, respectively. For example, assume that a high-efficiency boiler may cost $10,000 more than a standard boiler, meaning the boiler would have an incremental cost of $10,000. In the medium scenario, this measure's hypothetical incentive from FortisBC would be $5,000. The other $5,000 would be paid by the end user. In all scenarios, the non-incentive program costs are assumed to be 15% of the incentive cost. In the example above, FortisBC's non-incentive spending would be $750. FortisBC's total cost for providing the measure to an end user would be $5,750.

The market potential savings results, with a TRC screen and with an MTRC screen, are shown in Exhibit 132 and Exhibit 133, respectively. These graphs are very similar because of the 39 measures included in the assessment, 34 pass the TRC screen and 38 pass the MTRC screen.

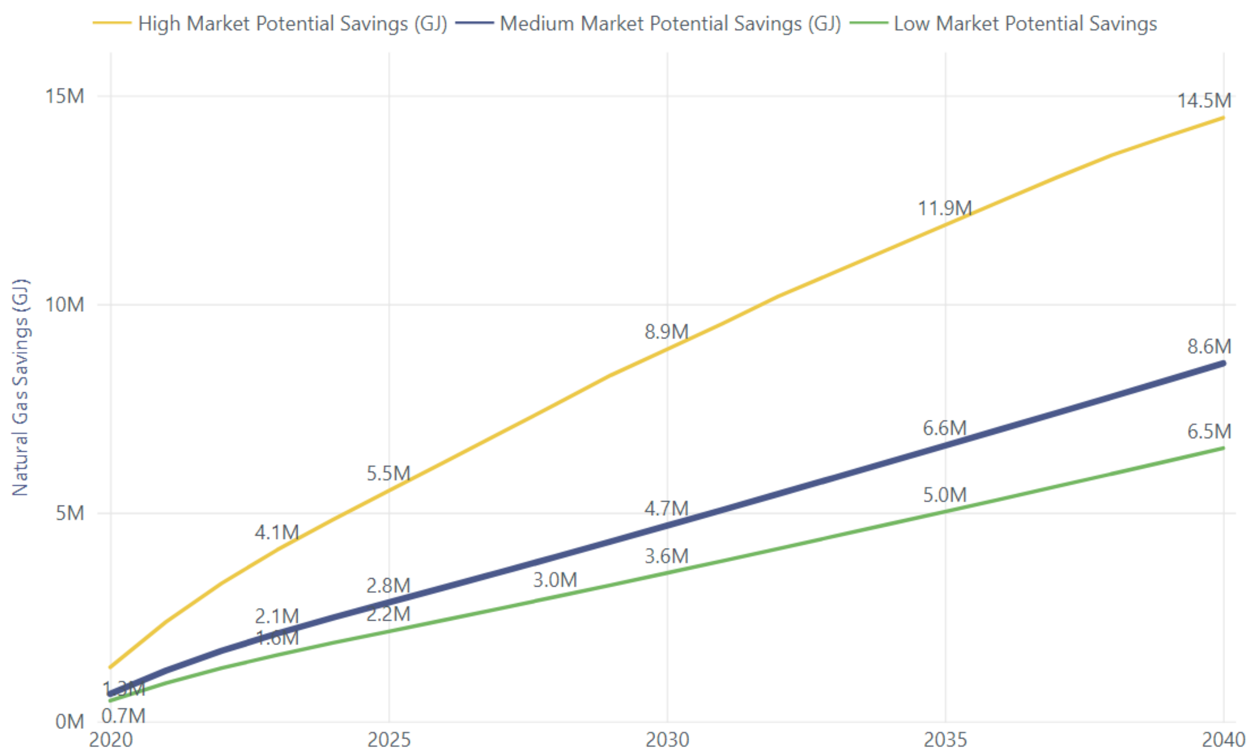
By 2040, the industrial low, medium, and high market TRC potential savings are estimated to be 5.6 PJ, 7.3 PJ, and 12.8 PJ, respectively.

Exhibit 132 – Market Potential Savings (GJ) – Industrial, TRC



By 2040, the industrial low, medium, and high market MTRC potential savings are estimated to be 6.5 PJ, 8.6 PJ, and 14.5 PJ, respectively.

Exhibit 133 – Market Potential Savings (GJ) – Industrial, MTRC



The market potential consumption results, with a TRC screen and with an MTRC screen, are shown in Exhibit 134 and Exhibit 135 respectively. These graphs are very similar because of the 39 measures included in the assessment, 34 pass the TRC screen and 38 pass the MTRC screen.

By 2040, the industrial low, medium, and high market TRC potential consumption levels are estimated to be 81 PJ, 79 PJ, and 73 PJ, respectively, while reference consumption is forecasted to reach 86 PJ.

By 2040, the industrial low, medium, and high market MTRC potential consumption levels are estimated to be 80 PJ, 78 PJ, and 72 PJ, respectively, while reference consumption is forecasted to reach 86 PJ.

### Exhibit 134 – Market Potential Consumption (GJ) Forecasts – Industrial, TRC

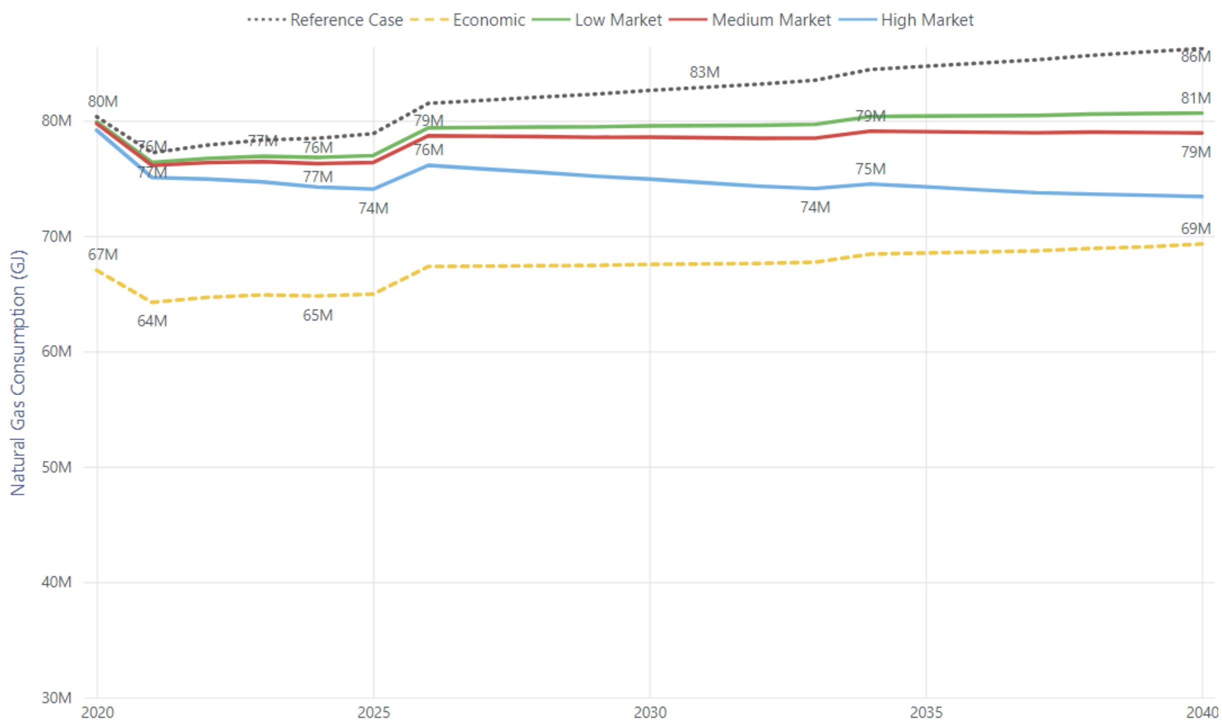
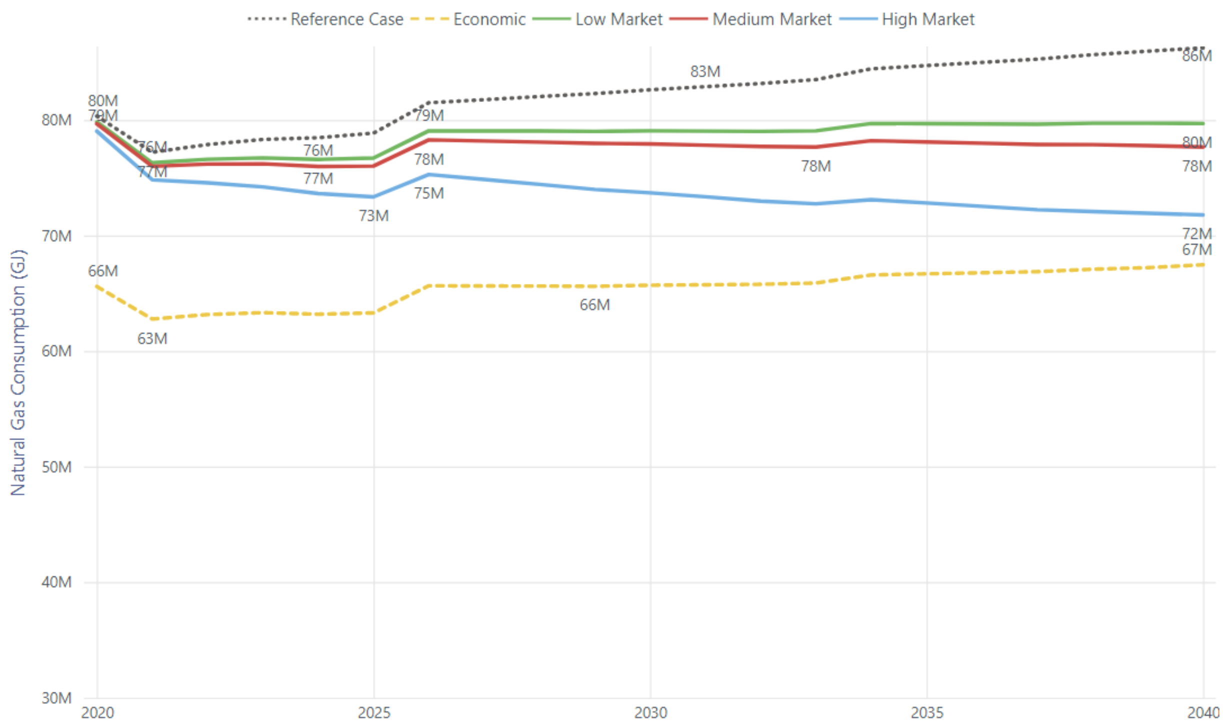


Exhibit 135 – Market Potential Consumption (GJ) Forecasts – Industrial, MTRC




The remainder of this section presents detailed results of the medium market potential scenario only. Similarly detailed results of the low and high market potential scenarios can be found on the Power BI dashboard and the Excel workbooks.

### *Results by Region*

The medium market potential savings for 2025 are presented by region in Exhibit 136 (TRC) and Exhibit 137 (MTRC). TRC medium market potential savings for 2025 are estimated to be between 3% and 4% of reference case consumption in all regions, other than Whistler, where they are estimated to be less than 1%. MTRC medium market potential percentages are similar except in City of Vancouver (5%) and Whistler (11%).

Exhibit 136 – Medium Market Potential Savings by Region in 2025 – Industrial, TRC

| Region | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Lower Mainland x Van | 28,893K | 1,108K | 4% |
| Southern Interior | 19,995K | 535K | 3% |
| Northern BC | 15,774K | 483K | 3% |
| Vancouver Island | 8,407K | 299K | 4% |
| City of Vancouver | 5,788K | 76K | 1% |
| Whistler | 7K | 0K | 0% |
| **Total** | **78,864K** | **2,501K** | **3%** |

Exhibit 137 – Medium Market Potential Savings by Region in 2025 – Industrial, MTRC

| Region | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Lower Mainland x Van | 28,893K | 1,186K | 4% |
| Southern Interior | 19,995K | 547K | 3% |
| Northern BC | 15,774K | 496K | 3% |
| City of Vancouver | 5,788K | 317K | 5% |
| Vancouver Island | 8,407K | 301K | 4% |
| Whistler | 7K | 1K | 11% |
| **Total** | **78,864K** | **2,848K** | **4%** |

### *Results by Segment*

The medium market potential savings for 2025 are presented by segment in Exhibit 138 (TRC) and Exhibit 139 (MTRC). In TRC medium market potential, the highest percentages savings are estimated to occur in the agriculture (5%) and fabricated metal segments (8%). The largest medium market potential savings (725 TJ) is estimated to occur in the pulp & paper – kraft segment. In MTRC medium market potential, the highest percentages savings are estimated to occur in the agriculture (5%), fabricated metal (8%) and district energy (7%) segments. The largest medium market potential savings (744 TJ) is still from the pulp & paper – kraft segment.

Exhibit 138 – Medium Market Potential Savings by Segment in 2025 – Industrial, TRC

| Segment | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Pulp & Paper - Kraft | 20,542K | 725K | 4% |
| Agriculture | 11,951K | 608K | 5% |
| Food & Beverage | 4,966K | 220K | 4% |
| Mining | 9,044K | 217K | 2% |
| Wood Products | 10,195K | 206K | 2% |
| Manufacturing | 4,877K | 158K | 3% |
| Pulp & Paper - TMP | 3,291K | 134K | 4% |
| Non-metallic Mineral | 4,856K | 112K | 2% |
| Chemical | 3,627K | 71K | 2% |
| Fabricated Metal | 643K | 50K | 8% |
| District Energy | 4,029K | 0K | 0% |
| Utilities | 842K | 0K | 0% |
| **Total** | **78,864K** | **2,501K** | **3%** |

Exhibit 139 – Medium Market Potential Savings by Segment in 2025 – Industrial, MTRC

| Segment | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Pulp & Paper - Kraft | 20,542K | 744K | 4% |
| Agriculture | 11,951K | 617K | 5% |
| District Energy | 4,029K | 273K | 7% |
| Food & Beverage | 4,966K | 223K | 4% |
| Mining | 9,044K | 219K | 2% |
| Wood Products | 10,195K | 208K | 2% |
| Manufacturing | 4,877K | 171K | 4% |
| Non-metallic Mineral | 4,856K | 137K | 3% |
| Pulp & Paper - TMP | 3,291K | 134K | 4% |
| Chemical | 3,627K | 72K | 2% |
| Fabricated Metal | 643K | 51K | 8% |
| Utilities | 842K | 0K | 0% |
| **Total** | **78,864K** | **2,848K** | **4%** |

### *Results by End Use*

The medium market potential savings for 2025 are presented by end use in Exhibit 140 (TRC) and Exhibit 141 (MTRC). The highest percentages of economic potential savings are estimated to occur in the heat-treating end use (7% in both TRC and MTRC scenarios).

