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June 6, 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 Inc. (FBC)

Application for Acceptance of Demand-Side Management (DSM) Expenditures Plan for the period covering from 2023 to 2027

Pursuant to section 44.2 of the *Utilities Commission Act*, FBC hereby applies to the British Columbia Utilities Commission for acceptance of the attached DSM Expenditures Plan covering the period from 2023 to 2027.

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

Sincerely,

FORTISBC INC.

Original signed:

Diane Roy

Attachments

cc (email only): Registered Interveners to the FBC Annual Review for 2022 Rates

FORTIS BC™

FORTISBC INC.

Application for Acceptance of Demand-Side Management Expenditures 2023 to 2027

June 6, 2022

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1. INTRODUCTION

FortisBC Inc. (FBC or the Company) submits this Application for Acceptance of Demand Side Management (DSM) Expenditures for 2023 to 2027 (the Application) to the British Columbia Utilities Commission (BCUC or the Commission) pursuant to section 44.2(1)(a) of the *Utilities Commission Act*, R.S.B.C. 1996, c. 473 (UCA). The funding request outlined in the Application is supported by the detailed 2023 to 2027 DSM Plan (the DSM Plan) found in Appendix A. The DSM Plan provides details on each of FBC's program areas and individual DSM programs, including cost-effectiveness test results.

The DSM Plan increases the level of expenditures and cost-effective programs compared to the previously accepted 2019-2022 DSM Plan[1] and the pro-forma expenditures[2] in FBC's Long-Term DSM Plan (LT DSM Plan), filed as part of its 2021 Long-Term Electric Resource Plan (LTERP) on August 24, 2021. The DSM Plan continues many of the cost-effective programs previously accepted in the 2019-2022 DSM Plan, with some additions and modifications to simplify offers for customers, align programs with provincial partners, and comply with changes to applicable legislation.

Table 1-1 summarizes FBC's proposed DSM expenditures and savings that are further detailed in the DSM Plan, included as Appendix A, (inflation adjusted).

Table 1-1: 2023-2027 DSM Plan Expenditures and Savings

Plan	2023	2024	2025	2026	2027	Total
Expenditures ($000s)						
2023-2027 DSM Plan	$14,455	$15,436	$16,572	$17,412	$18,707	**$82,583**
Energy savings (GWh)						
2023-2027 DSM Plan	26.4	27.4	28.6	29.7	31.3	**143.4**

The DSM Plan provides details on each of FBC's program areas and individual DSM programs, including cost-effectiveness test results. The information presented in the DSM Plan involved a collaborative working effort between FBC DSM program personnel and the Posterity Group, an energy efficiency consulting firm that is also assisting FortisBC Energy Inc. (FEI) with its DSM expenditures planning. More details on the approach undertaken to develop the DSM Plan can be found in section 1 of the DSM Plan (Appendix A).

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

[1] Order G-113-18
[2] 2021 LTERP Volume 2 (LT DSM Plan) Table 3-2 p.16

As set out in the Application, FBC's proposed DSM expenditure schedule is consistent with the British Columbia's energy objectives and FBC's LTERP, meets the adequacy and cost-effectiveness requirements of the Demand-Side Measures Regulation, and responds to government policy encouraging an increase in DSM program incentives and support.

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

2. APPROVALS SOUGHT AND PROPOSED REGULATORY PROCESS

FBC seeks an order from the BCUC pursuant to section 44.2(3) of the UCA accepting the DSM expenditure schedule totalling $82.583 million, inflation adjusted, as set out in Table 4-2 of the Application. The Company submits that these expenditures are cost-effective, fulfil the adequacy requirements of the DSM Regulation[3], and are in the public interest.

In addition, FBC is also seeking approval of:

- proposed changes to its existing funding transfer and carryover rules that provide flexibility in the timing of expenditures within the proposed program areas, as set out in Sections 7.1.1 and 7.1.2;
- a new variance allowance rule on total portfolio expenditures in the final year of the DSM Plan, as set out in Section 7.1.3; and
- a rate base deferral account to capture the regulatory costs associated with the review of this Application, as set out in Section 7.2.

A Draft Order is attached as Appendix C.

FBC believes that a written public hearing with one round of Information Requests is appropriate for this Application based on the stakeholder reviews undertaken on the key inputs to, and the consultation process carried out for, the DSM Plan.

FBC has undertaken, in conjunction with FEI, a wide-ranging consultation leading up to this DSM Plan expenditure schedule. Section 4.2 outlines the extent of the consultation, which included two consultations with the Energy Efficiency and Conservation Action Group (EECAG[4]) regarding the DSM Plan.

Table 2-1 outlines FBC's proposed regulatory timetable.

Table 2-1: Proposed Regulatory Timetable

Regulatory Timetable	Date (2022)
Registration of Interveners	Friday June 24, 2022
BCUC Information Request No. 1	Wednesday June 29, 2022
Intervener Information Request No. 1	Wednesday July 6, 2022
FBC Response to Information Request No. 1 from BCUC and Interveners	Wednesday July 27, 2022
FBC Final Submission	Thursday August 18, 2022
Intervener Final Submission	Thursday September 15, 2022
FBC Reply Submission	Wednesday October 12, 2022

[3] Demand-Side Measures Regulation 326/2008, as amended by B.C. Reg. 117/2017.

[4] EECAG is FEI's long-standing energy efficiency and conservation advisory group. As part of ongoing C&EM integration efforts, the September and December 2021 EECAG meetings were "joint" with both gas and electric stakeholders present to discuss FBC's 2023-27 DSM Plans.

3. DSM PLAN MEETS THE REQUIREMENTS OF THE LEGAL FRAMEWORK

FBC is filing this Application pursuant to section 44.2(1)(a) of the UCA, which provides that a utility may file with the Commission an "expenditure schedule" containing "a statement of the expenditures on demand-side measures the public utility has made or anticipates making during the period addressed by the schedule." All proposed activity in the DSM Plan qualifies as "demand-side measures", as defined in the *Clean Energy Act* (CEA)[5]. Under section 44.2(2) of the UCA, DSM expenditures must be the subject of a schedule of DSM expenditures accepted by the BCUC before those expenditures are included in a utility's rates.

Pursuant to sub-sections 44.2(3) and (4) of the UCA, the Commission must accept all (or a part of) a DSM expenditure schedule if it considers that making the expenditures in the schedule (or a part of it) would be in the public interest. In considering whether an expenditure schedule put forward by a public utility, other than the British Columbia Hydro and Power Authority (BC Hydro), is in the public interest, the Commission 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 of the UCA, if any;
- 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.[6]

Section 3.1, addresses how the DSM Plan supports the applicable of BC's energy objectives. Consistency with FBC's most recently filed long-term resource plan (the 2021 LTERP) is addressed in Section 3.2. Consideration of adequacy, as defined in the DSM Regulation, is discussed in Section 3.3. The discussion in the DSM Application and these supporting materials confirms that the DSM Plan is in the interests of persons in British Columbia who receive or may receive service from FBC.

FBC notes that the BCUC Decision and Order G-47-19 accepting FBC's 2019-22 DSM Expenditure Application did not include any directives with respect to FBC's next DSM expenditure filing.

[5] *Clean Energy Act*, S.B.C. 2010, c. 22, s. 1(1) (Definitions).
[6] Section 44.2(5) also includes "(c) the extent to which the schedule is consistent with the applicable requirements under sections 6 and 19 of the [CEA]"; however, neither of those provisions is applicable to FBC in respect of the Application.

3.1 CONSISTENCY WITH BRITISH COLUMBIA ENERGY OBJECTIVES

British Columbia's energy objectives are set out in section 2 of the CEA. A summary of how the DSM Plan supports the applicable of these energy objectives is provided in the table below.

Table 3-1: BC's Energy Objectives Met by FBC DSM Plan

Energy Objective	FBC DSM Plan
(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%;	FBC's DSM proposals are designed to implement cost-effective (as defined by the DSM Regulation) demand-side measures. See Section 3.3.
(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;	FBC's DSM Plan includes provision for Innovative Technology projects, see Appendix A, Section 9.
(i) to encourage communities to reduce greenhouse gas emissions and use energy efficiently;	Local government and institutional strategic energy planning, and Community Education and Outreach, are enabled through Supporting Initiatives. Provision for, and further development of, the BC Step Code are included within Program areas. See Section 3.4.5 and Appendix A, Section 6.

3.2 CONSISTENCY WITH LONG TERM RESOURCE PLAN

Under section 44.2(5)(b) of the UCA, in determining whether to accept an expenditure schedule filed by a utility, the Commission must consider the utility's most recent long-term resource plan filed under section 44.1 of the UCA.

On August 24, 2021, FBC filed its 2021 LTERP, which included its LT DSM Plan, and is currently under review by the BCUC. The 2021 LTERP and LT DSM Plan included Conservation Potential Review (CPR) results for the FBC service territory (FBC CPR)[7]. The LT DSM Plan included an assessment of the appropriate level of cost-effective DSM resource acquisition to match FBC's resource needs over the LTERP's 20-year planning horizon.

The Base DSM scenario FBC selected for its LT DSM Plan contemplated total DSM expenditures between 2023 and 2027 of $63 million[8] and total DSM savings of 139.8 GWh[9]. The LT DSM Plan was premised on a ramp up in DSM spending and savings, beginning in 2021, that would offset an average of 32 percent of FBC's forecast load growth annually over the LTERP's planning horizon. In response to emerging customer activities, the DSM Plan that is the subject of this Application builds on the target savings contemplated in the LT DSM Plan. Table 3-2 below, shows that the proposed budget for the DSM Plan is $19 million more, in total, than the pro-forma

[7] FBC's CPR Technical and Economic report can be found in Appendix A of the LT DSM Plan.
[8] $57.2 million ($2020) 2021 LTERP and LT DSM Plan, Volume 2, Section 3.3, Table 3-2: Pro-forma DSM Savings Targets, pg. 18
[9] 2021 LTERP and LT DSM Plan, Volume 2, Section 3.3, Table 3-2: Pro-forma DSM Savings Targets, pg. 18.

budget contemplated in the LT DSM Plan (inflation adjusted) and is expected to achieve an additional 3.6 GWh of electricity savings for this period.

Table 3-2: 2023-2027 DSM Plan Compared with the LT DSM Plan[10]

Plan	2023	2024	2025	2026	2027	Total
Expenditures ($000s)						
2023-2027 DSM Plan	$14,455	$15,436	$16,572	$17,412	$18,707	**$82,583**
LT DSM Plan	$11,249	$11,907	$13,139	$12,951	$14,014	**$63,260**
Difference	*$3,206*	*$3,529*	*$3,433*	*$4,461*	*$4,693*	***$19,323***
Energy savings (GWh)						
2023-2027 DSM Plan	26.4	27.4	28.6	29.7	31.3	**143.4**
LT DSM Plan	27	27.3	29.3	28.6	27.6	**139.8**
Difference	*-0.6*	*0.1*	*-0.7*	1.1	*3.7*	***3.6***

FBC has created a DSM Plan that is consistent with the LT DSM Plan using a number of inputs: the Company's Conservation and Energy Management (C&EM) guiding principles; review of historical and forecasting of future program activity levels; consultation with stakeholders; and calibration to the market potential results contained in FBC's CPR (included as Appendix D).

FBC uses the market potential results contained in the FBC CPR as an input to the planning process. The market potential is an estimate of energy savings for a list of technologies that could be achieved over time. Broad assumptions about customer acceptance and adoption rates are made to estimate the potential. Market potential differs from program potential in that it does not account for the various mechanisms that can be used to deliver DSM programs for a specific measure and/or customer segment. FBC evaluates the potential identified for each energy end-use, compares it to program activity, and calibrates programs where appropriate. Detailed discussion of the FBC CPR is contained in Section 4.4 of the Application and the full report is included in the Application as Appendix D.

Beyond the changes proposed as a result of detailed program design, the main drivers of deviations of the DSM Plan from the LT DSM Plan are as follows:

- Based on feedback from EECAG stakeholders (see section 4.2), FBC is proposing increased expenditures in the Low Income Program Area to support additional energy conservation projects in Indigenous communities.
- Based on feedback from EECAG stakeholders, FBC is proposing increased expenditures in the Innovative Technologies Program Area to support a small residential deep energy retrofit pilot in electrically heated homes in Indigenous communities.

[10] LT DSM Plan Expenditure has been adjusted for annual inflation from 2023 to 2027

- FBC has increased expenditures in the Residential and Commercial Program Areas to support demand and capacity savings measures not included within the scope of the FBC CPR.
- Based on the results of the Kelowna Demand Response Pilot, FBC is proposing a new program area specifically focussed on demand response which was not included within the scope of the FBC CPR.

The DSM measures included in the 2023-2027 DSM Plan are consistent with the measures assessed and the benefit/cost methodology used in the 2021 LTERP and LT DSM Plan. More specifically, the measures included within programs in the DSM Plan pass the Total Resource Cost (TRC) test[11] and address the key end-uses of the principal customer rate classes – consistent with the 2021 LTERP (and accepted for the 2019-2022 DSM Plan).

The benefits of the TRC test are FBC's "avoided costs", calculated as the DSM measures' present value over the effective measure life of energy savings and demand savings, represented by the long run marginal cost (LRMC) and deferred capital expenditure (DCE) values. In response to BCUC IR1 38.1 in the 2021 LTERP, FBC indicated that the LRMC of acquiring electricity from BC "clean or renewable" resources is as follows:

- $90 per MWh (for measures that save energy and capacity)
- $63 per MWh (for measures that only save energy)
- $145 per kW-y (for measures that only save capacity)

In the DSM Plan, FBC continues to use the $90/MWh as the LRMC for most measures except demand response and air conditioning measures that use an LRMC of $145/kW-y. In the same response to BCUC IR1 38.1 in the 2021 LTERP, FBC proposes to use a DCE value of $51.22 per kW-yr[12] as its avoided costs for the purposes of DSM benefits calculations. The DSM Plan achieves a TRC Benefit/Cost ratio of 1.2 on a portfolio basis using the above LRMC and DCE factor.

3.3 *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 3-3, 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, FBC addresses how the DSM Plan is compliant with each of these considerations in Table 3-3 below.

[11] The TRC test is the ratio of the benefits of a DSM measure divided by the DSM measure's cost, including the utility's program costs. The TRC is further described in Section 5.1.2.
[12] Order G-19-17 (FBC's 2017 DSM Expenditure Application)

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

DSM Regulation Adequacy	DSM Plan Compliance
a) a demand-side measure intended specifically i. to assist 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 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	The Low Income section of the DSM Plan (Appendix A, Section 6) shows plans for FBC 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	FBC will be continuing to collaborate with FEI in the Rental Apartment Efficiency Program (RAP). As referenced in the Commercial section of the DSM Plan (Appendix A, Section 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 DSM Plan (Appendix A, Section 7) includes continuation of the School Education Program which includes programming for grade schools and post- secondary institutions in FBC'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 i. of the definition of "specified demand-side measure", representing no less than	The Enabling Activities section of the DSM Plan includes Codes & Standards (Appendix A, Section 8), which forecasts an expenditure of $900 thousand. This equates to approximately 1.1% percent of the overall forecast portfolio spend over the DSM Plan period.

DSM Regulation Adequacy	DSM Plan Compliance
ii. 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.	BC Energy Step Code support is included within the following programs listed in the DSM Plan (Appendix A): • Residential New Home Program (Section 3) • Commercial Performance Program – New Buildings (Section 4) • Enabling Activities – Codes & Standards (Section 8) • Enabling Activities – Community Energy Specialist Program (section 8)

1

4. DSM PLAN AND PROPOSED EXPENDITURES

The DSM Plan (Appendix A) provides program details and projected cost-effectiveness test results by program, sector, and at the portfolio level. FBC's funding proposal for 2023 to 2027 includes all major customer sectors and program areas: Residential, Low Income, Commercial, Industrial, Conservation Education and Outreach, Enabling Activities (previously named Supporting Initiatives), Innovative Technologies (previously included within Portfolio Expenditures), Demand Response, and Portfolio Expenditures. In this Application, FBC requests funding for two new program activities for 2023-2027.

Table 4-1 below lists the programs and activities in the DSM Plan compared to the 2021 Annual Report, showing where previously approved programs have been consolidated, moved between program areas or renamed. The DSM Plan (Appendix A) provides further program details and program descriptions.

Table 4-1: Comparison of 2021 Annual Report and 2023-2027 DSM Plan

Status	2021 Annual Report	2023-2027 DSM Plan
Residential		
Approved Programs	Home Renovation Program	No Change
	New Home	No Change
	Lighting	Consolidated under Home Renovation
	Rental Apartment	Moved under Commercial Rental Apartment Efficiency Program
New Programs	None	None
Commercial		
Approved Programs	Commercial Prescriptive	Prescriptive
	Commercial Custom	Performance
	N/A	Rental Apartment Efficiency Program
	Rental Apartment	No Change
New Programs	None	None
Industrial		
Approved Programs	Industrial Prescriptive	No Change
	Industrial Performance	No Change
New Programs	None	Strategic Energy Management
Low Income		
Approved Programs	Self Install (ESK)	Self Install
	Direct Install (ECAP)	Direct Install
	Social Housing Support	Performance
		Prescriptive
New Programs	None	None

Status	2021 Annual Report	2023-2027 DSM Plan
Conservation, Education, and Outreach		
Approved Programs	Residential Customer Engagement Tool	Customer Engagement Tool
	Residential Education Program	No Change
	Commercial Education Program	No Change
	School Education Program	School and Post-Secondary Education Program
New Programs	None	None
Enabling Activities (Previously Supporting Initiatives)		
Approved Programs	Trade Ally Network	No Change
	Codes and Standards	No Change
	Reporting Tool & Customer Portal	No Change
	Commercial Energy Specialist	No Change
	Community Energy Specialist	No Change
New Program	None	Customer Research
Innovative Technologies		
Approved Programs	Innovative Technologies	Moved from line in Portfolio Expenditure to its own Program Area
New Program	None	None
Demand Response		
Approved Programs	Demand Response	Residential Demand Response
	Codes and Standards	Commercial and Industrial Demand Response
New Program	None	Considered transitioned from approved Pilot to regular Programming for Residential, Commercial, and Industrial sectors
Portfolio Expenditures		
Approved Programs	Monitoring and Evaluation	Evaluation
	DSM Studies	None
	Innovative Technologies	Moved from Portfolio Expenditures to its own Program Area
New Program	None	None

The DSM Plan increases the level of expenditures and cost-effective programs compared to the previously accepted 2019-2022 DSM Plan[13] and the pro-forma expenditures[14] in FBC's LT DSM Plan. The DSM Plan continues many of the cost-effective programs previously accepted in the

[13] Order G-113-18
[14] 2021 LTERP Volume 2 (LT DSM Plan) Table 3-2 p.16

2019-2022 DSM Plan, with some additions and modifications to simplify offers for customers, align programs with provincial partners, and comply with changes to applicable legislation.

The following sections describe FBC's guiding principles, consultation with stakeholders, proposed DSM expenditures forecast by program area, and the FBC CPR results and reports including market potential.

4.1 *GUIDING PRINCIPLES*

The FEI and FBC (collectively FortisBC) C&EM department is responsible for the development and operation of both electric and gas demand-side management programs. The C&EM department's common guiding principles are the following:

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 1.0 (unity) or higher.

5. FortisBC will submit its annual DSM Reports to the BCUC that detail the results of the previous year's activity by the end of the first quarter of the following year.

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. FortisBC 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 FortisBC's DSM activities.

9. DSM expenditure schedules will be multi-year, where feasible, so as to create the funding certainty necessary to support effective implementation in the marketplace – this Application requests funding for a five-year portfolio of DSM programs.

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. FortisBC 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, FortisBC will undertake program area specific stakeholder consultation(s) on effective program design and implementation.

4.2 *CONSULTATION*

A key input in the development of the DSM Plan was information gathered through consultation with various program stakeholders and interested parties. FortisBC undertook an in-depth consultation process that 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.

FBC engaged in and documented over 40 interactions and consultations related to the DSM Plan. The range of entities consulted with included: communities, customers, contractors, manufacturers, government, First Nations, vendors, interest groups, and EECAG. The forms of consultations included workshops, surveys, in-person interviews, webinars, and conference calls. FBC also provided confidential draft versions of its DSM Plan to EECAG members for review and input.

Most of the key learning from these consultations was market data refinement, which was then considered and assessed within program plans and profiles within the DSM Plan. The feedback also 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 FortisBC. Satisfaction appeared to be high for FortisBC in this area and none of the consultations suggested that any significant change in approach was required.