Under both economic screens, almost three quarters of savings are attributable to the Process Boilers end uses (1,500 TJ for TRC and 1,773 TJ for MTRC, distributed across all segments except utilities).

Exhibit 140 – Medium Market Potential Savings by End Use in 2025 – Industrial, TRC

| Parent End Use | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Process Boilers | 29,383K | 1,500K | 5% |
| Product Drying | 20,665K | 407K | 2% |
| Direct-fired Heating | 11,270K | 231K | 2% |
| Space Heating | 6,400K | 196K | 3% |
| Heat Treating | 755K | 55K | 7% |
| Kilns | 3,428K | 51K | 1% |
| Ovens | 1,204K | 32K | 3% |
| Petrochem Refining | 1,219K | 18K | 1% |
| Other | 1,382K | 8K | 1% |
| Water Heaters | 942K | 3K | 0% |
| Direct Gas Use | 1,376K | 0K | 0% |
| On-Site Generation | 842K | 0K | 0% |
| **Total** | **78,864K** | **2,501K** | **3%** |

Exhibit 141 – Medium Market Potential Savings by End Use in 2025 – Industrial, MTRC

| Parent End Use | Ref Case Consumption (GJ) | Medium Market Potential Savings (GJ) | % of Consumption |
|---|---|---|---|
| Process Boilers | 29,383K | 1,773K | 6% |
| Product Drying | 20,665K | 407K | 2% |
| Direct-fired Heating | 11,270K | 231K | 2% |
| Space Heating | 6,400K | 230K | 4% |
| Kilns | 3,428K | 91K | 3% |
| Heat Treating | 755K | 55K | 7% |
| Ovens | 1,204K | 32K | 3% |
| Petrochem Refining | 1,219K | 18K | 1% |
| Other | 1,382K | 8K | 1% |
| Water Heaters | 942K | 3K | 0% |
| Direct Gas Use | 1,376K | 0K | 0% |
| On-Site Generation | 842K | 0K | 0% |
| **Total** | **78,864K** | **2,848K** | **4%** |

The TRC and MTRC medium market potential savings for 2040 are presented by end use in Exhibit 142. As only four measures pass the MTRC but not the TRC screen, most savings totals are the same, except for the process boilers end use (954 TJ higher in MTRC), kilns end use (188 TJ higher in MTRC), and the space heating end use (117 TJ higher in MTRC).

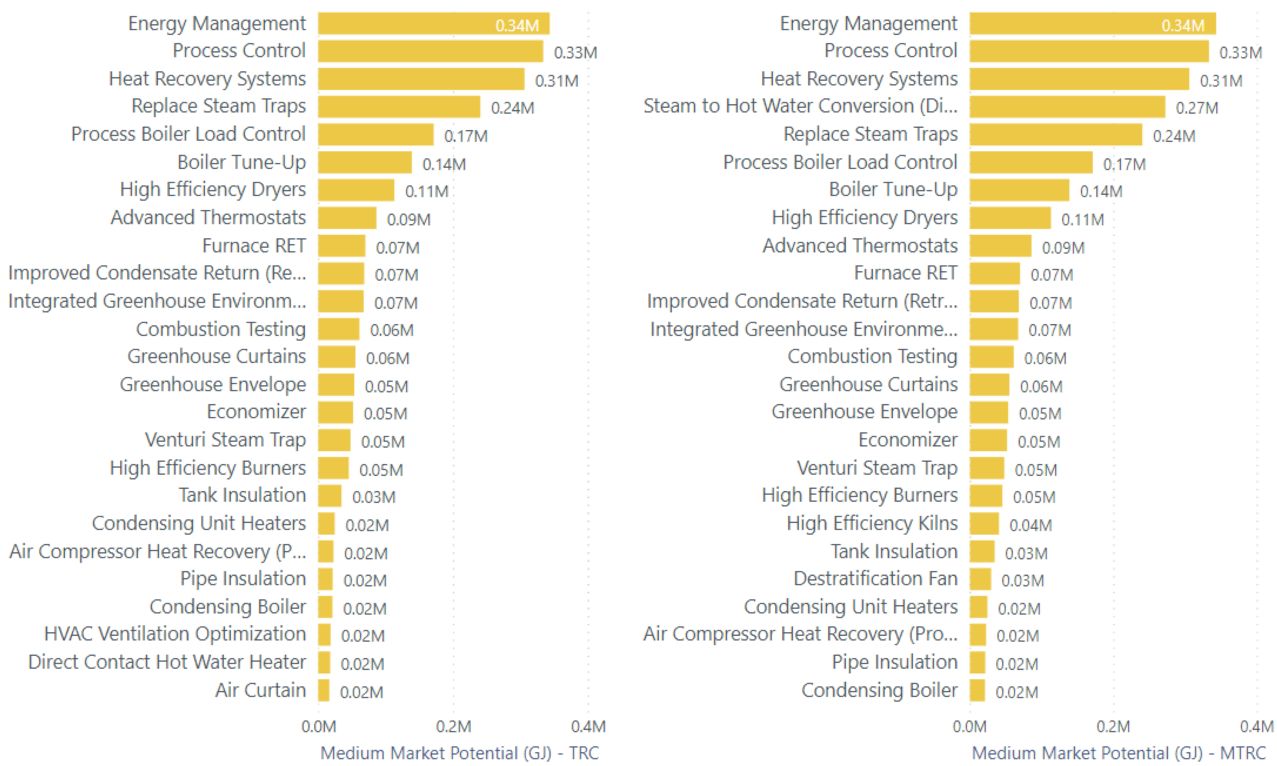
Exhibit 142 – Medium Market Potential Savings by End Use in 2040 – Industrial, TRC and MTRC

| Parent End Use | Medium Potential Savings (GJ) - TRC | Medium Potential Savings (GJ) - MTRC | Difference (GJ) |
|---|---|---|---|
| Process Boilers | 4,761K | 5,716K | 954K |
| Kilns | 88K | 276K | 188K |
| Space Heating | 522K | 639K | 117K |
| Direct Gas Use | 0K | 0K | 0K |
| Direct-fired Heating | 523K | 523K | 0K |
| Heat Treating | 67K | 67K | 0K |
| On-Site Generation | 0K | 0K | 0K |
| Other | 15K | 15K | 0K |
| Ovens | 118K | 118K | 0K |
| Petrochem Refining | 31K | 31K | 0K |
| Product Drying | 1,189K | 1,189K | 0K |
| Water Heaters | 8K | 8K | 0K |
| **Total** | **7,323K** | **8,582K** | **1,259K** |

*Results by Measure*

The total medium market potential savings (GJ per year) in 2025 of each of the top 25 industrial measures are shown in Exhibit 143, sorted by decreasing potential. As in the technical and economic potential scenarios, the top three measures (energy management, process control, and heat recovery systems) are expected to contribute a large portion of the medium market potential savings (approximately 0.34 PJ, 0.33 PJ, and 0.31 PJ in 2025).

### Exhibit 143 – Medium Market Potential (TRC on Left, MTRC on Right) - Gas Savings from Top 25 Industrial Measures in 2025 (GJ)



### 6.7.1 Incentive and Non-Incentive Spending

The incentive and non-incentive spending required to achieve the medium and high market potential are shown in Exhibit 144 (TRC) and Exhibit 145 (MTRC). Medium and high market incentives are assumed to be 50% and 100% of measures' incremental costs, respectively. In both medium and high scenarios, non-incentive costs are estimated to be 15% of incentive costs. The tables also show the total as well as incremental (that is, savings from new measures installed in a year) savings every year.

**Exhibit 144 – Medium and High Market Incentive Costs and Natural Gas Savings – Industrial, TRC**

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $3.3M | $0.5M | $3.8M | 600K | 600K | $13.0M | $2.0M | $15.0M | 1,178K | 1,178K |
| 2021 | $3.3M | $0.5M | $3.8M | 1,099K | 499K | $12.9M | $1.9M | $14.8M | 2,144K | 966K |
| 2022 | $3.2M | $0.5M | $3.7M | 1,518K | 419K | $12.7M | $1.9M | $14.6M | 2,949K | 805K |
| 2023 | $3.1M | $0.5M | $3.5M | 1,874K | 356K | $12.1M | $1.8M | $13.9M | 3,631K | 681K |
| 2024 | $3.0M | $0.4M | $3.4M | 2,196K | 323K | $11.5M | $1.7M | $13.2M | 4,234K | 603K |
| 2025 | $2.9M | $0.4M | $3.3M | 2,501K | 305K | $11.3M | $1.7M | $13.0M | 4,805K | 572K |
| 2026 | $2.9M | $0.4M | $3.4M | 2,804K | 303K | $11.4M | $1.7M | $13.1M | 5,373K | 568K |
| 2027 | $3.0M | $0.5M | $3.5M | 3,109K | 305K | $11.6M | $1.7M | $13.4M | 5,944K | 571K |
| 2028 | $3.1M | $0.5M | $3.6M | 3,419K | 310K | $12.0M | $1.8M | $13.8M | 6,520K | 577K |
| 2029 | $3.2M | $0.5M | $3.7M | 3,733K | 315K | $12.5M | $1.9M | $14.4M | 7,103K | 583K |
| 2030 | $3.4M | $0.5M | $3.9M | 4,051K | 317K | $13.0M | $2.0M | $15.0M | 7,689K | 585K |
| 2031 | $3.5M | $0.5M | $4.0M | 4,371K | 320K | $13.4M | $2.0M | $15.4M | 8,276K | 587K |
| 2032 | $3.5M | $0.5M | $4.0M | 4,694K | 323K | $13.2M | $2.0M | $15.2M | 8,848K | 572K |
| 2033 | $3.5M | $0.5M | $4.0M | 5,018K | 324K | $12.7M | $1.9M | $14.6M | 9,386K | 538K |
| 2034 | $3.5M | $0.5M | $4.0M | 5,343K | 325K | $12.6M | $1.9M | $14.4M | 9,924K | 538K |
| 2035 | $3.5M | $0.5M | $4.0M | 5,667K | 324K | $12.4M | $1.9M | $14.3M | 10,458K | 534K |
| 2036 | $3.5M | $0.5M | $4.0M | 5,994K | 327K | $12.4M | $1.9M | $14.2M | 10,990K | 532K |
| 2037 | $3.5M | $0.5M | $4.0M | 6,323K | 329K | $12.4M | $1.9M | $14.2M | 11,518K | 528K |
| 2038 | $3.6M | $0.5M | $4.1M | 6,653K | 331K | $12.0M | $1.8M | $13.8M | 12,020K | 502K |
| 2039 | $3.6M | $0.5M | $4.1M | 6,986K | 333K | $9.1M | $1.4M | $10.5M | 12,434K | 414K |
| 2040 | $3.7M | $0.6M | $4.2M | 7,323K | 337K | $8.8M | $1.3M | $10.1M | 12,833K | 399K |

Exhibit 145 – Medium and High Market Incentive Costs and Natural Gas Savings – Industrial, MTRC

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $8.8M | $1.3M | $10.2M | 658K | 658K | $35.2M | $5.3M | $40.5M | 1,298K | 1,298K |
| 2021 | $8.8M | $1.3M | $10.1M | 1,215K | 557K | $35.0M | $5.3M | $40.3M | 2,384K | 1,086K |
| 2022 | $8.8M | $1.3M | $10.1M | 1,692K | 477K | $34.9M | $5.2M | $40.1M | 3,309K | 925K |
| 2023 | $8.6M | $1.3M | $9.9M | 2,105K | 414K | $34.3M | $5.1M | $39.4M | 4,110K | 801K |
| 2024 | $8.5M | $1.3M | $9.8M | 2,486K | 381K | $33.7M | $5.1M | $38.8M | 4,833K | 723K |
| 2025 | $8.5M | $1.3M | $9.7M | 2,848K | 362K | $33.5M | $5.0M | $38.6M | 5,524K | 691K |
| 2026 | $8.5M | $1.3M | $9.7M | 3,209K | 361K | $33.6M | $5.0M | $38.7M | 6,211K | 687K |
| 2027 | $8.6M | $1.3M | $9.8M | 3,572K | 363K | $33.9M | $5.1M | $39.0M | 6,901K | 690K |
| 2028 | $8.7M | $1.3M | $10.0M | 3,940K | 367K | $34.3M | $5.1M | $39.4M | 7,597K | 696K |
| 2029 | $8.8M | $1.3M | $10.1M | 4,313K | 373K | $34.8M | $5.2M | $40.0M | 8,299K | 703K |
| 2030 | $8.9M | $1.3M | $10.3M | 4,688K | 376K | $15.2M | $2.3M | $17.5M | 8,914K | 615K |
| 2031 | $9.1M | $1.4M | $10.4M | 5,067K | 379K | $15.7M | $2.3M | $18.0M | 9,532K | 618K |
| 2032 | $9.1M | $1.4M | $10.5M | 5,451K | 383K | $25.7M | $3.9M | $29.5M | 10,182K | 649K |
| 2033 | $9.1M | $1.4M | $10.5M | 5,835K | 384K | $15.2M | $2.3M | $17.5M | 10,753K | 571K |
| 2034 | $9.1M | $1.4M | $10.5M | 6,221K | 386K | $15.1M | $2.3M | $17.4M | 11,326K | 572K |
| 2035 | $9.1M | $1.4M | $10.5M | 6,607K | 386K | $15.1M | $2.3M | $17.3M | 11,895K | 569K |
| 2036 | $9.2M | $1.4M | $10.5M | 6,997K | 389K | $15.1M | $2.3M | $17.4M | 12,464K | 569K |
| 2037 | $9.2M | $1.4M | $10.6M | 7,389K | 392K | $15.2M | $2.3M | $17.5M | 13,030K | 566K |
| 2038 | $9.3M | $1.4M | $10.7M | 7,783K | 394K | $14.9M | $2.2M | $17.1M | 13,572K | 542K |
| 2039 | $9.4M | $1.4M | $10.8M | 8,180K | 397K | $12.1M | $1.8M | $13.9M | 14,026K | 454K |
| 2040 | $9.5M | $1.4M | $10.9M | 8,582K | 402K | $11.9M | $1.8M | $13.7M | 14,467K | 441K |

# 7 Portfolio Level Results

This section provides the results of the market potential savings on a portfolio (i.e. total of residential, commercial, and industrial sectors) level. It also presents estimated emissions reduction and job creation possibilities that can result from the energy savings in market potential scenarios.

## 7.1 Market Potential

Low, medium, and high scenarios assume that measure incentive levels will be 25%, 50%, and 100% of incremental costs, respectively. For example, assume that a high-efficiency furnace may cost $200 more than a standard furnace, meaning the furnace would have an incremental cost of $200. In the medium scenario, this measure's hypothetical incentive from FortisBC would be $100. The other $100 would be paid by the end user. In all scenarios, the non-incentive program costs are assumed to be 15% of the incentive cost. In the example above, FortisBC's non-incentive spending would be $15. FortisBC's total cost for providing the measure to an end user would be $115.

### 7.1.1 Results

The total market potential savings for all sectors, with a TRC screen and with an MTRC screen, are shown in Exhibit 146 and Exhibit 147, respectively. The medium market potential using the MTRC screen is 50% higher than the market potential using TRC screen.

By 2040, the total low, medium, and high market TRC potential savings are estimated to be 12 PJ, 16 PJ, and 27 PJ, respectively. By 2040, the low, medium, and high market MTRC potential savings are estimated to be 19 PJ, 24 PJ, and 46 PJ, respectively.

Exhibit 146 – Market Potential Savings (GJ) – All Sectors, TRC

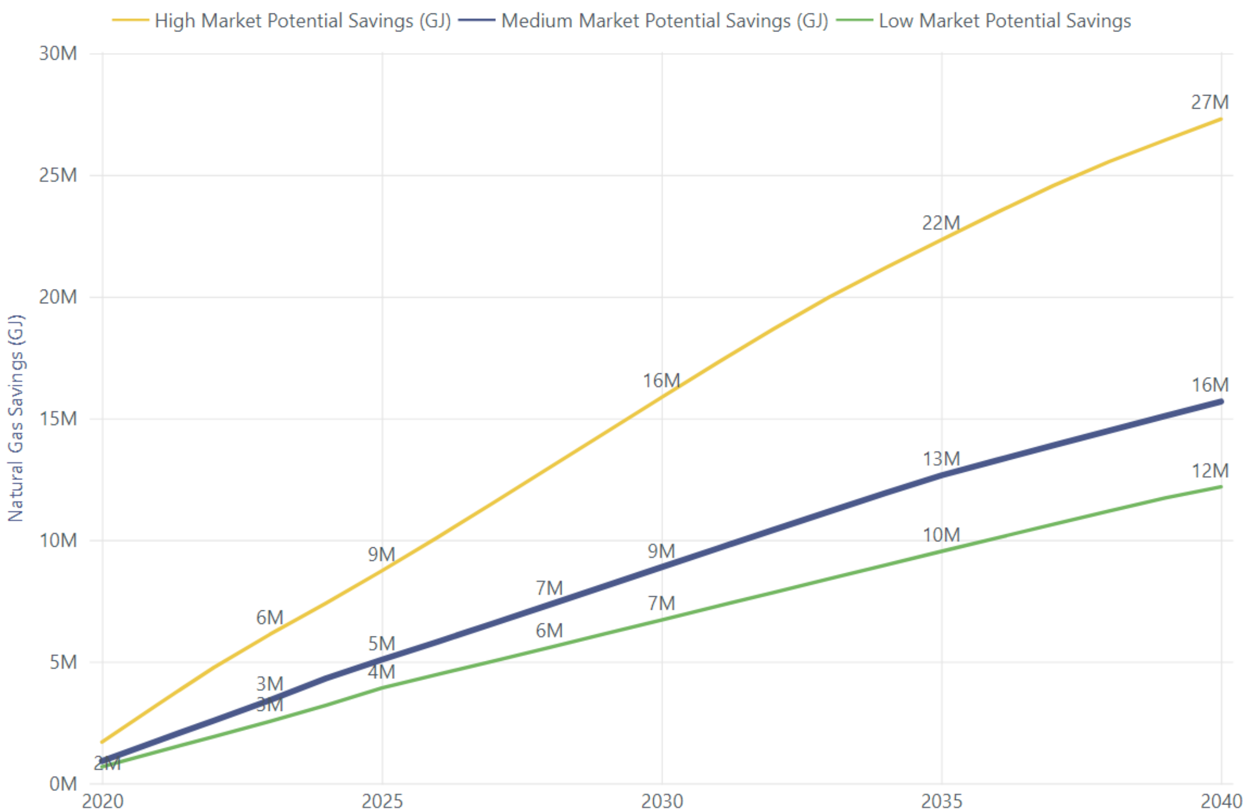
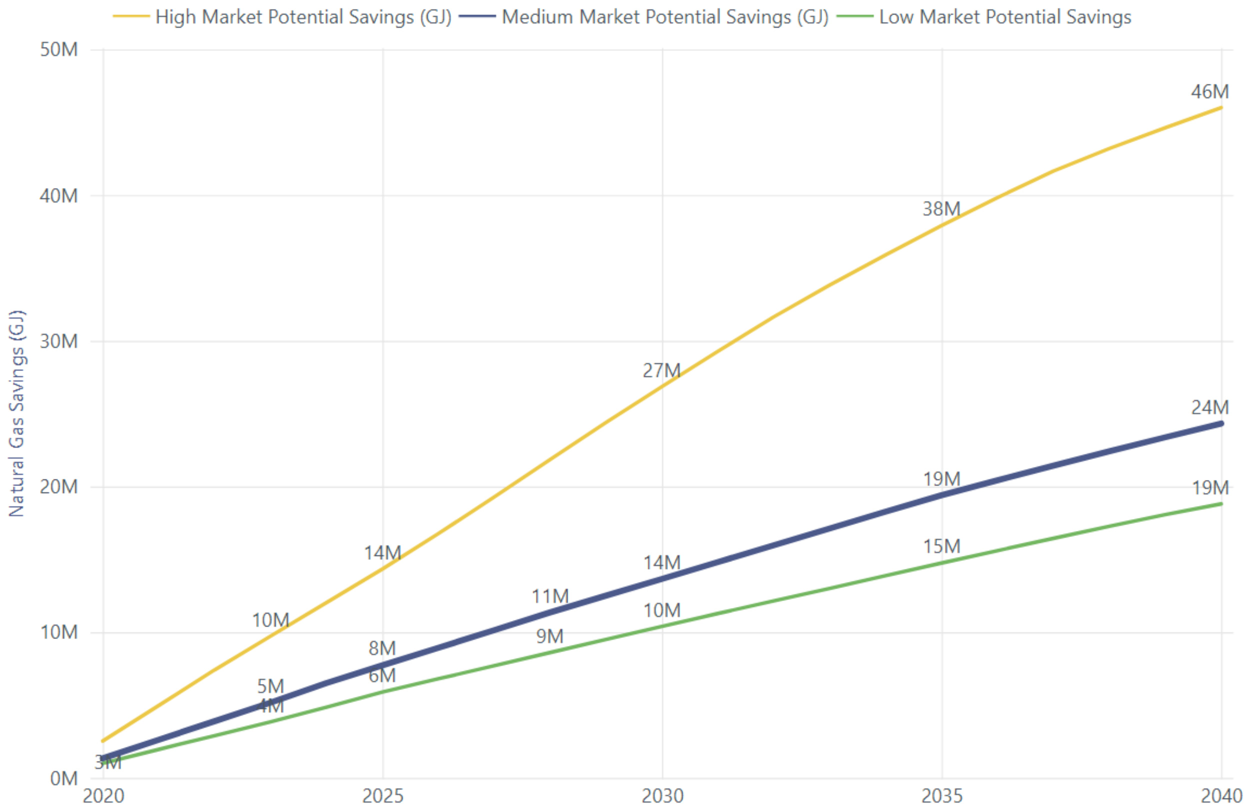


Exhibit 147 – Market Potential Savings (GJ) – All Sectors, MTRC




The forecasted total natural gas consumption under the three market potential scenarios relative to reference case forecast is shown in Exhibit 148 (TRC) and Exhibit 149 (MTRC). The reference consumption is forecasted to increase to 241 PJ – it is 222 PJ today. By 2040, the total low, medium, and high market TRC potential consumption levels are estimated to be 229 PJ, 226 PJ, and 214 PJ, respectively. By 2040, the low, medium, and high market MTRC potential consumption levels are estimated to be 222 PJ, 217 PJ, and 195 PJ, respectively.

Exhibit 148 – Market Potential Consumption (GJ) Forecasts – All Sectors, TRC

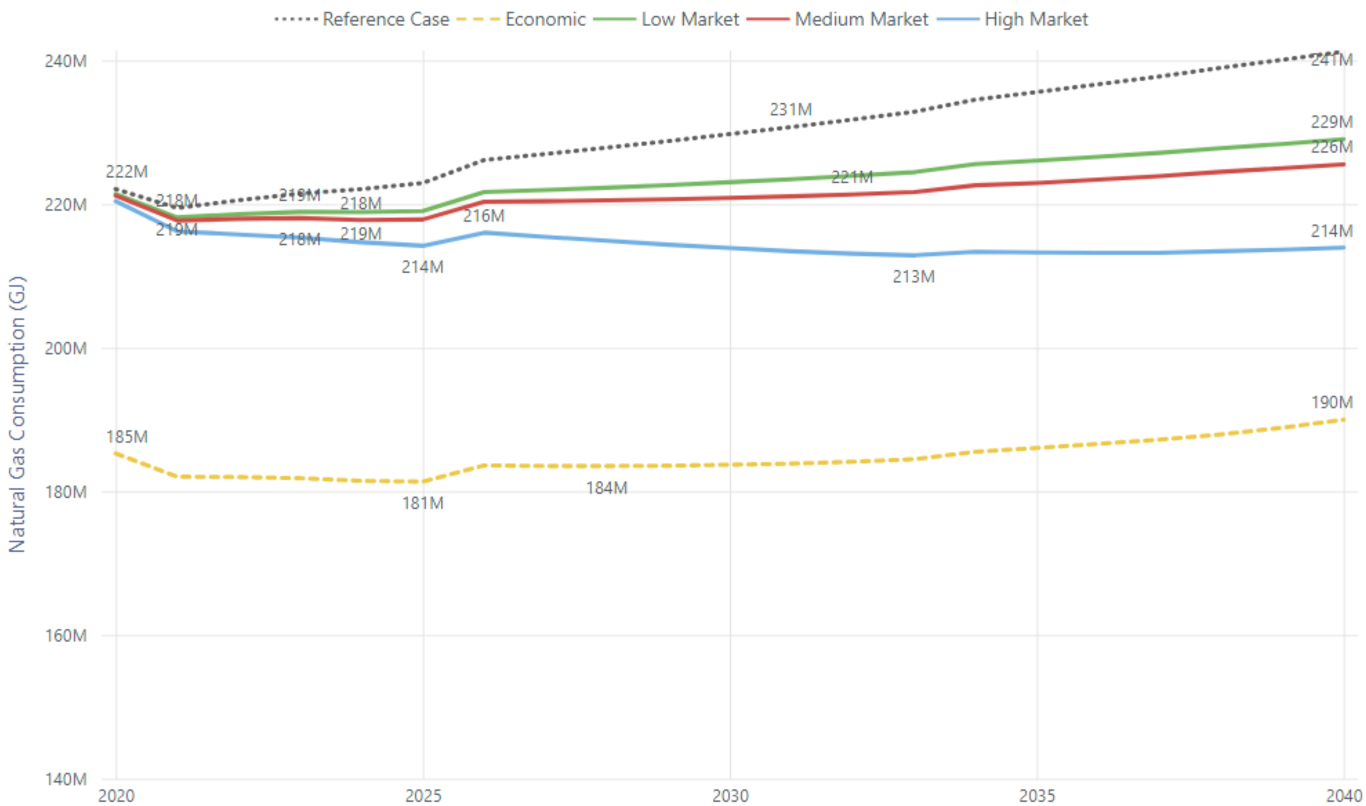
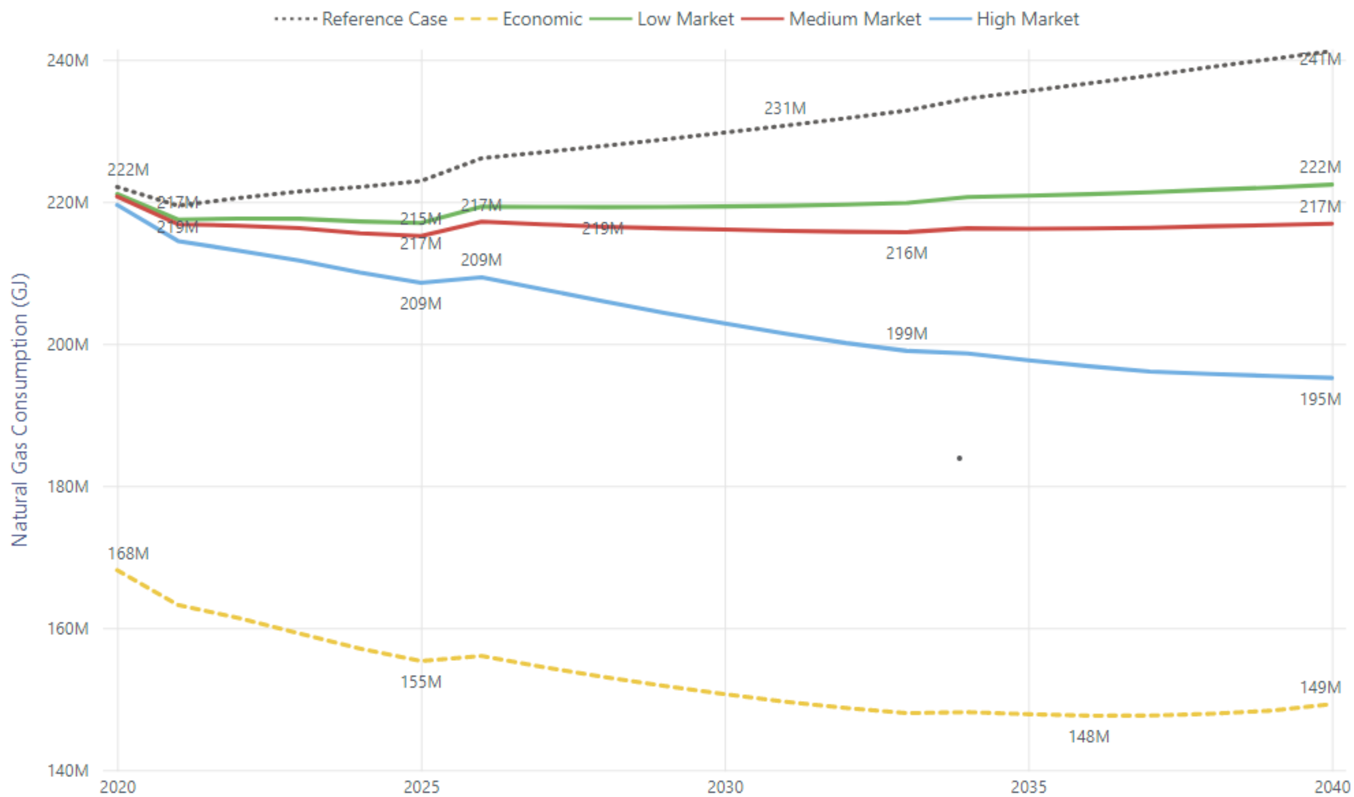