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

- Increase in expenditures in the Low Income Program Area to support additional energy conservation projects in Indigenous communities;
- Support for Demand Response transition from pilot to program and incentives for demand response measures such as residential air conditioning units;
- Within the Innovative Technologies Program Areas strong feedback was received to support a residential deep energy retrofit pilot in electrically heated homes in Indigenous communities;
- Continue support and higher tier adoption of the BC Energy Step Code for new construction;
- Support deeper retrofits and building envelope support;
- Consider upstream incentives;
- Support pre-commercial technologies;
- Expand energy efficiency opportunities for existing and emerging industries (ex. cannabis production) in the Industrial program area;
- Pursue attribution for Codes and Standards; and
- Support Energy Advisors.

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

4.3 *DSM EXPENDITURE FORECAST BY PROGRAM AREA*

Table 4-2 summarizes the DSM Plan forecast energy savings and expenditures (inflation adjusted) by program area (sector), non-program areas, and portfolio level totals. The table also presents TRC Benefit/Cost ratios by program area and at the portfolio level. FBC used an inflation rate of two percent annually for program expenses. The inflation rates assumed for program labour for each year are 3.3 percent (2024), 2.7 percent (2025), 2.6 percent (2026) and 2.7 percent (2027). Inflation is only accounted for in Tables 1-1, 3-2 and Table 4- for the plan years 2024~~3~~ to 2027. For simplicity, all other tables in Appendix A show proposed expenditures in 2023 dollars (uninflated).

Table 4-2: 2023-2027 DSM Plan Proposed Expenditures (inflation adjusted)

Program Area (Sector)	2019-22 Plan	Expenditures ($000's)						Energy Savings (GWh)						TRC 2023-2027
	Approved 2022	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total	Ratio
Residential	$3,795	$2,946	$3,258	$3,566	$4,015	$4,548	$18,334	5.7	6.2	6.9	7.6	8.6	35.0	1.4
Commercial	$930	$3,129	$3,416	$3,643	$3,850	$4,012	$18,050	10.8	11.1	11.5	11.8	12.2	57.4	1.4
Industrial	$3,047	$2,119	$2,130	$2,187	$2,196	$2,206	$10,837	8.4	8.4	8.6	8.6	8.6	42.5	2.1
Low Income	$1,815	$1,743	$1,730	$1,790	$1,844	$1,934	$9,043	1.6	1.6	1.7	1.8	1.9	8.5	1.1
Program sub-total	*$8,587*	*$9,938*	*$10,543*	*$11,186*	*$11,905*	*$12,700*	*$56,264*	*26.5*	*27.3*	*28.7*	*29.8*	*31.3*	*143.4*	*1.5*
Conservation Education and Outreach	$666	$897	$978	$1,002	$1,028	$1,163	$5,067							
Enabling Activities*	$1,044	$1,550	$1,600	$1,960	$1,846	$2,046	$9,001							
Innovative Technologies*		$485	$685	$255	$318	$276	$2,019							
Demand Response	$133	$773	$803	$1,316	$1,443	$1,626	$5,962							1.0
Portfolio	$956	$813	$836	$853	$872	$896	$4,270							
Total	**$11,400**	**$14,455**	**$15,436**	**$16,572**	**$17,412**	**$18,707**	**$82,583**	**27.4**	**27.4**	**28.6**	**29.7**	**31.3**	**143.4**	**1.3**
LT DSM Plan	**$10,600**	**$11,249**	**$11,907**	**$13,139**	**$12,951**	**$14,014**	**$63,259**	**27**	**27.3**	**29.3**	**28.6**	**27.6**	**139.8**	

* Innovative Technologies 2022 budget was included within the Supporting Initiatives Program Area of the approved 2019-22 DSM Plan. Supporting Initatives is now named to Enabling Activities, to align with FEI

4.4 *CONSERVATION POTENTIAL REVIEW (CPR)*

FBC engaged Lumidyne Consulting (Lumidyne) to review and update the energy efficiency potential for FBC's service area in the residential, commercial, and industrial sectors over the planning horizon of 2021 to 2040. The FBC CPR is included as Appendix D to the Application.

The FBC CPR was a key input to the 2021 LTERP and the LT DSM Plan. The FBC CPR used the model initially developed for the 2016 BC CPR[15], which used three distinct steps to estimate potential: generating a reference forecast, characterizing energy savings measures, and estimating the economic savings potential. The scope of the FBC CPR also included assessing the conservation potential of the total loads in FBC's service territory, including those partially supplied by self-generating customers.

The FBC CPR reviewed over 200 energy savings measures from the residential, commercial, and industrial sectors. Three different potentials were developed:

- **Technical potential:** the hypothetical savings when each CPR measure immediately replaces its corresponding low-efficiency or minimum-code baseline measure wherever it is technically feasible.
- **Economic potential:** the subset of technical potential considering measures that have a benefit-cost ratio of 1.0 or higher.
- **Market potential:** the subset of economic potential that captures real-world dynamics influencing measure adoption, including replacement timing conservation, measure market maturity, and economic attractiveness, as assessed by payback acceptance curves.

FBC uses the market potential to estimate the potential of DSM over a 20-year planning period and identify measures for potential incorporation into future DSM Expenditure Plans, including this one. FBC evaluated five different market potential DSM Scenarios (Low, Base, Medium, High,

[15] In 2016 FBC partnered with FEI and BCH to perform a provincial, dual-fuel conservation potential review (BC CPR)

Maximum) based on varying the amount of incentive provided (i.e. the Low DSM Scenario had the lowest incentives, which the Maximum DSM Scenario had the highest incentives). FBC selected the Base DSM as its preferred scenario, with the rationale detailed in Section 3 of the 2021 LT DSM Plan.

4.4.1 Market Potential Results from FBC CPR

FBC uses market potential as an input to the DSM planning process. Market potential differs from program potential in that it does not account for the various mechanisms that can be used to deliver DSM programs for a specific measure or market. Rather, market potential represents a high-level assessment of savings that could be achieved over time, factoring in broader assumptions about customer acceptance and adoption rates that are not dependent on a particular program design. Additional effort is typically undertaken by program managers, using the directional guidance from a market potential study, to develop detailed plans for delivering conservation programs. The forecasted savings from the proposed DSM Plan exceed the Market Potential outlined in the Base DSM Scenario of the Conservation Potential Review.

From the FBC CPR, Figure 4-1 shows that the cumulative market potential increases steadily throughout the CPR period, reaching 583 GWh/year in 2040. By 2040, market potential reaches nearly 58 percent of the economic potential. Incremental annual market potential added year-over-year to the cumulative potential averages 29 GWh/year over the 20-year study horizon.[16]

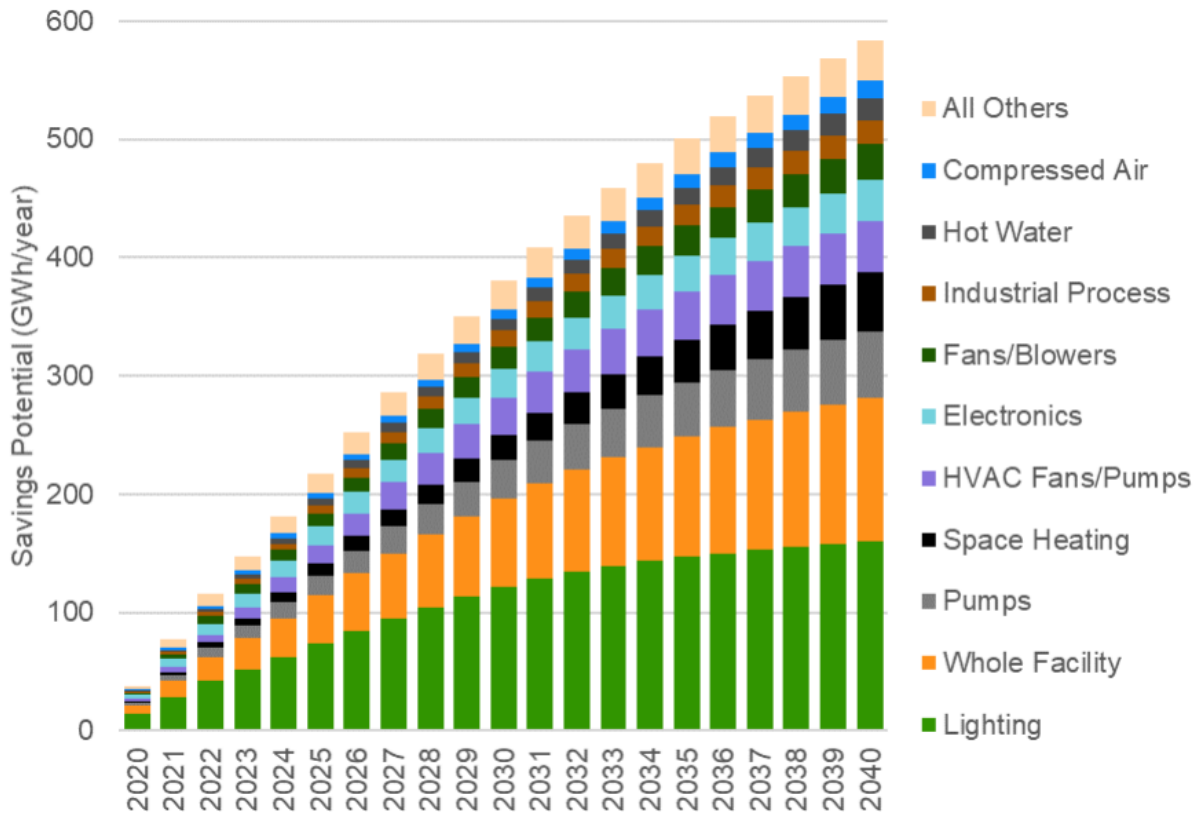
Figure 4-1: Total Cumulative Electric Energy Savings Potential (GWh/year)

Source: Lumidyne

[16] The time horizon for the CPR is 2021-2040 (20 years).

Figure 4-2 shows the electric energy market savings potential across end-uses aggregated across all sectors. The dominant end-uses are lighting and whole facility. The bulk of savings potential in the lighting end-use comes from LEDs. The whole facility end-use primarily consists of savings from building automation controls, whole-building new construction practices and smart thermostats. As such, whole-facility savings implicitly include savings from multiple end-uses.