Exhibit 149 – Market Potential Consumption (GJ) Forecasts – All Sectors, MTRC



The medium market potential savings from the commercial, industrial, residential sectors are plotted together in Exhibit 150 (TRC) and Exhibit 151 (MTRC).

Under the TRC medium market scenario, by 2025, the industrial sector is estimated to have the most savings potential, followed by the residential and then commercial sectors. By 2030, the commercial sector overtakes residential. This is because there are only 14 residential measures that pass the TRC, and almost all of them are retrofit measures that can be implemented early in the study period. By 2040, potential savings from industrial, commercial, and residential sectors are estimated to be 7.3 PJ, 5.0 PJ, and 3.4 PJ, respectively.

Under the MTRC medium market scenario, the residential sector is estimated to have the most savings potential throughout the study period, followed by industrial and then commercial. By 2040, potential savings from residential, industrial, and commercial sectors are estimated to be 9.9 PJ, 8.6 PJ, and 5.8 PJ, respectively.

Exhibit 150 – Medium Market Potential Savings (GJ) – All Sectors, TRC

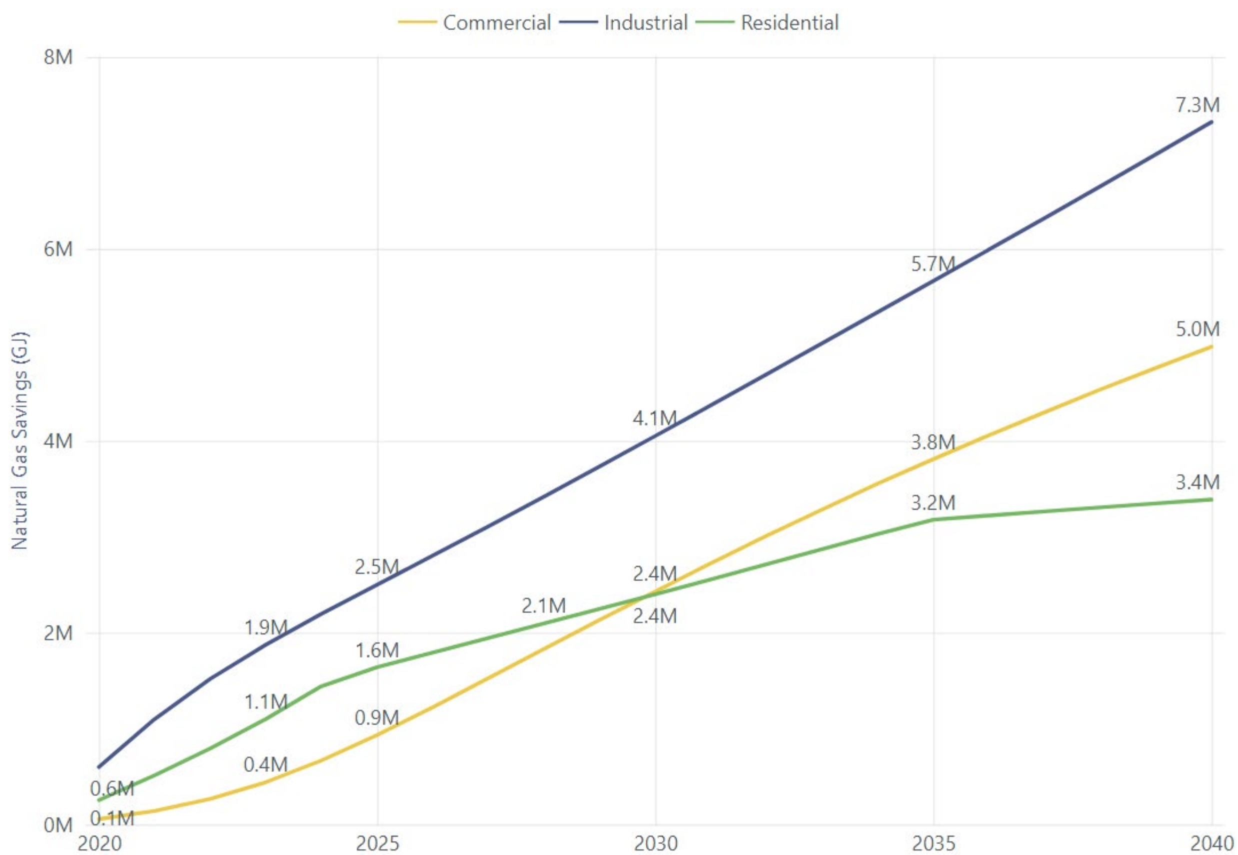
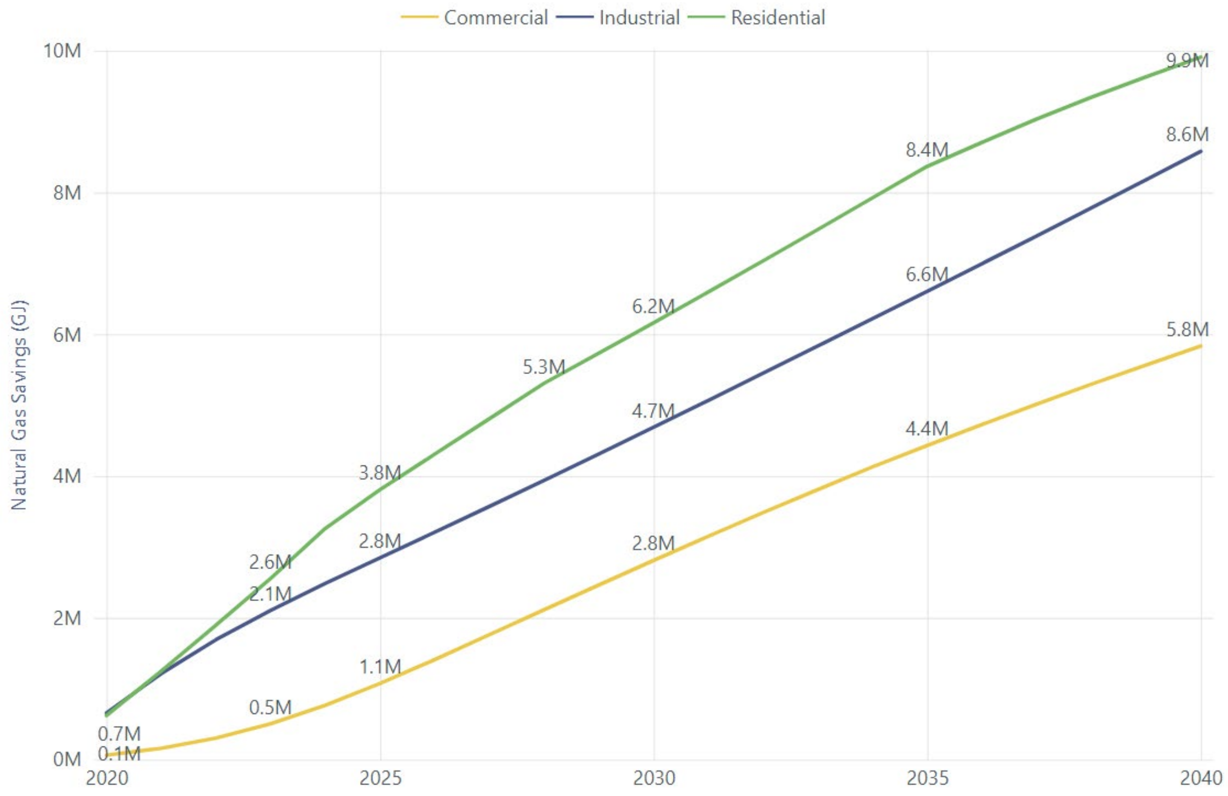


Exhibit 151 – Medium Market Potential Savings (GJ) – All Sectors, MTRC



### 7.1.2 Incentive and Non-Incentive Spending

The incentive and non-incentive spending required to achieve the medium and high market potential are shown in Exhibit 152 (TRC) and Exhibit 153 (MTRC). Medium and high market incentives are assumed to be 50% and 100% of measures' incremental costs, respectively. In both medium and high scenarios, non-incentive costs are estimated to be 15% of incentive costs. For each year, the tables show the total as well as incremental savings from new measures installed in each year.

Note that these costs and savings are not directly comparable to the costs and savings of FortisBC's current DSM portfolio for several reasons, including:

- Market potential includes a mix of measures that does not align exactly with the current DSM portfolio.
- The current DSM portfolio includes a mixture of measures that pass the TRC test and measures that pass the MTRC test only. This report presents TRC and MTRC analysis separately.
- Program-level incentive and non-incentive costs are estimated, and do not align exactly with current DSM costs.
- DSM spending includes portfolio-level non-incentive costs, whereas CPR modelling does not.

Exhibit 152 – Medium and High Market Incentive Costs and Natural Gas Savings – All Sectors, TRC

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $7.8M | $1.2M | $8.9M | 912K | 912K | $31.5M | $4.7M | $36.3M | 1,698K | 1,698K |
| 2021 | $8.5M | $1.3M | $9.8M | 1,754K | 842K | $35.8M | $5.4M | $41.2M | 3,252K | 1,554K |
| 2022 | $9.9M | $1.5M | $11.3M | 2,578K | 824K | $42.9M | $6.4M | $49.4M | 4,763K | 1,511K |
| 2023 | $11.5M | $1.7M | $13.2M | 3,415K | 837K | $47.0M | $7.1M | $54.1M | 6,120K | 1,357K |
| 2024 | $13.5M | $2.0M | $15.5M | 4,306K | 891K | $53.7M | $8.1M | $61.8M | 7,398K | 1,278K |
| 2025 | $12.6M | $1.9M | $14.5M | 5,077K | 771K | $63.5M | $9.5M | $73.0M | 8,733K | 1,334K |
| 2026 | $13.5M | $2.0M | $15.5M | 5,819K | 743K | $73.0M | $11.0M | $84.0M | 10,114K | 1,382K |
| 2027 | $14.4M | $2.2M | $16.5M | 6,578K | 759K | $79.3M | $11.9M | $91.2M | 11,536K | 1,421K |
| 2028 | $15.1M | $2.3M | $17.4M | 7,344K | 766K | $84.5M | $12.7M | $97.1M | 12,976K | 1,441K |
| 2029 | $15.5M | $2.3M | $17.9M | 8,114K | 770K | $86.9M | $13.0M | $99.9M | 14,422K | 1,446K |
| 2030 | $15.9M | $2.4M | $18.3M | 8,882K | 769K | $88.5M | $13.3M | $101.8M | 15,863K | 1,440K |
| 2031 | $16.1M | $2.4M | $18.5M | 9,650K | 767K | $89.5M | $13.4M | $102.9M | 17,288K | 1,425K |
| 2032 | $16.4M | $2.5M | $18.9M | 10,415K | 766K | $90.1M | $13.5M | $103.6M | 18,671K | 1,384K |
| 2033 | $16.1M | $2.4M | $18.5M | 11,172K | 757K | $86.7M | $13.0M | $99.7M | 19,991K | 1,320K |
| 2034 | $16.2M | $2.4M | $18.7M | 11,926K | 754K | $86.5M | $13.0M | $99.5M | 21,189K | 1,198K |
| 2035 | $16.0M | $2.4M | $18.4M | 12,655K | 729K | $85.0M | $12.7M | $97.7M | 22,338K | 1,149K |
| 2036 | $15.5M | $2.3M | $17.8M | 13,273K | 618K | $83.7M | $12.5M | $96.2M | 23,469K | 1,131K |
| 2037 | $15.5M | $2.3M | $17.9M | 13,885K | 612K | $83.0M | $12.5M | $95.5M | 24,565K | 1,095K |
| 2038 | $15.4M | $2.3M | $17.8M | 14,494K | 609K | $78.2M | $11.7M | $90.0M | 25,554K | 989K |
| 2039 | $15.1M | $2.3M | $17.4M | 15,094K | 599K | $71.6M | $10.7M | $82.3M | 26,434K | 880K |
| 2040 | $15.2M | $2.3M | $17.5M | 15,692K | 598K | $72.4M | $10.9M | $83.3M | 27,299K | 865K |