Figure 4-2: Cumulative Electric Energy Savings Market Potential by End-Use (GWh/year)



Source: Lumidyne

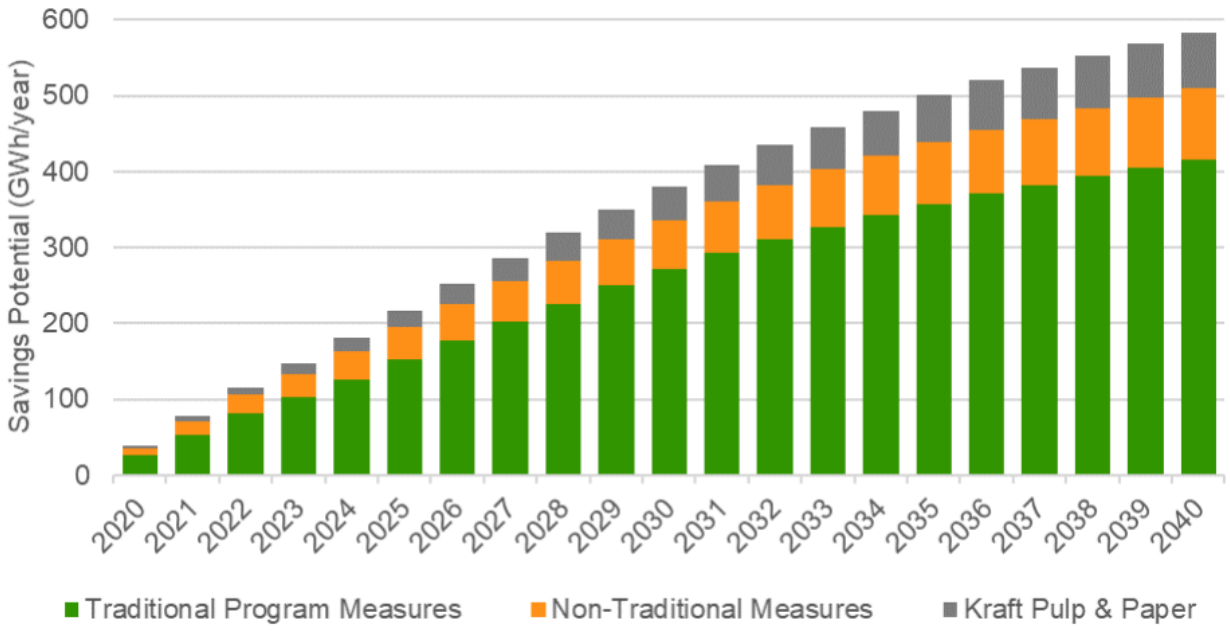
The market potential evaluated three different classifications of measures:

- "Traditional Measures", which represent measures that are included in FBC's current DSM plan in the residential, commercial and industrial sectors, excluding the kraft pump and paper sector;
- "Non-traditional measures", which represent measures that are not included in FBC's current DSM plan in the residential, commercial and industrial sectors, excluding the kraft pump and paper sector; and
- "Kraft pulp and paper" measures, which represent measures applicable in the kraft pulp and paper sector.

Non-traditional measures were excluded from the Base DSM scenario targets as there were other market and adoption barriers that did not make these measures reliable for DSM programs, even in consideration of economic factors. Measures in the kraft pulp and paper sector were also excluded from the Base DSM scenario targets as the kraft pulp and paper facility in FBC's service territory primarily self-generates its own electricity; thus, the savings in the facility do not result in significant savings realized by FBC. Savings from those areas represent 168 GWh or nearly 29 percent of the total cumulative market potential by 2040. The remaining 415 GWh of market potential comes from traditional measures typically included in FBC's DSM programs.

Figure 4-3 illustrates the amount of market potential electric savings from the traditional, kraft pulp and paper, and non-traditional sectors.

Figure 4-3: Annual Electric Energy Savings Market Potential by Source (GWh/year)



Source: Lumidyne

The DSM Plan savings forecast exceeds the market potential largely due to newly anticipated activity in cannabis production facilities in FBC's service area and other differences between the DSM Plan and the LT DSM Plan discussed in Section 3.2.

5. COST EFFECTIVENESS APPROACH

The following section explains the TRC cost-effectiveness test required under the DSM Regulation and shows how the DSM Plan meets those requirements.

5.1 *COST-EFFECTIVENESS UNDER THE DEMAND-SIDE MEASURES REGULATION*

FBC's proposed DSM portfolio for 2023-2027 is cost-effective, with a TRC of 1.3, based on the methodology set out in section 4 of the DSM Regulation. The approach to determining the cost-effectiveness of FBC's DSM programs is comprehensive, aligned with the DSM Regulation, and consistent with past practice.

The following sections discuss the relevant parameters for calculating the TRC cost-effectiveness test as set out in the DSM Regulation.

5.1.1 Portfolio-Level Analysis

Section 4(1) of the DSM Regulation provides that the Commission, in determining the cost-effectiveness of a demand-side measure proposed in an expenditure portfolio or a plan portfolio, may assess 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 BCUC has historically considered the cost-effectiveness of FBC's DSM plans at the portfolio level.[17] FBC proposes that the BCUC apply the same portfolio level approach to cost effectiveness in its review of the DSM Plan.

Individual program cost-effectiveness estimates are provided in the DSM Plan (Appendix A to the Application), and FBC will continue to report on individual DSM program cost-effectiveness results in its DSM Annual Reports.

5.1.2 Total Resource Cost (TRC) Test

The governing TRC test is often expressed as a ratio of the benefits of a DSM measure divided by the measure's cost, including the utility's program costs. The benefits are the "avoided costs", calculated as the present value over the effective measure life of:

i. the measure's energy savings, valued at the LRMC; and

ii. the measure's demand savings, valued at the DCE.

The measures' energy and demand savings are grossed-up by the avoided transmission and distribution energy losses ("line losses") of 8 percent before the benefits are calculated. In its DSM

[17] See BCUC Decision and Order G-110-12, page 136 on FBC's 2012-13 Revenue Requirements Application, BCUC Decision and Order G-186-15, page 4 on FBC's 2015-16 DSM Expenditures Application, and BCUC Decision and Order G-47-19, page 7 on FBC's 2019-22 DSM Expenditures Application.

Plan, FBC uses the follow values for cost effectiveness testing under the DSM Regulation, proposed in the 2021 LTERP and LT DSM Plan:

- A LRMC of $90 per MWh ($2020);
- A DCE value of $51.22 per kW-yr ($2020); and
- A 7.9 percent discount rate.

Section 4 of the DSM Regulation requires that DSM cost effectiveness be evaluated using the governing TRC test and, as necessary, the modified TRC (mTRC) test for up to 10 percent of the expenditure portfolio (per section 4(1.5)(b)(iv)). Where the evaluation occurs at the portfolio level, the total costs of the portfolio are compared to the total value of the benefits of the programs contained in the portfolio.

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 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. FBC has included specified demand-side measures within its Conservation Education and Outreach and Supporting Initiatives program areas.

For a DSM measure(s) intended specifically to assist residents of low-income households to reduce their energy consumption (which would include the activities within FBC's Low Income Program), the Commission must, per section 4(2) of the DSM Regulation, in addition to any other analysis the Commission considers appropriate, use the TRC test and, in so doing, increase the value of the benefit of the DSM measure by 40 percent. FBC has applied this approach in the cost-effectiveness analysis of the Low Income programs presented in the DSM Plan.

For a DSM measure(s) with only capacity savings and no energy savings (such as the demand response program), FBC used the capacity-only LRMC of $145 per kW-yr ($2020), rather than the blended energy and capacity LRMC of $90 per MWh. Otherwise, the TRC calculation remains the same.

5.1.3 Non-energy Benefits and the Modified Total Resource Cost Expenditure Cap

Section 4(1.1)(c) of the DSM Regulation requires the Commission to allow the inclusion of non-energy benefits (NEBs) for all DSM measures other than charity programs and low-income measures, which receive a different benefits adder under section 4(2), as described above. The amount of the NEBs which may be allowed by the Commission under s. 4(1.1)(c) is based on either evidence from the utility or by using a deemed 15 percent increase to the benefits side of the DSM expenditure portfolio of which the measure is a part. FBC uses the latter approach in its

mTRC calculations. Section 4(1.5) limits this use of NEBs to a maximum of 10 percent of the total expenditures in an electricity DSM expenditure portfolio.

The measures contained in the DSM Plan all passed the standard TRC test, without requiring the use of the 15 percent NEB adder; hence, there are no expenditures falling into the 10 percent mTRC cap.

5.2 *OTHER STANDARD COST BENEFIT TESTS*

While the TRC and mTRC continue to be the governing tests that FBC 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)[18], the Utility Cost Test (UCT)[19] and the Participant Cost Test (PCT)[20] applied at the program, program area (or sector) and portfolio levels. These cost-effectiveness tests are from the California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects (California Manual)[21].

Table 5-1 shows the standard test results at the portfolio level and demonstrates that the DSM Plan is cost effective under the standard TRC test and also under the mTRC, UCT and PCT tests. Although the 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.[22]

Table 5-1: Portfolio Level Cost Effectiveness Results

	TRC	mTRC	UCT	PCT	RIM
Total Portfolio	1.3	1.4	1.8	3.2	0.5

[18] 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).

[19] 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.

[20] 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.

[21] 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

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

6. EVALUATION, MEASUREMENT AND VERIFICATION

Evaluation, Measurement and Verification (EM&V) are important aspects of managing a DSM portfolio. FBC follows the EM&V framework that FEI created with stakeholder review which is attached as Appendix E.

The Company employs Measurement and Verification (M&V) protocols on individual DSM projects, using IPMV[23] best practices, to ensure energy savings estimates are sound. Furthermore, the Company conducts Monitoring and Evaluation (M&E) activities on all programs, with comprehensive impact, process and/or market reviews[24] at appropriate times in program life cycles. The evaluation results inform program design, and summaries of M&E reports are shared with stakeholders and the BCUC through FBC's DSM Annual Reports.

6.1 *MONITORING AND EVALUATION*

Section 8.1 of the DSM Plan (Appendix A) details the M&E expenditures FBC proposes to make to ensure an adequate M&E review is in place for the DSM Plan period.

FBC's portfolio expenditures include costs for EM&V activities. The total proposed expenditure for EM&V activities to be conducted over the 2023 – 2027 DSM Plan period is approximately $1.6 million, or four percent of the DSM expenditure portfolio.

6.2 *NET-TO-GROSS RATIO: SPILL-OVER AND FREE RIDERS*

Historically, FBC calculated the net-to-gross (NTG) ratio by adjusting the benefits downward for the presumed presence of free riders[25]. Additionally, FBC has included known spill-over[26] effects in the NTG ratio, which is a recognized approach used by other utilities including BC Hydro. Spill-over is the conceptual opposite of free riders, thus including both effects presents a more complete and balanced view of program impacts.

FBC will continue to evaluate and quantify free-rider and spill-over effects on a program-by-program basis. Where adequate estimates are developed or acquired based on the results of an evaluation, free-rider and spill-over effects will be accounted for in the NTG ratio, as appropriate.

Table 6-1 below lists the free-ridership and spill-over rates currently used by FBC. The figure "0%" indicates zero [free-ridership], and a "blank" space indicates that spill-over has not been determined in prior M&E studies.

[23] International Performance Measurement and Verification Protocol® (IPMVP) http://evo-world.org/en/

[24] Types of evaluation activities include: Process evaluations, where surveys and interviews are used to assess customer satisfaction and program success; Impact evaluations, including NTG assessment, to measure the achieved energy savings attributable to the program; and Market reviews to gauge Market Transformation progress.

[25] Individuals who participate in an incentive program who would have undertaken the measure even in the absence of an incentive.

[26] Spillover effects involve non-participants who acquired an energy conservation measure (ECM), and who did not receive an incentive, but were influenced by the operation of the utility's DSM program.

Table 6-1: FBC Program Free-Rider and Spill-Over Rates

Program Area	Free-rider	Spill-over	Source of Justification
Residential			
HRR – Home Improvement	63%	0%	Evergreen Economics, 2015
HRR – Heat Pumps, Incentive	36%	4%	Evergreen Economics, 2020
HRR – Heat Pumps, Loans	25%	4%	Evergreen Economics, 2020
HRR – Heat Pump Water Heaters	13%	55%	Evergreen Economics, 2020
HRR – Retail Lighting	50%	15%	Evergreen Economics, 2019
HRR - Appliances	39%	17%	Evergreen Economics, 2019
New Home Program	26%	0%	Mazzi Consulting, 2022
Low Income			
Self Install Program	0%	0%	as per BC Hydro
Direct Install Program	0%	0%	as per BC Hydro
Prescriptive Program	0%	0%	(To be evaluated in the future)
Performance Program	0%	0%	(To be evaluated in the future)
Commercial			
Performance Program – Custom Efficiency	69%	0%	Evergreen Economics, 2018
Performance Program – New Construction	0%	0%	(To be evaluated in the future)
Performance Program – Continuous Optimization	0%	0%	FortisBC Business Case, 2020
Prescriptive Program - Lighting	27%	43%	Mazzi Consulting, 2019
Prescriptive Program – Non-lighting	30%	12%	Sampson Research, 2012
Rental Apartment Efficiency Program	10%	4%	Cohesium Research, 2022
Industrial			
Performance Program – Custom Efficiency	12%	0%	Sampson Research, 2013
Performance Program – Strategic Energy Management	20%	0%	FortisBC Business Case, 2018
Prescriptive Program	30%	12%	Sampson Research, 2012
Demand Response			
Residential Demand Response	0%	0%	(To be evaluated in the future)
Commercial and Industrial Demand Response	0%	0%	(To be evaluated in the future)

7. ADDITIONAL APPROVALS SOUGHT

7.1 *FUNDING TRANSFERS AND VARIANCES*

The following sections detail FBC's proposed changes to the two types of funding transfers within the DSM portfolio that were previously approved as part of its 2019-22 DSM Expenditure Plan Application and proposal to add an additional allowed percentage variance to the total portfolio expenditures in the final year of the Plan.

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

Section 7.1.2 details FBC's proposed change to the rules for transfers within a Program Area from one year to the next (funding carryover); and

Section 7.1.3 details FBC's proposal for an allowed percentage variance above the approved DSM expenditures in the final year of the 2023-27 DSM Plan.

7.1.1 Funding Transfers

BCUC Decision and Order G-47-19 laid out the following inter-program funding transfer rules for the duration of FBC's 2019-22 DSM Plan:

> The Panel approves transfers of up to twenty five percent of accepted DSM expenditures from one existing program area to another existing program area without prior approval of the BCUC on the condition that FBC adds information regarding such transfers so that all amounts transferred from one existing program area to another existing program area are transparently accounted for in the DSM annual reports. In cases where a proposed transfer into or out of an approved program area is greater than twenty five percent of that program area's accepted expenditures for the year in question, prior BCUC approval is required.[27]

In the Decision, the BCUC Panel further noted that some discretion should be permitted to the utility in transferring funds, but within defined limits. FBC agrees that the funding transfer rules in place for its 2019-22 DSM Plan provide some flexibility to respond to changes in the execution of its DSM programs. However, FBC is proposing some small changes to the rules to overcome some of the challenges of working within the transfer rules. These proposed changes provide the necessary boundaries to ensure that the DSM portfolio still aligns with the approved portfolio deemed to be in the public interest.

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

- **Remove the requirement for approval of transferred funds into a program area:** FBC 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

[27] Order G-47-19, pp. 15-16

area can lose funding are still in place, but eliminates the limits on how much one program area can gain. FBC 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. FBC would still report on transfers into and out of program areas in its annual reporting to the BCUC.

- **Remove the requirement of *prior* approval:** FBC 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 that the 25 percent limit will be passed until it is about to occur or already occurring. Additionally, the exact amount of the transfer above 25 percent is difficult to forecast ahead of its occurrence, and time is also required to draft and submit an application to the BCUC.

In summary, FBC is requesting the following funding transfer rule be in place for its 2023-27 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 acceptance is required.*

7.1.2 Funding Carryover

FBC is requesting to continue the funding carryover rules that were previously approved as part of its 2019-22 DSM Expenditure Plan with one proposed change. FBC is requesting to be permitted to carryover overspent (or negative amounts) into the following year. For clarity, FBC would be permitted to carryover unspent and **overspent** expenditures in a Program Area to the same Program Area in the following year. In effect, FBC is requesting that the BCUC accept the total expenditures per Program Area over the time period of the expenditure schedule.

FBC considers that carrying over negative amounts is consistent with the spirit and intent of its existing funding carryover rules. The ability to carryover funding amounts from one year to the next within the DSM funding period was applied for and approved in order to provide FBC with additional flexibility to manage the portfolio expenditures as it strives to meet the overall expenditure targets set out in the DSM Plan. Although the existing carryover rules focused on carrying over unspent amounts in the early years of the Plan to future years, the primary purpose of the carryover funding transfer request was to help FBC achieve the four-year total expenditures. Carrying forward negative amounts to future years of the plan will similarly help FBC to manage timing of expenditures and decrease the likelihood of underspending of the 2023-2027 DSM Plan. While spending may be higher than planned in one year, it may be lower than planned in the following year. Therefore, FBC considers that the funding carryover rules should include the flexibility to manage both positive and negative carry over amounts.

In its Decision and Order G-301-21 on FEI's Application for Additional DSM Expenditures for 2021 to 2022, the BCUC Panel stated that it did not object to the negative carryover of funds to the extent that it supports rather than hinders FEI's ability to effectively carry out its current four year

DSM Plan within the existing overall spending envelope as approved by the BCUC. The Panel also noted that it would be beneficial to seek specific approval of the Funding Carryover rules.[28]

In summary, FBC is requesting the following funding carryover rule be in place for its 2023-27 DSM Plan:

> *FBC is permitted to carryover unspent and overspent expenditures in a Program Area to the same Program Area in the following year.*

7.1.3 Total Portfolio Variance Allowance

FBC is seeking approval of an allowed variance above the approved DSM expenditure amount for the final year of the 2023-27 DSM Plan without prior approval from the BCUC. FBC is proposing that in the final year of the 2023-27 DSM Plan (i.e. 2027 DSM expenditures), actual DSM expenditures for 2027 may only exceed 2027 approved DSM expenditures (excluding any carryover amounts from prior years) by no more than five percent without prior approval from the BCUC. This means that in the final year of the Plan, FBC has additional flexibility to overspend 2027 approved expenditures by $935 thousand.

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

For clarity, FBC is requesting the following variance allowance rule be in place for its 2023-27 DSM Plan:

> *FBC is permitted to exceed total approved DSM Portfolio expenditures before any carryover amounts in the final year of the DSM Plan by no more than five percent without prior approval from the BCUC.*

In summary, the funding transfer and carryover rules, and the variance allowance will all serve to provide FBC with the flexibility to manage its DSM portfolio most effectively.

7.2 2023-27 DSM EXPENDITURE SCHEDULE DEFERRAL ACCOUNT

FBC 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 five years starting in 2023 to match the time period that the DSM Plan will be in place.

[28] Order G-301-21, Appendix A, page 8

8. CONCLUSION

The DSM Plan increases the level of expenditures and cost-effective programs compared to the previously accepted 2019-2022 DSM Plan[29] and the pro-forma expenditures[30] in FBC's LT DSM Plan, filed as part of its 2021 LTERP on August 24, 2021. The DSM Plan continues many of the cost-effective programs previously accepted in the 2019-2022 DSM Plan, with some additions and modifications to simplify offers for customers, align programs with provincial partners, and comply with changes to applicable legislation.

As set out in the Application, FBC's proposed DSM expenditure schedule is consistent with the British Columbia's energy objectives and FBC's LTERP, meets the adequacy and cost-effectiveness requirements of the Demand-Side Measures Regulation, and responds to government policy encouraging an increase in DSM program incentives and support.

FBC therefore requests that the BCUC accept the 2023-2027 DSM expenditures of $82.583 million as filed to support and implement the DSM Plan.

[29] Order G-113-18
[30] 2021 LTERP Volume 2 (LT DSM Plan) Table 3-2 p.16

Appendix A
FBC 2023-2027 DSM PLAN

POSTERITY GROUP

FortisBC Inc.
2023 – 2027 DSM Plan
Final Report

Date: 1 June 2022

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

Contents

List of Exhibits

1 Introduction

FortisBC Inc. (FBC or the Company) has offered demand-side management (DSM) programs to customers since 1989 that are available to eligible customers served by FBC and its wholesale customers of Grand Forks, Nelson Hydro, Penticton, and Summerland.

The 2023 – 2027 Demand Side Management (DSM) Plan presents FBC's Conservation and Energy Management (C&EM) funding request for the following energy efficiency program areas and supporting initiatives:

- Residential
- Low Income
- Commercial
- Industrial
- Conservation Education and Outreach (CEO) Initiatives
- Innovative Technologies
- Enabling Activities
- Demand Response

This report 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.

Most of the programs in this plan are part of FBC's existing DSM portfolio previously accepted in the 2019 – 2022 DSM Expenditure Plan. The activities and measures within some of the programs have been updated. These modifications are meant to simplify offers for customers and to align programs within the portfolio as well as with other partners.