## Exhibit 153 – Medium and High Market Incentive Costs and Natural Gas Savings – All Sectors, MTRC

| Year | Medium Market Incentive Cost | Medium Market Non-Incentive Cost | Medium Market Total Costs | Medium Market Potential Savings (GJ) | Medium Incremental Savings (Year-over-Year, GJ) | High Market Incentive Cost | High Market Non-Incentive Cost | High Market Total Costs | High Market Potential Savings (GJ) | High Incremental Savings (Year-over-Year, GJ) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | $51.3M | $7.7M | $59.0M | 1,343K | 1,343K | $198.3M | $29.8M | $228.1M | 2,538K | 2,538K |
| 2021 | $53.1M | $8.0M | $61.1M | 2,625K | 1,282K | $210.7M | $31.6M | $242.3M | 4,975K | 2,437K |
| 2022 | $55.3M | $8.3M | $63.6M | 3,892K | 1,267K | $227.2M | $34.1M | $261.3M | 7,418K | 2,443K |
| 2023 | $57.7M | $8.7M | $66.3M | 5,166K | 1,274K | $240.8M | $36.1M | $276.9M | 9,736K | 2,317K |
| 2024 | $60.6M | $9.1M | $69.7M | 6,514K | 1,349K | $252.5M | $37.9M | $290.3M | 12,032K | 2,296K |
| 2025 | $60.2M | $9.0M | $69.2M | 7,734K | 1,219K | $255.2M | $38.3M | $293.5M | 14,340K | 2,308K |
| 2026 | $62.1M | $9.3M | $71.4M | 8,931K | 1,197K | $279.0M | $41.9M | $320.9M | 16,766K | 2,426K |
| 2027 | $63.9M | $9.6M | $73.5M | 10,146K | 1,215K | $296.2M | $44.4M | $340.6M | 19,282K | 2,516K |
| 2028 | $65.3M | $9.8M | $75.1M | 11,365K | 1,219K | $309.6M | $46.4M | $356.1M | 21,852K | 2,569K |
| 2029 | $58.0M | $8.7M | $66.7M | 12,512K | 1,147K | $302.5M | $45.4M | $347.8M | 24,402K | 2,550K |
| 2030 | $59.5M | $8.9M | $68.5M | 13,663K | 1,151K | $286.2M | $42.9M | $329.1M | 26,862K | 2,461K |
| 2031 | $60.8M | $9.1M | $69.9M | 14,816K | 1,153K | $284.5M | $42.7M | $327.2M | 29,287K | 2,424K |
| 2032 | $62.2M | $9.3M | $71.6M | 15,972K | 1,156K | $293.9M | $44.1M | $338.0M | 31,650K | 2,363K |
| 2033 | $63.0M | $9.5M | $72.5M | 17,124K | 1,152K | $275.4M | $41.3M | $316.7M | 33,838K | 2,188K |
| 2034 | $64.4M | $9.7M | $74.1M | 18,277K | 1,153K | $272.5M | $40.9M | $313.4M | 35,907K | 2,069K |
| 2035 | $65.4M | $9.8M | $75.3M | 19,408K | 1,131K | $267.1M | $40.1M | $307.2M | 37,905K | 1,999K |
| 2036 | $63.3M | $9.5M | $72.8M | 20,430K | 1,022K | $262.6M | $39.4M | $302.0M | 39,832K | 1,927K |
| 2037 | $62.9M | $9.4M | $72.3M | 21,440K | 1,011K | $254.1M | $38.1M | $292.2M | 41,660K | 1,828K |
| 2038 | $61.0M | $9.1M | $70.1M | 22,425K | 984K | $228.8M | $34.3M | $263.1M | 43,199K | 1,539K |
| 2039 | $58.9M | $8.8M | $67.7M | 23,381K | 957K | $220.3M | $33.0M | $253.3M | 44,622K | 1,423K |
| 2040 | $58.3M | $8.8M | $67.1M | 24,325K | 944K | $219.8M | $33.0M | $252.8M | 46,010K | 1,388K |

## 7.2 Emissions

Reducing natural gas use results in lower greenhouse gas emissions. The estimated GHG emission reductions for the three sectors combined, in the medium and high market potential scenarios are shown in Exhibit 154 (TRC) and Exhibit 155 (MTRC).

These estimates use an emissions factor of 51.6 kg of $CO_2e$, or carbon dioxide equivalent, per GJ of natural gas saved.[46] The emissions reductions are shown in $tCO_2e$, or Tonnes of $CO_2e$.

**Exhibit 154 – Estimated Greenhouse Gas Emissions Reduction (Tonnes of CO2e) – All Sectors, TRC**

| *Year* | Reference Case Emissions (tCO2e) | Medium Market Potential Emissions Reduction (tCO2e) | % | High Market Potential Emissions Reduction (tCO2e) | % |
|---|---|---|---|---|---|
| *2025* | 11.5M | 262k | 2.3% | 451k | 3.9% |
| *2030* | 11.8M | 458k | 3.9% | 819k | 6.9% |
| *2035* | 12.1M | 653k | 5.4% | 1.1M | 9.5% |
| *2040* | 12.5M | 810k | 6.5% | 1.4M | 11.3% |

**Exhibit 155 – Estimated Greenhouse Gas Emissions Reduction (Tonnes of $CO_2e$) – All Sectors, MTRC**

| *Year* | Reference Case Emissions (tCO2e) | Medium Market Potential Emissions Reduction (tCO2e) | % | High Market Potential Emissions Reduction (tCO2e) | % |
|---|---|---|---|---|---|
| *2025* | 11.5M | 399k | 3.5% | 740k | 6.4% |
| *2030* | 11.8 M | 705k | 5.9% | 1.4M | 11.7% |
| *2035* | 12.1 M | 1.0M | 8.2% | 1.9M | 16.1% |
| *2040* | 12.5 M | 1.3M | 10.1% | 2.4M | 19.1% |

46 Lifecycle emissions factor derived from *Environment Canada National Inventory Report on Greenhouse Gases and Sinks, 1990-2007*, consistent with FortisBC practice.

## 7.3 Employment Impacts

Employment impacts from spending on energy conservation measures in the market potential are presented in this section. Using multipliers, this analysis illustrates the economic effect investing in energy efficiency can have on the labour market.

The literature defines three types of impacts on employment: direct, indirect, and induced. Details of the analysis approach for each employment category are provided below.

### 7.3.1 Direct/Indirect Jobs

Direct and indirect jobs are created by spending, as capital and labour are required to create and ship products, and conduct the work associated with an efficiency project.

The CPR includes a variety of measure types, each of which would have different employment impacts.[47] For the purpose of this analysis, impacts were estimated in aggregate using the following approach:

1. Estimate DSM spending: The total annual medium market incentive cost for all sectors, multiplied by two (as the incentive represents 50% of the incremental cost of implementing the measure). This value represents the spending injected into the economy from implementing the CPR measures.
2. Estimate direct and indirect employment impacts:
    a. Apply the multiplier for direct jobs – to estimate direct jobs supported by spending.
    b. Apply the multiplier for indirect jobs – to estimate indirect jobs supported by spending.
3. Sum results for the study period to derive the total estimated number of jobs supported by spending on CPR measures.

### 7.3.2 Induced Jobs

Induced jobs are created when people or businesses spend more money because they have lower fixed costs, such as energy bills.

Lower energy costs result in higher disposable income for households and people often spend disposable income in their local economy (going out for dinner or to the movies, for example). Similarly, businesses can become more competitive when lower energy costs reduce their operating expenses, creating more

47 Multipliers for job impacts may vary by measure type, as different measures involve different industries, and levels of labour and capital. For a more detailed analysis of employment impacts by measure type and sector, please see "Analysis of Job Creation and Energy Cost Savings from Building Energy Rating and Disclosure Policy" by the Institute for Market Transformation and the Political Economy Research Institute (2012) and "The Economic Impact of Improved Energy Efficiency in Canada" by Efficiency Canada (2018).

working capital. The Institute for Market Transformation estimates that 60% of net jobs created through energy efficiency projects are associated with the energy cost savings.[48]

The following steps were taken for the TRC and MTRC scenario to estimate induced jobs:

- Estimate cost savings: Annual retail rates by sector were multiplied by the medium market potential savings to generate an annual cost savings figure.
- Estimate employment impacts: Apply the multiplier for induced jobs to estimate induced jobs.

### 7.3.3 Summary of Employment Impacts

The analysis uses the following multipliers:[49]

- Direct jobs: 5 job-years[50] per $1 million CAD spent on energy efficiency measures.
- Indirect jobs: 4 jobs-years per $1 million CAD spent on energy efficiency measures.
- Induced jobs: 4 jobs-years per $1 million CAD saved, used to estimate induced jobs from bill savings resulting in energy efficiency measures.

Multipliers for direct and indirect jobs are net numbers, meaning they account for job losses in other sectors that may result from spending on energy efficiency.

Using the method described in the sections above, the following exhibits provide the cumulative incentive spending, total spending (double the incentive spending), direct and indirect jobs-years resulting from this spending, customer bill savings, induced jobs resulting from bill savings, and total employment impacts for the study period. Exhibit 156 and Exhibit 157 present results using spending and bill savings levels for the TRC and MTRC screens, respectively.

48 Institute for Market Transformation and Political Economy Research Institute. “Analysis of Job Creation and Energy Cost Savings.” (2012).
49 Multipliers derived from Pembina Institute. “Deep emissions reductions in the existing building stock.” April 11, 2017. (Online) Available at: http://www.pembina.org/pub/building-retrofits. Per dollar value multipliers were not converted from the source year to 2020 dollars.
50 A “Job-year” is defined as the resources to employ 1 person for 12 months.

Exhibit 156 – Annual and Cumulative Employment Impacts from CPR Measures, 2020-2040 - TRC Scenario

| Year | Incentive Spending ($ Millions) | Total Spending ($ Millions) | Direct Job-years | Indirect Job-years | Bill Savings ($ Millions) | Induced Job-years | Total Job-years |
|---|---|---|---|---|---|---|---|
| 2020 | $7.8 | $15.5 | 80 | 60 | $13.5 | 55 | 195 |
| 2021 | $8.5 | $17.1 | 85 | 70 | $27.0 | 110 | 265 |
| 2022 | $9.9 | $19.7 | 100 | 80 | $40.7 | 165 | 345 |
| 2023 | $11.5 | $23.0 | 115 | 90 | $54.8 | 220 | 425 |
| 2024 | $13.5 | $26.9 | 135 | 110 | $73.3 | 295 | 540 |
| 2025 | $12.6 | $25.3 | 125 | 100 | $90.3 | 360 | 585 |
| 2026 | $13.5 | $26.9 | 135 | 110 | $104.5 | 420 | 665 |
| 2027 | $14.4 | $28.7 | 145 | 115 | $118.7 | 475 | 735 |
| 2028 | $15.1 | $30.3 | 150 | 120 | $133.3 | 535 | 805 |
| 2029 | $15.5 | $31.1 | 155 | 125 | $148.3 | 595 | 875 |
| 2030 | $15.9 | $31.8 | 160 | 125 | $163.9 | 655 | 940 |
| 2031 | $16.1 | $32.2 | 160 | 130 | $179.9 | 720 | 1,010 |
| 2032 | $16.4 | $32.8 | 165 | 130 | $196.4 | 785 | 1,080 |
| 2033 | $16.1 | $32.1 | 160 | 130 | $213.4 | 855 | 1,145 |
| 2034 | $16.2 | $32.5 | 160 | 130 | $230.8 | 925 | 1,215 |
| 2035 | $16.0 | $32.0 | 160 | 130 | $248.3 | 995 | 1,285 |
| 2036 | $15.5 | $31.0 | 155 | 125 | $263.9 | 1,055 | 1,335 |
| 2037 | $15.5 | $31.1 | 155 | 125 | $279.8 | 1,120 | 1,400 |
| 2038 | $15.4 | $30.9 | 155 | 125 | $296.1 | 1,185 | 1,465 |
| 2039 | $15.1 | $30.2 | 150 | 120 | $312.8 | 1,250 | 1,520 |
| 2040 | $15.2 | $30.5 | 150 | 120 | $330.1 | 1,320 | 1,590 |
| TOTAL | $296 | $592 | 2,955 | 2,370 | $3,520 | 14,095 | 19,420 |

Exhibit 157 – Annual and Cumulative Employment Impacts from CPR Measures, 2020-2040 - MTRC Scenario

| Year | Incentive Spending ($ Millions) | Total Spending ($ Millions) | Direct Job-years | Indirect Job-years | Bill Savings ($ Millions) | Induced Job-years | Total Job-years |
|---|---|---|---|---|---|---|---|
| *2020* | $51.3 | $102.5 | 515 | 410 | $21.4 | 85 | 1,010 |
| *2021* | $53.1 | $106.2 | 530 | 425 | $43.0 | 170 | 1,125 |
| *2022* | $55.3 | $110.6 | 555 | 440 | $65.4 | 260 | 1,255 |
| *2023* | $57.7 | $115.3 | 575 | 460 | $88.0 | 350 | 1,385 |
| *2024* | $60.6 | $121.2 | 605 | 485 | $116.0 | 465 | 1,555 |
| *2025* | $60.2 | $120.4 | 600 | 480 | $142.8 | 570 | 1,650 |
| *2026* | $62.1 | $124.2 | 620 | 495 | $166.7 | 665 | 1,780 |
| *2027* | $63.9 | $127.8 | 640 | 510 | $190.8 | 765 | 1,915 |
| *2028* | $65.3 | $130.6 | 655 | 520 | $215.4 | 860 | 2,035 |
| *2029* | $58.0 | $116.1 | 580 | 465 | $239.1 | 955 | 2,000 |
| *2030* | $59.5 | $119.1 | 595 | 475 | $263.8 | 1,055 | 2,125 |
| *2031* | $60.8 | $121.5 | 610 | 485 | $289.1 | 1,155 | 2,250 |
| *2032* | $62.2 | $124.5 | 620 | 500 | $315.3 | 1,260 | 2,380 |
| *2033* | $63.0 | $126.0 | 630 | 505 | $342.3 | 1,370 | 2,505 |
| *2034* | $64.4 | $128.8 | 645 | 515 | $370.2 | 1,480 | 2,640 |
| *2035* | $65.4 | $130.9 | 655 | 525 | $398.4 | 1,595 | 2,775 |
| *2036* | $63.3 | $126.7 | 635 | 505 | $425.1 | 1,700 | 2,840 |
| *2037* | $62.9 | $125.8 | 630 | 505 | $452.4 | 1,810 | 2,945 |
| *2038* | $61.0 | $121.9 | 610 | 490 | $479.7 | 1,920 | 3,020 |
| *2039* | $58.9 | $117.8 | 590 | 470 | $507.3 | 2,030 | 3,090 |
| *2040* | $58.3 | $116.7 | 585 | 465 | $535.6 | 2,140 | 3,190 |
| *TOTAL* | **$1,267** | **$2,535** | **12,680** | **10,130** | **$5,668** | **22,660** | **45,470** |

## 7.4 Findings and Conclusions

Readers are encouraged to use the CPR Data Visualization Tool to explore output data and draw their own insights for the purposes of DSM planning, program research and program design.

This section summarizes findings of this study at a high level:

- This study has found significant cost-effective and market achievable natural gas savings throughout the study period 2020-2040, and in all sectors and segments.

  Across all sectors, and using the MTRC screen, medium market potential savings are estimated at approximately 8 PJ, or 4% of reference consumption in 2025, rising to 24 PJ, or 10% of reference consumption in 2040.

  This estimated 24 PJ savings by 2040 includes potential savings from Residential, Industrial, and Commercial sectors of 9.9 PJ, 8.6 PJ, and 5.8 PJ respectively.
- In the ***residential sector***, only a small number of measures are cost-effective based on the TRC test, most being low-cost retrofit measures. Measures that pass the MTRC screen only become more important in the residential sector as the study period progresses.
  - The opportunities for equipment replacement measures, especially space heating measures, are much smaller relative to previous studies. This is primarily due to increasingly higher federal and provincial minimum energy performance standards (MEPS) for furnaces, which have caused DSM opportunities to become increasingly scarce.
  - In terms of percentage of reference case consumption forecast, more residential opportunities are available in the domestic hot water end use than the space heating end use throughout the study period. In absolute terms, savings potential for DHW measures (4 PJ by 2040 in the medium market potential scenario, MTRC screen) approaches that of space heating measures (5 PJ by 2040 in the medium market potential scenario, MTRC screen).
- ***Commercial sector*** savings show the most variance between the high and medium market potential scenarios. Using the MTRC screen, by 2040 the difference in potential between the medium and high market scenarios is 11.6 PJ.

  Gas heat pumps (GHPs) and efficient new construction are major contributing factors to this difference. These measures have high technical and economic potential, but future uptake is uncertain. For example, in the medium scenario, GHPs are modeled as an innovative technology with low forecasted growth. In the high scenario, they are modeled as an innovative technology with high forecasted growth, especially in the second half of the study period (2030-2040).
- The ***industrial sector*** is estimated to have the largest cost-effective savings potential on the TRC economic screen relative to other sectors. However, industrial customers require shorter payback periods relative to commercial and residential customers. Achieving savings from industrial measures that are cost-effective but have longer customer payback periods may be challenging and/or more expensive due to higher incentives and program costs.

- This CPR is the first to use a model that is fully compatible with the end use model developed for FortisBC's Long-Term Gas Resource Plan (LTGRP). The LTGRP provided the CPR's reference case, at a level of granularity not available to previous CPRs.

  Questions about the trends or assumptions in the reference case were easily answered by delving into the LTGRP model and the data upon which it was based. Furthermore, the results of the CPR will be provided to the LTGRP project for further analysis. Because the models are compatible, the LTGRP can easily explore variations in the CPR's potential estimates with different assumptions about economic conditions in the province or different budget envelopes for DSM programs.

- This CPR does not consider announcements related to the federal carbon tax made in 2021, which were made after modelling was complete for this project. Increases in the federal carbon tax are expected to positively impact the savings potential presented in this CPR: as natural gas costs rise, more measures will become cost-effective and pass the benefit/cost tests, and all measures will become more attractive financially to end users.

# Appendix E

# FEI DSM EVALUATION PLAN 2023

# FortisBC Energy Inc.

# DSM Evaluation Plan

# 2023

**July 2022**

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# 1. INTRODUCTION

This DSM Evaluation Plan presents the studies and timing for FEI's Evaluation, Measurement & Verification (EM&V) activities for 2023. These activities are aligned with the 2023 DSM Expenditure Plan. As with the DSM Plan, the Evaluation Plan may be adjusted during the period in consideration of changes in market conditions and other factors that can impact the DSM Plan, as well as the feedback received from EM&V activities throughout this time period. The Evaluation Plan has been prepared in consideration of the Companies' EM&V Framework.

## 1.1 *EVALUATION, MEASUREMENT & VERIFICATION*

EM&V activities are split between the evaluation activities, and the measurement and verification activities. Evaluation activities[1] are conducted to look at a program as a whole to determine its effectiveness. The timing of evaluation activities vary depending on the program's progress, acceptance and objectives. The scope and cost of evaluation studies should be practical and feasible within the confines of resources and time available. Evaluation study objectives should align with the program's objectives in order to provide feedback for future program improvements. Typically, evaluation activities can commence after the program has been in the market for a minimum of 1 year or covers a full heating season. The evaluation activities are focused on identifying energy savings, assessing participant awareness and satisfaction, confirming research results, and providing feedback for program improvements and implementation.

Measurement and Verification (M&V) studies are conducted mainly to assess pilot programs, demonstration projects, and custom programs. M&V activities use measurement technologies and engineering techniques to identify the energy savings that result from an Energy Conservation Measure (ECM). The Companies' M&V studies adhere to the IPMVP[2] protocol and industry best practices to assess the actual savings attributable to the implementation of the new ECM. These activities require a greater allocation of the overall program budget than other evaluation activities do since M&V studies may rely on real-time monitoring of each measure being studied and are therefore more resource intensive.

[1] Types of evaluation activities include: Communications evaluations, which focus on advertising and media outreach, and focus groups; Evaluation studies, where quality assurance is conducted to gain more insight on the incented measure, and literature reviews conducted to better understand the incented measure; Market studies, research and interviews with industry stakeholder to assess market penetration; Process evaluations, where surveys and interviews are used to assess customer satisfaction and program success; Impact evaluations, to measure the achieved energy savings attributable from the program; Market Analysis, to characterized the industry and the program's effect on market penetration and, Measurement & Verification, to monitor real time energy savings associated with energy conservation measures and validation of energy savings through energy study and energy model reviews.

[2] International Performance Measurement and Verification Protocol. Concepts and Options for Determining Energy and Water Savings. Prepared by the Efficiency Valuation Organization. www.evo-world.org. January 2012.

## 1.2 *EVALUATION PLAN*

Table E-1 provides a list of programs and pilot studies currently planned for evaluation in 2023. The Evaluation Plan allows for variation in the proposed activities and budget. The extent and detail of the evaluation activities presented in the Evaluation Plan is subject to the availability of the resources, timing and budget.

Overall expenditures for the programs have been reported in Appendix A, Section 2 of the 2023 DSM Expenditure Plan, but are reported here in order to provide an easy-to-view summary of the evaluation expenditure and the 1 Year Evaluation Plan. Included in the table is: a list all proposed evaluation activities for 2023; the Program Name and Area where EM&V activities occur; the general type of evaluation activity undertaken, Program Partners; and the Companies' proposed 1 year budget. The total proposed expenditure for program evaluation and M&V activities to be conducted in 2023 is approximately $2.9 million. The proposed budget aligns with the Companies EM&V Framework, historical evaluation expenditure, and industry general practice[3] for budget spending on EM&V activities. The evaluation budget shown in Table E-1 represents approximately 2 percent of the Companies' total DSM portfolio expenditure.

[3] Two separate sources report that spending on EM&V activities across the industry averages from just under 2 percent for larger portfolios greater than $US 55 million to between 2 and 3 percent for portfolios between $US 20 million and $US 55 million:

- E Source Poster: How Much do Utilities Spend on Evaluation? 2015. Prepared from data available in E Source DSM Insights 2015, and
- CEE Annual Industry Report – State of the Efficiency Program Industry, Section 4. Consortium for Energy Efficiency, 2014, 2015 and 2016.

1 **Table E-1: FEU Evaluation Plan for 2019-2022**

| Program | Program Area | Service Region | Type of Evaluation or Activities | Program Partners | Proposed 1 Year Budget (000's) |
|---|---|---|---|---|---|
| Home Renovation Rebate Program | Residential | FEU | Evaluation Studies, Market Studies, Process & Impact | BCH Hydro, Fortis BC Inc., Municipal, Provincial and Federal Government | $107 |
| New Home Program | Residential | FEU | Market Studies, Process & Impact | BC Hydro, FortisBC Inc., NRCan, MEMPR, Municipal Government | $20 |
| Prescriptive Program | Commercial | FEU | Market Studies, Process & Impact | FortisBC Inc. | $107 |
| Performance Program - Existing Buildings | Commercial | FEU | Process & Impact, Measurement & Verification | FortisBC Inc. | $100 |
| Performance Program - New Buildings | Commercial | FEU | Process & Impact, Measurement & Verification | FortisBC Inc. | $110 |
| Rental Apartment Efficiency Program | Commercial | FEU | Process & Impact | FortisBC Inc. | $47 |
| Performance Program | Industrial | FEU | Process, Measurement & Verification | FortisBC Inc. | $50 |
| Prescriptive Program | Industrial | FEU | Measurement & Verification | FortisBC Inc. | $25 |
| Strategic Energy Management Program | Industrial | FEU | Measurement & Verification | BC Hydro | $25 |
| Direct Install Program | Low Income | FEU | Process & Impact, Evaluation Studies | BC Hydro, FortisBC Inc. | $448 |
| Self Install Program | Low Income | FEU | Process & Impact | BC Hydro, FortisBC Inc. | $20 |

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1 **Table E-1: FEU Evaluation Plan for 2019-2022 (continued)**

| Program Name | Program Area | Service Region | Type of Evaluation or Activities | Program Partners | Proposed 1 Year Budget (000's) |
|---|---|---|---|---|---|
| Prescriptive Program | Low Income | FEU | Process & Impact | None | $32 |
| Support Program | Low Income | FEU | Process | None | $3 |
| Performance Program | Low Income | FEU | Process & Impact | None | $6 |
| Residential Customer Engagement Tool | Customer Education and Outreach | FEU | Process & Impact | FortisBC Inc. | $72 |
| Pilot Projects | Innovative Technology | FEU | Measurement & Verification | None | $1,110 |
| Customer Research | Enabling Activities | FEU | Communications | None | $100 |
| Commercial Energy Specialist | Enabling Activities | FEU | Process & Impact | FortisBC Inc. | $57 |
| Community Energy Specialist | Enabling Activities | FEU | Process & Impact | FortisBC Inc. | $35 |
| Codes & Standards | Enabling Activities | FEU | Process | none | $60 |
| Trade Ally Network | Enabling Activities | FEU | Evaluation Studies | none | $315 |
| Portfolio | Enabling Activities | FEU | Process | none | $40 |

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# Appendix F

# EM&V FRAMEWORK

# Evaluation, Measurement & Verification Framework

Revised, May 2018

## Acknowledgements

The authors wish to acknowledge and express our appreciation to the many individuals who contributed to the development of the FortisBC Evaluation Measurement & Verification Framework.

Feedback and comments from FortisBC Internal Stakeholders, EEC Advisory Group members, BC Hydro, PowerSense, and Habart & Associates assisted in the development of the FortisBC Evaluation, Measurement & Verification Framework.

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# 1. INTRODUCTION

## 1.1 BACKGROUND

FortisBC Energy Inc. (FEI), provides primarily natural gas distribution throughout most of BC. FortisBC Inc. (FBC) is an integrated electric utility that generates, transmits and distributes electricity to customers in the southern interior of British Columbia (BC). Collectively these utilities, referred to as “FortisBC” or “the Companies”, have developed a framework for evaluation, measurement and verification (EM&V) activities to examine the effectiveness of its Demand Side Management (DSM) programs.