1.1 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 Electric Resource Plan, 2021 Long Term DSM Plan, and 2021 Conservation Potential Report
- In collaboration with FBC 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 (program managers, FBC management team, Energy Efficiency & Conservation Advisory Group (EECAG))

- Revised and finalized budget, program offerings, measures, and cost effectiveness results

1.2 Report Organization

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

- Section 2 provides a summary of the overall DSM Program 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 Program Area.
- Section 8 describes the Enabling Activities that are required over the 5-year DSM Plan period and their budgets.
- Section 9 describes the Innovative Technologies activities that are required over the 5-year DSM Plan period and their budgets.
- Section 10 describes the individual programs and their savings and cost-effectiveness results for the Demand Response Program Area.
- Section 11 describes the Portfolio Activities that are required over the 5-year DSM Plan period and their budgets.

1.3 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 FBC's DSM Plan 2023 - 2027. It shows the expenditures, estimated electricity savings, and associated cost-effectiveness.

The 2023 - 2027 DSM Plan includes programs for: the Residential, Commercial, and Industrial customer classes; and Low Income. This DSM Plan also includes non-program expenditure categories: Conservation Education and Outreach (CEO); enabling activities; portfolio activities (including Innovative Technologies); and a Demand Response program. The DSM Plan provides an overview and high-level description of each DSM program that FBC offers to its customers. Detailed Terms & Conditions for each program govern the actual measure incentives available, and process required, for qualifying customers.

2.2 Overall Portfolio Results

Exhibit 1 provides a summary of expenditures, including inflation, and represents the total budget requested by FBC for the 2023 - 2027 DSM plan.

The inflation rate is assumed to be 2% for admin, communications, and evaluation expenditures for all years. For labour expenditures, the inflation rate for each year is assumed to be 3.3% (2024), 2.7% (2025), 2.6% (2026) and 2.7% (2027). It should be noted that the inflation rate was only applied to non-incentive spending (i.e., incentives are already assumed to be year of spending). It should also be noted that inflation is only accounted for in Exhibit 1. All other exhibits presented in this document present non-incentive expenditures in 2023 dollars.

Exhibit 1 – Annual Total DSM Expenditures by Program Area ($000s)

Program Area	2023	2024	2025	2026	2027	Total
Residential	2,946	3,258	3,566	4,015	4,548	18,334
Commercial	3,129	3,416	3,643	3,850	4,012	18,050
Industrial	2,119	2,130	2,187	2,196	2,206	10,837
Low Income	1,743	1,730	1,790	1,844	1,934	9,043
Conservation Education and Outreach	897	978	1,002	1,028	1,163	5,067
Enabling Activities	1,550	1,600	1,960	1,846	2,046	9,001
Innovative Technologies	485	685	255	318	276	2,019
Demand Response	773	803	1,316	1,443	1,626	5,962
Portfolio Activities	813	836	853	872	896	4,270
Total ($000s)	**14,455**	**15,436**	**16,572**	**17,412**	**18,707**	**82,583**

** Portfolio Level Activities are those activities for which the costs cannot be assigned to individual DSM programs. It should be noted that these activities are distinct from Enabling Activities. These distinct Portfolio Level Activities include expenditures such as DSM support and portfolio level staff labour, some staff training and conferences, facilities and equipment, some industry association memberships, regulatory work, and EECAG[1] activities.*

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

Exhibit 2 - Exhibit 4 show the overall DSM portfolio's expenditures, electricity savings, and cost-effectiveness broken down by program areas. All expenditures shown here onwards in this report are in 2023 dollars and do not account for inflation.

Exhibit 2 – Expenditures, Electricity Savings, and Cost-Effectiveness of the DSM Portfolio

	2023	2024	2025	2026	2027	Total
Expenditures – Incentives ($000s)	8,288	8,981	9,759	10,567	11,524	49,118
Expenditures - Non-Incentives ($000s)	6,167	6,286	6,503	6,391	6,543	31,890
Expenditures – Total ($000s)	14,455	15,268	16,262	16,958	18,066	81,008
Net Incremental Annual Electricity Savings (GWh)	26.4	27.4	28.6	29.7	31.3	
Cumulative Net Annual Electricity Savings (GWh)						143.4
Net Present Value of Net Electricity Savings (GWh)						1,256
Cumulative Net Annual Demand Savings (MW)						62.1
Levelized Cost of Electricity ($/kWh)						$0.06
TRC						1.3
UCT						1.8

Exhibit 3 – Portfolio Expenditures by Program Area

Program Area	Incentive Expenditures ($000s)						Non-Incentive Expenditures ($000s)						Total Expenditures ($000s)					
	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total
Residential	2,187	2,484	2,774	3,203	3,710	4,357	760	753	754	757	760	3,782	2,946	3,236	3,528	3,959	4,469	18,138
Commercial	2,141	2,399	2,606	2,788	2,922	12,856	988	988	988	988	988	4,940	3,129	3,387	3,594	3,776	3,910	17,796
Industrial	1,770	1,770	1,820	1,820	1,820	9,000	349	349	349	349	349	1,745	2,119	2,119	2,169	2,169	2,169	10,745
Low Income	1,209	1,267	1,315	1,355	1,431	6,577	534	451	453	457	458	2,355	1,743	1,718	1,769	1,812	1,889	8,932
Conservation Education and Outreach	-	-	-	-	-	-	897	954	958	962	1,064	4,835	897	954	958	962	1,064	4,835
Enabling Activities	739	774	908	1,017	1,159	4,595	811	807	1,008	777	813	4,216	1,550	1,580	1,916	1,794	1,972	8,811
Innovative Technologies	175	175	-	-	-	350	310	499	244	298	252	1,603	485	674	244	298	252	1,953
Demand Response	67	113	337	385	482	1,384	706	673	936	991	1,046	4,352	773	785	1,273	1,375	1,528	5,736
Portfolio Activities	-	-	-	-	-	-	813	813	813	813	813	4,063	813	813	813	813	813	4,063
Total ($000s)	**8,288**	**8,981**	**9,759**	**10,567**	**1,524**	**49,118**	**6,167**	**6,286**	**6,503**	**6,391**	**6,543**	**31,890**	**14,455**	**15,268**	**16,262**	**16,958**	**18,066**	**81,008**

Exhibit 4 – Portfolio Electricity Savings, Cost-Effectiveness, Levelized Cost of Electricity by Program Area

Program Area	Net Incremental Annual Electricity Savings (GWh)						NPV of Electricity Savings ($000s)	NPV of Electricity Savings (GWh)	Annual Demand Savings (MW)	NPV of Demand Savings ($000s)	TRC	LCOE ($/kWh)
	2023	2024	2025	2026	2027	Total						
Residential	5.7	6.2	6.9	7.6	8.6	35	$33,700	328	14.5	7,800	1.4	$0.06
Commercial	10.8	11.1	11.5	11.8	12.2	57.4	$53,600	526	8.7	5,200	1.4	$0.03
Industrial	8.4	8.4	8.6	8.6	8.6	42.5	$33,000	331	7.4	3,200	2.1	$0.03
Low Income	1.6	1.6	1.7	1.8	1.9	8.5	$7,200	71	0.9	400	1.2	$0.13
Conservation Education and Outreach	Savings not estimated											
Enabling Activities	Savings not estimated											
Innovative Technologies	Savings not estimated											
Demand Response									30.6	$4,400	1.0	
Portfolio Activities	Savings not estimated											
Total	**26.4**	**27.4**	**28.6**	**29.7**	**31.3**	**143.4**	**$127,600**	**1,256**	**62.1**	**$21,100**	**1.3**	**$0.06**

On August 4, 2021, FBC filed its 2021 Long Term Electric Resource Plan (LTERP) and Long-Term Demand Side Management Plan (LT DSM Plan). The 2021 LTERP and LT DSM Plan included the 2021 Conservation Potential Review (CPR) results for the FBC service territory (FBC CPR). The LT DSM Plan included an assessment of the appropriate level of cost-effective DSM resource acquisition to match FBC's resource needs over the LTERP's 20-year planning horizon. The Base DSM scenario FBC selected for its LT DSM Plan contemplated annual DSM expenditures for 2023 of $10.6 million ($2020) and annual DSM savings of 27.0 GWh.

Exhibit 5 compares the 2023 – 2027 DSM plan with the LT DSM Plan. The proposed DSM plan budget is $23.7 million higher than the LT DSM Plan budget. The extra budget results in 3.6 GWh of electricity savings over the DSM plan duration. Additionally, demand response programs and pilot projects for deep retrofits account for a substantial part of the additional expenditures – these items are new additions that are not included in the LT DSM Plan budget.

Exhibit 5 – Comparison Between DSM Plan Budget vs Long-Term (LT) DSM Plan

Expenditures ($000s)	2023	2024	2025	2026	2027	Total
2023-2027 DSM Plan	14,455	15,268	16,139	16,958	18,066	80,886
LT DSM Plan	10,600	11,000	11,900	11,500	12,200	57,200
Difference	3,855	4,268	4,239	5,458	5,866	23,686
Energy savings (GWh)						
2023-2027 DSM Plan	26.4	27.4	28.6	29.7	31.3	143.4
LT DSM Plan	27	27.3	29.3	28.6	28.6	139.8
Difference	-0.6	0.1	-0.7	1.1	2.7	3.6

2.3 The Long Run Marginal Cost

The proposed 2023 - 2027 DSM Plan calculates cost-effectiveness based on the long run marginal cost (LRMC) for clean or renewable BC resources and differed capital expenditure (DCE) values presented in the 2021 LTERP in response to BCUC IR1 38.1. The LRMC used is as follows:

- $90 per MWh ($2020, for measures that save energy and capacity)
- $63 per MWh ($2020, for measures that only save energy)
- $145 per kW-y ($2020, for measures that only save demand and capacity)
- The DCE used is as follows:
- $51.22 per kW-y ($2020, for all measures that save energy and capacity)

Based on those avoided costs, the 2023 - 2027 DSM Plan achieves a TRC ratio of 1.2 at the portfolio level.

3 Residential Program Area

In this DSM plan, the Residential Energy Efficiency Program Area consists of two program areas:

- Home Renovation Rebate Program (Includes Retail 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 of FortisBC Energy Inc (FEI).

The Home Renovation Rebate (HRR) 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 the BC Utilities (FortisBC Gas, FortisBC Electric, and BC Hydro), and the Ministry of Energy, Mines and Low Carbon Innovation's (EMLI) CleanBC Better Homes program.

Retail and lighting programs directed towards the home renovation segment are included in this section. FBC collaborates with BC Hydro, retailers, and distributors to offer point-of-sale incentives on several low-cost and easy to install measures such as LED fixtures, controls, select light bulbs, draft proofing, water savers, bathroom fans and connected thermostats. Rebates for ENERGY STAR appliances for existing homes are also available for additional energy savings.

The New Home Program aligns with and provides incentives for the tiers of the BC Energy Step Code for Part 9 Buildings, as as per the Demand-Side Measures (DSM) Regulation Section 3[2]. 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. FBC, in partnership with FEI, supports local governments in their adoption of the Step Code as part of an ongoing initiative for market transformation to high performance homes. FBC and its program partners[3] support[4] 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.

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

[3] These initiatives may be partially co-funded by program partners FortisBC Energy Inc., BC Hydro, the BC Ministry of Energy, Mines and Petroleum Resources and BC Housing

[4] 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 – 2027 DSM Plan has the following key updates in the Residential program area:

- The Rental Apartment Efficiency Program (RAP) will not be a program under FBC's residential program area. The program has been consolidated under the commercial program area. RAP is administered in collaboration with FEI, the natural gas utility. In this DSM plan, the program will be included under FBC's commercial program area.
- Air conditioners and air sealing added as new measures under the Home Renovation Rebate program.
- Connected home bundle added as a new measure under the New Home program
- LED bulbs removed from the Lighting (under Home Renovation Program). LED controls and fixtures remain.
- Step 2 and Step 3 new home code measures are ramped down to align with the Step Code updates. Starting in 2025, there are no Step 2 and 3 measures – the focus instead shifts to the higher Step 4, and 5 measures.

3.2 Program Budget and Savings

Exhibit 6 shows the annual incentive, non-incentive, and total expenditures for the residential program area by program. Exhibit 7 shows the electricity savings, cost-effectiveness, and levelized cost of electricity (LCOE) for each residential program.

Exhibit 6 – Residential Program Area Expenditures by Program ($000s)

Program Area	Incentive Expenditures ($000s)						Non-Incentive Expenditures ($000s)						Total Expenditures ($000s)					
	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total
Home Renovation	1,792	2,006	2,294	2,619	2,988	11,699	148	139	139	139	139	704	1,940	2,145	2,433	2,758	3,127	12,403
New Home	395	477	480	583	722	2,658	40	40	40	40	40	200	435	517	520	623	762	2,858
Labour							536	536	536	536	536	2,678	536	536	536	536	536	2,678
Non-Program Specific Expenses		-	-	-	-	-	36	38	39	42	45	200	36	38	39	42	45	200
Total ($000s)	**2,187**	**2,484**	**2,774**	**3,203**	**3,710**	**14,357**	**760**	**753**	**754**	**757**	**760**	**3,782**	**2,946**	**3,236**	**3,528**	**3,959**	**4,469**	**18,138**

Exhibit 7 - Residential Electricity Savings, Demand Savings, and Cost-Effectiveness by Program

Program Area	Net Incremental Annual Electricity Savings (GWh)						NPV of Electricity Savings ($000s)	NPV of Electricity Savings (GWh)	Annual Demand Savings (MW)	NPV of Demand Savings ($000s)	TRC	LCOE ($/kWh)
	2023	2024	2025	2026	2027	Total						
Home Renovation	5.2	5.7	6.2	6.8	7.6	31.5	$29,300	287	12.7	$6,744	1.6	$0.05
New Home	0.5	0.6	0.7	0.8	1.0	3.5	$4,400	41	1.8	$1,034	1.0	$0.08
Total	**5.7**	**6.3**	**6.9**	**7.6**	**8.6**	**35.0**	**$33,700**	**328**	**14.5**	**$7,778**	**1.4**	**$0.05**

4 Commercial Program Area

Commercial DSM programs encourage commercial customers (including institutions and government) to reduce electricity use. In this DSM plan, the Commercial Energy Efficiency Program Area consists of three programs:

- Prescriptive Program
- Performance Program
- Rental Apartment Efficiency Program

The **Prescriptive Program** includes incentives for the purchase and installation of specific qualifying new construction and retrofit measures. It provides rebates for energy efficient measures where the savings are well understood - and where installation may not be a part of a larger, more complex upgrade. Examples of such measures include, LED lighting and lighting controls, commercial refrigeration, variable speed drives, heat pumps, and high efficiency commercial air conditioners.

The Prescriptive Program has two market delivery channels. Commercial customers can purchase qualifying measures at the vendor of their choice and apply for rebate directly from FBC. Alternatively, for select qualifying measures (such as lighting and kitchen equipment), commercial customers can receive a rebate as a point-of-sale rebate from participating trade allies. Trade allies then apply for reimbursement of the point-of-sale rebates from FBC.

The **Performance Program** provides incentives to encourage commercial customers to identify, assess, and implement custom building energy-efficiency projects for existing and new buildings. The program is administered jointly with FEI, providing customers with a one-stop program in the FBC service territory to evaluate and implement building-scale energy efficiency projects. FBC Technical Advisors provide customer outreach and engagement for the Performance Program.

The commercial retrofit offer in the Performance Program provides incentives for customers to engage a qualified energy consultant to study potential building-scale electrical and natural gas energy efficiency and retro-commissioning opportunities. Incentives are also available to encourage the implementation of cost-effective electric energy efficiency measures. The commercial new construction offer in the Performance Program encourages the design of high-performance commercial buildings. Capital incentives are available for customers that design new buildings that exceed BC Building Code.

Joint with FEI and BC Hydro, incentives are also available through the Performance Program for the recommissioning of commercial building heat, ventilation, and air conditioning systems.

The **Rental Apartment Efficiency Program (RAP)**, in collaboration with FEI, provides the direct installation of in-suite measures, including LED light bulbs and 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 and FBC. 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 FBC'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 – 2027 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 included in the Residential program area.
- High efficiency air conditioners (four variations based on system sizes) have been added under the Prescriptive program.

4.2 Program Budget and Savings

Exhibit 8 shows the annual incentive, non-incentive, and total expenditures for the commercial program area by program. Exhibit 9 shows the electricity savings, cost-effectiveness, and levelized cost of electricity (LCOE) for each commercial program.

Exhibit 8 – Commercial Program Area Expenditures by Program ($000s)

Program Area	Incentive Expenditures ($000s)						Non-Incentive Expenditures ($000s)						Total Expenditures ($000s)					
	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total
Prescriptive	1,081	1,224	1,346	1,455	1,558	6,541	50	50	50	50	50	250	1,131	1,274	1,396	1,505	1,608	6,791
Performance	1,050	1,166	1,250	1,323	1,355	6,143	120	120	120	120	120	600	1,170	1,286	1,370	1,443	1,475	6,743
Rental Apartment	10	10	10	10	10	50	35	35	35	35	35	175	45	45	45	45	45	225
Labour	-	-	-	-	-	-	683	683	683	683	683	3,415	683	683	683	683	683	3,415
Non-Program Specific Expenses		-	-	-	-	-	100	100	100	100	100	500	100	100	100	100	100	500
Total ($000s)	**2,141**	**2,399**	**2,606**	**2,788**	**2,922**	**12,734**	**988**	**988**	**988**	**988**	**988**	**4,940**	**3,129**	**3,387**	**3,594**	**3,776**	**3,910**	**17,796**

Exhibit 9 - Commercial Electricity Savings, Demand Savings, and Cost-Effectiveness by Program

Program Area	Net Incremental Annual Electricity Savings (GWh)						NPV of Electricity Savings ($000s)	NPV of Electricity Savings (GWh)	Annual Demand Savings (MW)	NPV of Demand Savings ($000s)	TRC	LCOE ($/kWh)
	2023	2024	2025	2026	2027	Total						
Prescriptive	5.9	6.1	6.3	6.5	6.7	31.5	$29,800	293	7	$4,444	1.7	$0.03
Performance	4.7	4.9	5	5.1	5.3	25	$23,700	233	1.5	$779	1.1	$0.04
Rental Apartment	0.2	0.2	0.2	0.2	0.2	0.8	$100	1	0.2	$10	0.4	$0.34
Total	**10.8**	**11.2**	**11.5**	**11.8**	**12.2**	**57.3**	**$53,600**	**527**	**8.7**	**$5,233**	**1.4**	**$0.03**

5 Industrial Program Area

Industrial DSM programs encourage industrial customers to reduce their electricity use. In this DSM plan, the Industrial Energy Efficiency Program Area consists of three programs, one of which will be a new offering:

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

The **Prescriptive Program** includes fixed incentives for the purchase and installation of specific qualifying new construction and retrofit 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 LED lighting and lighting controls, variable speed drives, irrigation equipment, and compressed air systems.

The Prescriptive Program has two delivery marketing channels. Industrial customers can purchase qualifying measures and apply for rebates directly from FBC. Alternatively, for select qualifying measures such as lighting and irrigation equipment, industrial customers can receive their incentive as a point-of-sale rebate from participating trade allies. Trade allies then apply for reimbursement of the paid rebates from FBC.

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 FEI, providing customers with a one-stop program in the FBC service territory to evaluate and implement industrial energy efficiency projects. FBC Technical Advisors 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 offer 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 electricity and natural gas 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 electricity and natural gas more efficiently. DSM incentives are available to encourage the implementation of cost-effective electric energy efficiency measures.

The **Strategic Energy Management Program** is a comprehensive offering for large and medium industrial customers that 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 will be administered in collaboration with FEI. In 2020, FBC began a pilot project to extend FEI's SEM cohort offer to one wood products customer in the FBC service territory. This pilot is now being expanded into a full offer in this DSM Plan.

5.1 Key Changes in New Plan

Compared with the previous DSM Plan, the 2023 – 2027 DSM Plan has the following key updates in the Industrial program area:

- Addition of the Strategic Energy Management program (see this section's introduction)

5.2 Program Budget and Savings

Exhibit 10 shows the annual incentive, non-incentive, and total expenditures for the industrial program area by program. Exhibit 11 shows the electricity savings, cost-effectiveness, and levelized cost of electricity (LCOE) for each industrial program.