FEI and FBC have been involved with delivering DSM programs, and thus program evaluation since the 1990s[1]. This Framework was original created in 2013 to guide DSM program evaluation activities as FEI’s DSM activities and expenditures increased substantially between 2009 and 2013. FBC also adopted the Framework shortly thereafter. Minor updates to the Framework have been completed since 2013 as the Companies gained greater experience conducting higher levels of EM&V activity that followed the increase in DSM program spending for FEI.

Provincial and Federal regulations also influence a utilities’ EM&V activities. In BC, the Demand-Side Measures Regulation, made pursuant to the Utilities Commission Act, sets out many of the definitions, cost effectiveness requirements and calculation considerations, and other demand side activity portfolio requirements for BC utilities, many of which are unique to this jurisdiction. For example, the need to consider non-energy benefits and the methodology for assigning value to such benefits are set out in the Province’s Demand-Side Measures Regulation[2].

[1] The Companies’ earlier EEC activities were referred to in previous regulatory filings with the BCUC as Demand Side Management (DSM) activities.
[2] http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/10_326_2008

# 2. EVALUATION FRAMEWORK

## 2.1 *PURPOSE OF THE EVALUATION FRAMEWORK*

The EM&V Framework documents the background, objectives, principles and general practices that will guide the Companies' approach, resources and timeframes for EM&V activities. The purpose of the Framework is to provide reliable and consistent guidance relating to when evaluations should be conducted, the types of evaluation that can be conducted, and a discussion of approaches for conducting those evaluations. It is expected that this document will be updated from time to time in consultation with industry and stakeholders as industry practices evolve and are adopted by the Companies.

The Framework is not a step-by-step evaluation manual, rather it is a guideline that allows for flexibility while complying with industry standards and practices. The intended audience includes government, policy staff, program managers, program planners and evaluators, and other internal and external stakeholders. Section 2.2 provides a detail explanation of the Companies' evaluation objectives and role of the framework.

## 2.2 *EVALUATION OBJECTIVES*

The Companies' have five overriding objectives for conducting evaluations on C&EM programs, which include:

1. *Determining whether DSM program objectives are being met.* Program design targets and objectives are determined based on available industry sources. Evaluation activities are conducted to determine if program design targets are being met, such as the amount of energy savings, the number and nature of participants, emission reductions and other targets.
2. *Ensuring that the Companies and ratepayers are obtaining value from their DSM investments.* Evaluation results provide inputs to the cost-benefit analyses in determining the effectiveness of DSM programs. The Companies prescribed cost-benefit analyses are also defined by; the industry standards[3], provincial regulations[4], and the British Columbia Utilities Commission's (BCUC's) directives. The cost and savings data obtained from evaluation activities can also be used for the Companies' resource planning purposes and for DSM program planning.
3. *Providing feedback to program and company management on the performance of DSM programs.* Evaluations help program managers understand how their programs are performing and provide information to help them improve their programs over time to be

[3] The Companies use the cost-effectiveness methodologies articulated in the *California Standard Practices Manual (SPM): Economic Analysis of Demand-Side Programs and Projects.*

[4] The Modified Total Resource Cost Test (MTRC) is defined in the *Utilities Commission Act Demand-Side Measures Regulation*

more effective, or perhaps determine if some programs should be altered, expanded or discontinued.

4. *Examining the relationship between a program's activities and a market effect through the use of Market Transformation evaluation.* Evaluations are conducted to assess changes within a market that are caused, at least in part, by the energy efficiency programs attempting to change that market.

5. *Providing assurance to both internal and external stakeholders for the continued support of DSM programs.* Proper evaluation activities ensure that results from DSM programs are credible. This assurance is critical for ongoing support from:

    - External interest groups including customers, BCUC, government, First Nations, communities and other interest groups, trade allies and market participants; and
    - Internal stakeholders including senior management, departments competing for resources, departments responsible for oversight, such as finance and internal audit, and shareholders.

## 2.3 *EVALUATION PRINCIPLES*

The Companies will conduct their EM&V activities based on the following principles:

- All DSM programs will be evaluated on a program by program basis[5]. The type of evaluations, level of resources dedicated to each evaluation and the extent of the evaluation study will depend upon:
    - Size of investment in the DSM program being evaluated.
    - Amount of risk that a program may not meet cost effectiveness expectations.
    - Amount of data and information available on the effectiveness and evaluation of similar programs by FortisBC and elsewhere in the marketplace,
    - Budget constraints (see Section 4.1 for additional discussion on budgets).

  Subject to the same considerations as above, programs with explicit energy savings targets will have impact evaluations, unless there is a valid reason and an explicit decision is made not to do so.

- Transparency:
    - Reasons for decisions on evaluation methodologies will be documented

[5] DSM programs for which we do not report direct energy savings, such as Educational or Research Programs, may not be subject to the same impact evaluation activities as programs that we do report energy savings for.

- Assumptions made during the conducting of an evaluation study will be documented.
- Evaluation activities will be auditable.
- Summaries of completed evaluations will be presented in the Companies' DSM Annual Reports. Final evaluation reports will be made available to the BC Utilities Commission, if requested.

- The use of third party evaluators
  - In most cases, FEI retains external consultants to conduct evaluation activities. Some aspects of evaluation may also be conducted internally by FEI. Measurement and verification activities may be outsourced or conducted by FEI staff. (See Section 4.3 for additional discussion on staffing resources).
  - Third party evaluators are retained based on a combination of the consultant's qualifications, the level of detail evaluation work required and the program size.
  - Evaluation staff and Program Managers work collectively to select the suitable external consultant to ensure that evaluation objectives and industry best practices are maintained while providing the best result for program development where applicable. The selection process and format is determined by the evaluation staff.

- The evaluation process will be integral to DSM planning:
  - Evaluation activities will be an important consideration during portfolio and program planning, and as part of the program business case process.
  - Early consideration of evaluation requirements help ensure that the necessary and timely data is collected throughout the program development and implementation process.

- Continuous Improvement:
  - The Companies will continue to monitor the energy efficiency marketplace for industry best practices, standards and protocols for evaluation practices and will adopt those that make practical sense for evaluation activities in BC.
  - The Companies will strive to become industry leaders in evaluation activities.
  - This framework is expected to remain stable over time, but will be updated as necessary.

- Timeliness
    - FEI will strive to conduct and complete evaluations at appropriate times within the program lifecycle, given resource constraints and program growth.

## 2.4 *EVALUATION PLANS*

This framework is not intended to be or to replace an evaluation plan. Evaluation Plans will be prepared by FortisBC for inclusion with the Companies applications to the BCUC for DSM funding. These plans will detail the programs that the Companies intend to evaluate, the types of evaluations the Companies intend to undertake, and general time frames for the evaluation activities during the period of the funding request. Progress made toward completing the evaluation plan, and any needed adjustments to the plan, will be provided in the Companies' Annual DSM reports.

# 3. TYPES OF EVALUATION STUDIES

There are a range of EM&V studies that are undertaken to evaluate FortisBC DSM programs. The type, timing and frequency of studies, and the evaluation practices implemented for each study will depend on a variety of factors including the type of program being evaluated, the level of program spending, experience with similar programs, the number of program participants, the quality of data upon which any energy savings assumptions are based, and more. For clarity, the evaluation component of EM&V refers to the broad spectrum of evaluation activities that can make up an evaluation plan while Measurement and Verification refers more specifically to the range of methodologies used to measure and verify actual energy savings from implementing a program of demand side measures. Hence measurement and verification is a subset of evaluation activities.

## 3.1 *PROCESS EVALUATIONS*

Process evaluations examine the effectiveness of program delivery. Objectives for process evaluations include improving program implementation and program delivery as well as ensuring high satisfaction levels among customers, trade allies and other program participants. Areas reviewed include incentive and rebate levels; communication and promotional initiatives; program operations and implementation; customer awareness and acceptance as a customer service (satisfaction) of energy efficient technologies and measures; and trade ally (distribution & implementation) awareness and acceptance. Process evaluations are generally first conducted within 6 to 18 months following the launch of a new program and for long duration programs on a periodic basis thereafter.

## 3.2 *MARKET EVALUATIONS*

Market evaluations test a DSM program's effectiveness at increasing the market penetration of an efficient technology or measure. Objectives for market evaluations include measuring increases in market penetration of energy efficient technologies and assessing the share of measures attributable to the program. Market effects often have a larger impact on the adoption rate of a product or technology than they receive credit for, and taking credit for this can often negate some of the free rider impacts. Evaluation activities include:

- assessing market potential and market penetration over time through a review of the availability, accessibility and affordability of energy efficient technologies and measures,
- identifying barriers and assessing the program's effectiveness at overcoming barriers, and
- assessing how much of the remaining market the program can be expected to address.

When a market evaluation is determined to be necessary, the timing must allow a sufficient period for program implementation and uptake. These evaluations are therefore generally conducted between two and three years following a program launch.

## 3.3 IMPACT EVALUATIONS

Impact evaluations measure energy savings achieved by a DSM program. Objectives for impact studies include:

- evaluating the realized energy savings,
- estimating free-rider and spill-over (market) effects to determine net savings impacts, and
- determining the cost effectiveness of the program according to a set of cost-benefit analysis based on industry and/or regulatory standards.

Impact evaluations will draw on information available from measurement and verification studies, energy consumption data (billing analysis), results or key findings of similar programs and evaluations in other jurisdictions, and/or benchmarking studies as appropriate and where such information exists. As with process evaluations, an impact evaluation may include comments on appropriateness of program design and/or suggestions for changes to increase effectiveness.

The timing of impact evaluations must allow a sufficient period of program operation for implementation and uptake, including the adoption of process improvements that might be identified during the early program period. Generally, impact evaluations are conducted between two and three years following a program's launch. However, depending on the program life cycle, impact evaluations may be conducted annually to provide a preliminary check on the engineering estimates or when findings are required to launch the program for a second year.

For some programs, impact evaluations may occur in two stages. The first stage will involve participant survey work to improve the Companies' knowledge about the implementation of individual measures, and a second stage that involves a billing or other more detailed analysis.

## 3.4 PILOT STUDIES

Pilot studies are an important component of the Companies' DSM portfolio and are conducted to provide necessary research into potential new efficiency measures or technologies in support of developing new programs or initiatives. New measures can include new emerging technology but also existing technology with low adaption rate or used in a new application. Research objectives can include understanding how the market may respond to the introduction of a new measure, obtaining adequate performance data for a new measure (valid for local conditions), or both. FortisBC limits pilot study activity to the assessment of new efficiency measures or technologies that are market ready, but not yet widely available or adopted within BC.

Studies focused on obtaining an understanding of the market include typical market research investigations such as participant surveys. Studies focused on obtaining measure performance data include measurement and verification studies. In both cases, the pilot is used to test the idea on a small scale and hence reduce risk and cost if the program concept requires modifying prior to the launch of a full scale program or if performance results are insufficient for the development of a full program.

## 3.5 *MEASUREMENT AND VERIFICATION ACTIVITIES*

M&V refers to a range of activities or studies used to determine the performance of an installed DSM measure. M&V activities may also be implemented as part of the evaluation of full scale programs if such activities are viewed as helpful to meet evaluation objectives.

Wherever practical, the Companies intend to follow the International Performance Measurement and Verification Protocol (IPMVP)[6] in conducting M&V activities for evaluating DSM programs and pilots. FortisBC's review of industry standards, guidelines and protocols indicates that IPMVP is growing in use as a standard resource for guiding the design of M&V activities and provides both a comprehensive and flexible approach. It should be noted that while IPMVP summarizes common industry practices for M&V activities and sets out a range of methodologies that can be followed under ideal study conditions and in absence of budget or timing constraints, it also acknowledges that ideal study conditions and large M&V budgets are seldom available. As such, the Protocol provides guidelines for the evaluator to follow under less than ideal conditions and in the face of budget and timing constraints. The Protocol therefore allows room for judgment by the evaluator under less than ideal evaluation circumstances.

The following M&V principles[7] are embedded in the IPMVP:

**Accurate** M&V reports should be as accurate as the M&V budget will allow. M&V costs should normally be small relative to the monetary value of the savings being evaluated. M&V expenditures should also be consistent with the financial implications of over- or under-reporting of a project's performance. Accuracy tradeoffs should be accompanied by increased conservativeness in any estimates and judgments.

**Complete** The reporting of energy savings should consider all effects of a project. M&V activities should use measurements to quantify the significant effects, while estimating all others.

**Conservative** Where judgments are made about uncertain quantities, M&V procedures should be designed to under-estimate savings.

6 International Performance Measurement and Verification Protocol. Concepts and Options for Determining Energy and Water Savings. Prepared by the Efficiency Valuation Organization. www.evo-world.org. January 2012.

7 These principles have been reproduced from Chapter 3 of the IPMVP (see also the preceding footnote).

**Consistent** The reporting of a project's energy conservation effectiveness should be consistent between:

- different types of energy efficiency projects;
- different energy management professionals for any one project;
- different periods of time for the same project; and
- energy efficiency projects and new energy supply projects.

'Consistent' does not mean 'identical,' since it is recognized that any empirically derived report involves judgments which may not be made identically by all reporters. By identifying key areas of judgment, IPMVP helps to avoid inconsistencies arising from lack of consideration of important dimensions.

**Relevant** The determination of savings should measure the performance parameters of concern, or least well known, while other less critical or predictable parameters may be estimated.

**Transparent** All M&V activities should be clearly and fully disclosed.

## 3.6 *Evaluation Methodologies*

A range of evaluation methodology types can be utilized to determine the energy savings achieved from the implementation of an efficiency measure. One way to think of this range of methodologies is as of a tool box, with each methodology being a different tool that the evaluator can bring out of the tool box to apply to the evaluation problem. The best tool (or methodology) to use depends on the circumstances of the required evaluation and the available resources. In many cases, more than one methodology will be applied to evaluate the energy savings achieved from an efficiency measure or program of measures. Common evaluation methodologies are summarized as follows:

### *Billing Analysis*

Billing analysis uses customer billing information to assess the effect of a DSM program (or measure) on customer billed energy consumption. The analysis typically requires a baseline billing history period in the absence of the measure being installed and typically one year of billing data following the measure installation. The fundamental assumption is that the only, or major, change in energy consumption over this period has resulted from the measure being evaluated. This approach requires both data cleaning to ensure the quality of the billing data (i.e.: no missed billing reads or estimated bills) and weather adjusting. Combining a participant survey with the billing analysis can provide additional information regarding the changes in occupancy or usage patterns. When possible, a billing analysis should include both participants and non-participants, so that outside influences, such as price changes for fuels, can also be accounted in the analysis. Billing analysis is generally more effective for programs with higher customer savings. Lower savings levels (1-3% for example) can be more difficult to explain using billing analysis due to the potential for other factors to influence energy use patterns.

***Metering***

Metering involves the installation of energy use meters around the measure being studied to determine specific energy inputs and outputs both prior to and subsequent to the installation of an energy efficiency measure. In the residential sector, metering is primarily used in pilot projects to improve the accuracy of determining the energy impact associated with a DSM measure. Metering can also be used as part of monitoring studies to determine energy usage of appliances over time.

In the commercial and industrial sector metering is commonly used to determine the impact of both custom and pilot programs, where there is insufficient information about the impact of specific measures. Metering analysis can be done on a short-term "spot" basis or on a longer term basis. Long term metering of end-use before and after the installation is preferable to spot metering where economic, and where the participant behavior is not expected to be affected by the measurement.

***Simulation Modeling***

The effects of efficiency improvements in both residential and commercial buildings can be estimated through simulation of energy use under various scenarios using computer based energy models. In the residential sector, HOT2000 is a commonly used model developed for this purpose, while commercial energy use modeling often requires more complex models such as DOE2. Simulation modeling may be used as part of program design, to obtain initial estimates of energy impact, and/or as part of an initial impact evaluation where billing or metering data is not yet available to refine the modeling estimates.

***Engineering Estimates***

This method is based on an engineering analysis of the difference in efficiency between the "standard" measure and the installed efficiency measure. It may be based on standard efficiency measurements, such as the difference in EF rating for hot water tanks or the difference in AFUE ratings for furnaces. At a more basic level, it may require analysis of the differences in design of the energy efficient equipment being installed.

***Statistically Adjusted Engineering Estimates***

This approach utilizes engineering models and statistical approaches to examine the amount and nature of customer end-use loads. The results of simulated end-use loads from engineering methods become inputs into statistical models and are adjusted on the basis of customers' observed loads (statistical data). The resulting end-use loads, called statistically adjusted engineering (SAE) loads, depend on a variety of conditioning variables such as weather and the size and type of the customer's dwelling, or perhaps income and other household characteristics identified as part of the statistical analysis.

#### *Surveys*

Survey data is often the basis of both process and impact evaluations. Surveys may take the form of mail, telephone, internet panels, and more recently social media analysis, and may be done with participants and non-participants in any given program. Data collected includes awareness of the program, satisfaction, persistence, usage of the efficiency measure and information to help establish levels of free riders and spillover.

#### *Field Studies and Laboratory Research*

This type of analysis can be undertaken are as part of pilot program projects when the utility is conducting a detailed review of a small number of a specific efficiency measures that are "market ready" but not in wide use in the utility's service territory. Typically, the research combines survey data from the customer where the pilot project is being conducted (to understand parameters such as usability and satisfaction with the technology), and metering of baseline and post implementation periods to determine the change in energy use.

#### *Site Visits*

Site visits can be used to examine programs across all customer classes to confirm that the target efficiency measure has been successfully installed and is in operation. Site visits can be combined with interviews of homeowners or facility operators to provide additional data valuable to the evaluation process.

#### *Statistical Analysis*

Mathematical approaches such as regression analysis and conditional demand analysis are often used in evaluation studies. These approaches can approximate some of the benefits of metering, but through the use of surveys or audits combined with billing histories can include a much larger group of customers at a much lower evaluation cost. Offsetting the cost advantages of this approach, however, are increased uncertainties due to potential changes in energy use unrelated to the efficiency measure being studied.

## 3.7 OTHER EVALUATION CONSIDERATIONS

Evaluation activities need to consider a number of issues not yet discussed.

#### *Multi – Fuel Impacts*

DSM programs may impact the use of electricity, natural gas and other fuels. Often, a program aimed primarily at reducing natural gas consumption may also impact electricity consumption or vice versa. For example a furnace efficiency program that encourages the installation of a variable speed fan might reduce both natural gas and electricity consumption. Natural gas and electricity are the most commonly used energy fuels in BC's built environment; however, the potential exists for the consumption of other fuels, such as propane or heating oil, to similarly be impacted by a DSM program. The potential for such multi-fuel impacts needs to be addressed as part of program evaluation activities.

### *Persistence of Savings*

For natural gas programs, the persistence of energy savings over time is often a function of the life span of the measure or technology. In some cases, however, persistence can be more complex. There may be a need to determine if the equipment or technology being installed will maintain its efficiency rating over time. Also, circumstances may require a shorter (than life span) duration of savings to be assessed such as may occur if the program accelerates the installation of a high efficiency measure that would otherwise require installment at a later date. These complexities must also be addressed as part of the evaluation activities.

### *Interactive Effects*

Impact evaluations should look more broadly than just the energy savings that result from the change in efficiency of the energy conservation measure. Changes in the measure can cause a number of other changes. For example, the evaluation of the residential furnace program (from 2005 to 2007) illustrated that upgrading a furnace has larger impacts than just replacing one technology with another. This evaluation illustrated that the new furnace changed the usage of secondary heat for a share of participants, and also that increases in comfort may result in homeowners selecting lower temperatures in their dwellings. The changes can affect the overall efficiency of energy use, and can also result in changing the balance of all fuel types in use in the building usage including natural gas, electricity and wood.

### *Attribution of Savings from Joint Programs*

The Companies also undertake and participate in integrated electricity and natural gas programs, both within the FortisBC utilities and between the FortisBC natural gas utility and BC Hydro. Attributing for the energy savings and carbon emission reductions that result from such projects among partner organizations needs to be fair, consistent and transparent. The Companies apply the following principles, which incorporate current practice based on established industry standards and provincial regulation, while considering the regulatory environment in BC. These principles align with current best practices as described in the 2014 ACEEE report, “Successful Practices in Combined Gas and Electric Utility Energy Efficiency Programs”( U1406).

- *Double-counting of savings will continue to be avoided by each utility reporting only energy savings associated with their respective delivered energy source for integrated programs. In its reporting to the Provincial Government and BCUC, the partner electric utilities will report only electric savings. In its reporting to the BCUC, the FEI will report only gas savings.*

- *Non-primary fuel savings (i.e., natural gas savings for the partner electric utilities and electricity savings for the FEI) resulting from program activities are tracked in order to inform cost-effectiveness calculations, but are not included in formal reporting.*

- *When attributing savings in the cost benefit analysis of EEC programs, any claimed savings will be matched with appropriate associated costs. That is, if it makes sense to conduct an all-fuel cost-effectiveness test for a particular joint program, the test should include the appropriate costs and energy savings from both electricity and gas measures. However, if it is appropriate to calculate the cost effectiveness only for the FEI portion (for example) of an integrated program, then only the costs and energy savings related to the gas portion of the program will be included. As program design affects the inputs to the cost-effectiveness test, each utility will develop an understanding of the other's deemed partner cost approaches by collaborating during the development of business cases to ensure claimed savings match with costs as per industry standards and best practices where they exist.*

#### Related Studies

In addition to evaluation programs, FEI undertakes a number of studies which are used to support both program development and evaluation. These include:

- Sector End Use Studies conducted periodically to provide a "snapshot" of customers' products and equipment. These studies often include supporting analysis such as "Conditional Demand Analysis" (CDA) components that provide estimates of the amount of natural gas usage by end uses.
- Conservation potential reviews, which are systematic assessments of the current status of energy efficiency in the installed appliance stock in the marketplace and projections of the main end uses where efficiency improvements are possible, along with estimates of potential energy reductions.

### 3.8 FEEDING EM&V STUDY RESULTS INTO DSM PLANNING

Evaluation and program management staff at FortisBC review the results of evaluation studies and reports to determine if changes to programs are needed. In the case of M&V activities, this review will assist staff in determining if new programs should be developed based on pilot study results or if adjustments need to be made to the data used to determine program or project cost effectiveness. For program design and development, project managers need to consider additional factors such as human, technical and budgetary resources, portfolio priorities and any feedback received from stakeholders.

# 4. EVALUATION RESOURCES

Effective management of evaluation activities requires both financial and staffing resources.

## 4.1 EVALUATION BUDGETS

Industry practice for budget spending on EM&V activities appears to range from just below 2 percent to 3 percent of spending on overall energy efficiency and conservation program budgets. The Companies examined the results of recent industry surveys on evaluation expenditures. Survey results obtained from E Source, an energy efficiency consultancy serving gas and electric utilities throughout North America, indicate that for utilities with DSM expenditures of between US$ 20 and 55 Million, DSM budgets are between 2 percent and 3 percent, and that the proportion of DSM expenditures on evaluation decreases as the size of the portfolio increases[8]. Utilities with expenditures greater than $US 55 million tend to spend just under 2 percent on evaluation. The Consortium for Energy Efficiency (CEE) found that in 2014 US and Canadian natural gas utilities spent about 2 percent of their overall DSM budgets on evaluation and in 2015 this value dropped to 1 percent for Canadian Utilities[9].

This level of spending is in keeping with the principle that evaluation budgets should be a small component of overall programming budgets. That is, an evaluation budget, and therefore evaluation efforts, should not be so extensive that they unnecessarily cause a program to fail a cost-benefit test and thereby prevent the program from being implemented. As such, the Companies will plan EM&V budgets to be between 2 and 3 percent of the overall DSM portfolio spending.

On a program by program basis, there may be occasions when either higher or lower budgets for individual programs may be appropriate. A new program for which there is very little industry data available and for which energy efficiency performance may have a higher degree of uncertainty, may warrant a higher spending level. Pilot studies that examine the actual performance of a newer technology or measure, for example. In other cases, a program being implemented may benefit from similar programs in other jurisdictions having similar geographic and climate settings may be abundant, evaluation data may be well established and smaller budgets are appropriate.

## 4.2 EVALUATION ORGANIZATION

Wherever possible, the evaluation of programs that span across FEI's and FBC's separate utility service territories will be conducted as a single evaluation in order to take advantage of evaluation cost efficiencies and incorporate consistency across service areas. Similarly, evaluations of joint

[8] E Source Poster: How Much do Utilities Spend on Evaluation? 2015. Prepared from data available in E Source DSM Insights 2015.

[9] CEE Annual Industry Report – State of the Efficiency Program Industry, Section 4. Consortium for Energy Efficiency, 2014, 2015 and 2016.

electric and gas DSM programs will be conducted as a single for the partners involved in delivering the program.

Evaluations will be conducted or managed by staff who are independent from the program managers and other staff responsible for designing and implementing DSM programs. Staff responsible for evaluation activities will have separate reporting lines from that of program development and implementation staff wherever practical within the utilities.

## 4.3 STAFFING RESOURCES

The companies recognize that a combination of internal staffing resources and external professional consulting services will be needed to undertake the full range of evaluation activities that are required for the level of DSM program activity being implemented. The level of internal staff resourcing for evaluation activities will be sufficient to ensure that a base level of evaluation activity can be managed as appropriate for the level of program activity being delivered by the Companies.

Evaluation studies are generally outsourced by the Companies to external consultants. For M&V projects, external consultants will be retained whenever specialized expertise is required that FEI does not have in house and whenever increased levels of activity occur such that they cannot be completed by internal staff. Staffing and consultant resources will also be managed within the appropriate budgeting parameters (see Section 4.1).

Sufficient internal staff resources are needed to plan evaluation activities, manage evaluation projects, review third party consultation studies / reports and conduct some evaluation analysis.

- Development of RFPs
- Working with purchasing to obtain quotes from qualified service providers
- Developing selection criteria for the proposals
- Managing the selection criteria
- Managing the evaluation projects
- Maintaining communications with interested parts of the organization (esp. EEC)

Evaluation staff will be involved in the program planning process to determine the major evaluation issues for each program and ensuring that sufficient evaluation resources are available.

***Staff Resources for Measurement and Verification Activities:***

Internal engineering expertise is required to develop technical measurement and verification process requirements, develop measurement and verification plans, inspect measurement and verification work being done by third parties, be able to conduct measurement and verification activities when necessary. Number of internal staff must be sufficient to manage base level work load, provide consistent project management, and must be managed relative to overall EEC budgeting requirements.

## 4.4 *ROLE OF STAKEHOLDER ADVISORY GROUPS*

Advisory Groups made up of key stakeholders external to the Companies have been established by FortisBC to provide insight and feedback on the Companies' portfolios of DSM activities. Advisory Group members are not expected to have a high level of expertise in EM&V and are not expected to provide input on individual evaluation or measurement and verification projects. FEI will make any final evaluation report summaries available to Advisory Group members if requested. Members will also be able to contact FortisBC staff for more detailed discussions/explanations if desired. A list of evaluation activities will also be included in the Companies' Annual Reports for their DSM programs. From time to time, the Companies may review EM&V issues and results with the Advisory Groups for discussion and feedback.

The companies submit evaluation plans through either their Revenue Requirements Application or other filings for approval by the BCUC. Any stakeholder can participate in the review of the evaluation plans through the BCUC's regulatory review process[10].

[10] Visit www.bcuc.com