Exhibit 10 - Industrial Program Area Expenditures by Program ($000s)

Program Area	Incentive Expenditures ($000s)						Non-Incentive Expenditures ($000s)						Total Expenditures ($000s)					
	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total
Prescriptive	785	785	785	785	785	3,925	12	12	12	12	12	60	797	797	797	797	797	3,985
Performance	785	785	785	785	785	3,925	25	25	25	25	25	125	810	810	810	810	810	4,050
Strategic Energy Management	200	200	250	250	250	1,150	35	35	35	35	35	175	235	235	285	285	285	1,325
Labour	-	-	-	-	-	-	277	277	277	277	277	1,385	278	278	278	278	278	1,385
Non-Program Specific Expenses		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total ($000s)	**1,770**	**1,770**	**1,820**	**1,820**	**1,820**	**9,000**	**349**	**349**	**349**	**349**	**349**	**1,745**	**2,120**	**2,120**	**2,170**	**2,170**	**2,170**	**10,745**

Exhibit 11 - Industrial Electricity Savings, Demand Savings, and Cost-Effectiveness by Program

Program Area	Net Incremental Annual Electricity Savings (GWh)						NPV of Electricity Savings ($000s)	NPV of Electricity Savings (GWh)	Annual Demand Savings (MW)	NPV of Demand Savings ($000s)	TRC	LCOE ($/kWh)
	2023	2024	2025	2026	2027	Total						
Prescriptive	5.5	5.5	5.5	5.5	5.5	27.7	$23,900	238	5.2	$2,514	2.6	$0.02
Performance	2.0	2.0	2.0	2.0	2.0	10	$7,100	72	0.9	$367	1.5	$0.06
Strategic Energy Management	0.8	0.8	1.0	1.0	1.0	4.8	$2,000	21	1.3	$290	1.0	$0.07
Total	**8.3**	**8.3**	**8.5**	**8.5**	**8.5**	**42.5**	**$33,000**	**331**	**7.4**	**$3,171**	**2.1**	**$0.03**

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 benefits FBC's low income customers.

This program area also contributes to meeting the "adequacy" component of the DSM Regulation Section 3, whereby a utilities' 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"[5].

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

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

The **Self Install Program** is a program whereby low income participants receive an Energy Savings Kit (ESK) 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 FEI.

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., LED lighting, high efficiency showerheads, etc.) and provide customized energy efficiency coaching. Additionally, some participants qualify to receive more robust measures such as fridges and insulation. Partners in the Direct Install Program include FEI and BC Hydro.

The **Prescriptive Rebate 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 measures such as commercial lighting and kitchen equipment, and heat pump heating systems; and 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

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

example, participants access incentives by meeting the BC Energy Step Code standards for Part 3 and Part 9 buildings. The program is administered jointly with FEI. These activities were formerly allocated to the Support Program area.

6.1 Key Changes in New Plan

Compared with the previous DSM Plan, the 2023 – 2027 DSM Plan has the following key updates in the Low Income 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)
- More funding is allocated to stand-alone residential rebates and Indigenous communities' energy efficiency upgrades under the Prescriptive Rebate Program area and funding has been expanded to include performance-based incentives for high-performance residential and commercial buildings under the Performance Program area.

6.2 Program Budget and Savings

Exhibit 12 shows the annual incentive, non-incentive, and total expenditures for the Low Income program area by program. Exhibit 13 shows the electricity savings, cost-effectiveness, and levelized cost of electricity (LCOE) for each Low Income program.

Exhibit 12 – Low Income Program Area Expenditures by Program ($000s)

Program Area	Incentive Expenditures ($000s)						Non-Incentive Expenditures ($000s)						Total Expenditures ($000s)					
	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total
Self Install	43	43	48	48	54	236	18	18	19	19	20	94	61	61	67	67	74	330
Direct Install	500	500	500	500	500	2,500	180	157	157	158	158	810	680	657	657	658	658	3,310
Prescriptive	516	574	617	656	727	3,091	78	22	23	26	26	175	594	596	640	682	753	3,266
Performance	150	150	150	150	150	750	15	11	11	11	11	59	165	161	161	161	161	809
Labour	-	-	-	-	-	-	233	233	233	233	233	1,167	233	233	233	233	233	1,167
Non-Program Specific Expenses		-	-	-	-	-	10	10	10	10	10	10	50	10	10	10	10	10
Total ($000s)	**1,209**	**1,267**	**1,315**	**1,355**	**1,431**	**6,577**	**534**	**451**	**453**	**457**	**458**	**2,355**	**1,743**	**1,718**	**1,769**	**1,812**	**1,889**	**8,932**

Exhibit 13 - Low Income Electricity Savings, Demand Savings, and Cost-Effectiveness by Program

Program Area	Net Incremental Annual Electricity Savings (GWh)						NPV of Electricity Savings ($000s)	NPV of Electricity Savings (GWh)	Annual Demand Savings (MW)	NPV of Demand Savings ($000s)	TRC	LCOE ($/kWh)
	2023	2024	2025	2026	2027	Total						
Self Install	0.3	0.3	0.4	0.4	0.4	1.7	$1,000	10	-	-	3.2	$0.04
Direct Install	0.4	0.4	0.4	0.4	0.4	2.1	$2,000	20	-	-	0.7	$0.19
Prescriptive	0.7	0.8	0.8	0.9	0.9	4	$3,500	34	0.7	$332	1.3	$0.11
Performance	0.1	0.1	0.1	0.1	0.1	0.7	$800	7	0.2	$112	1.6	$0.13
Total	**1.5**	**1.6**	**1.7**	**1.8**	**1.8**	**8.5**	**$7,300**	**71**	**0.9**	**$444**	**1.2**	**$0.13**

7 Conservation Education and Outreach

The Conservation Education and Outreach (CEO) initiatives provide education about conserving energy and non-program specific outreach communications. 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 taking steps towards energy conservation 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[6] and support public awareness programs and specified demand-side measures[7], while being subject to Section 4 of the DSM Regulation[8].

For the 2019-2022 DSM plan, the suite of Conservation Education and Outreach customer offerings are organized into the following programs:

- Customer Engagement Tool
- Residential Education Program
- Commercial Education Program
- School and Post-Secondary Education Programs

The **Customer Engagement Tool** program provides energy reports and other tools that provide energy consumption analysis to residential and commercial customers, increasing customer's awareness of energy efficiency and conservation while fostering conservation behaviours. These initiatives are in partnership with FEI and include an online portal where customers can access targeted energy conservation content and build awareness of FBC's other DSM offers. Savings will be reported in FBC's annual DSM reports to the British Columbia Utilities Commission. In the later years of the plan, the Customer Engagement Tool may expand to include a pay for performance model, virtual energy audits, heat mapping, and a digital engagement tool for residential customers for residential customers. Business energy reports are planned to be a new offer for commercial customers.

The **Residential Education Program** provides information to residential customers and the public on electricity conservation and energy literacy through direct engagement (either face-to-face or through

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

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

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

online tools). This includes low income and multilingual customers. Ongoing partnerships with Canadian Home Builders Associations and local sports organizations expand outreach opportunities to engage with Residential customers.

Promotional activities include a multimedia rebate awareness campaign, engagement campaigns, educational seminars, and participation in home shows and community events. 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 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 participating in industry association meetings and tradeshows. FBC plans to continue the Efficiency in Action Awards, which recognizes commercial customers for their innovation in energy efficiency and the electricity savings achieved. These initiatives also guide and support energy specialists (or an energy manager) in their respective organizations or communities.

The School and Post-Secondary Education Program include 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.

FBC 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).

This program responds to meeting the adequacy requirements[9] 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 – 2027 DSM Plan has the following key updates:

- Digital Engagement Tool
- Heat Mapping

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

- Pay for Performance Model for Customer Engagement Tool
- Virtual Energy Audits
- Business Energy Reports

7.2 Program Budget

Exhibit 14 shows the annual incentive, non-incentive, and total expenditures for the Conservation Education and Outreach program by activity.

Exhibit 14 – Conservation Education and Outreach Expenditures by Activity ($000s)

Activity	Incentive Expenditures ($000s)						Non-Incentive Expenditures ($000s)						Total Expenditures ($000s)					
	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total
Residential Customer Engagement Tool	-	-	-	-	-	-	282	326	328	330	431	1,697	282	326	328	330	431	1,697
Residential Education Program	-	-	-	-	-	-	105	107	107	107	107	533	105	107	107	107	107	533
Commercial Education Program	-	-	-	-	-	-	86	93	95	95	95	464	86	93	95	95	95	464
School Education and Post-Secondary Program	-	-	-	-	-	-	51	55	55	58	58	277	51	55	55	58	58	277
Labour	-	-	-	-	-	-	373	373	373	373	373	1,865	373	373	373	373	373	1,865
Total ($000s)	**-**	**-**	**-**	**-**	**-**	**-**	**$897**	**$954**	**$958**	**$962**	**$1,064**	**$4,835**	**$897**	**$954**	**$958**	**$962**	**$1,064**	**$4,835**

8 Enabling Activities

Enabling Activities are initiatives that support and supplement FBC'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. 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 – 2027 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

The Trade Ally Network (TAN) includes the expenditures related to maintaining FBC's program partners. FBC relies on trade allies, such as contractors and distributors that provide the qualifying products and installations of energy efficiency measures. Through the TAN, FBC provides sponsorships for training and support for several initiatives for the building trades and electrical trade organizations[10]. This program also supports funding energy efficiency training, a specified demand-side measure outlined in the DSM Regulation Section 1[11].

The Codes and Standards budget finances FBC's support for codes and standards policy development and research, through in-kind and financial co-funding arrangements. A portion of the codes and standards funding is allocated to advancing the BC Energy Step Code as FBC supports the education and awareness of this new voluntary building standard. This includes support for high performance builder training, quality installation manuals, as well as energy modelling and blower door testing by certified energy advisors. FBC also works with and supports several international, national, and provincial entities, such as:

- CEATI International Inc.
- Consortium for Energy Efficiency
- Canadian Standards Association

[10] TECA (Thermal Environmental Comfort Association), BCEA (BC Electrical Association), HPSC (Home Performance Stakeholder Council), etc.

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

- Natural Resources Canada
- BC Ministry of Energy, Mines, and Low Carbon Innovation
- BC Building Safety & Standards Branch

to set new efficiency standards for buildings, HVAC equipment, appliances, and lighting products. Funding for codes and standards research is provided on a case-by-case basis.

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.

Codes and standards areas is in compliance with the DSM Regulation Section 3[12], 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 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 portal.

The Commercial Energy Specialist Program is a joint initiative between FBC and FEI that co-funds Energy Specialist, Analyst or Thermal Energy Manager positions in large commercial organizations. FBC provides up to $40,000 per year in an annual contract with the remaining $40,000 provided by FEI. The priority is to identify and implement energy efficiency upgrades for their organizations and to participate in FBC and FEI's DSM programs. They are also responsible to identify and implement non-program specific opportunities to use electricity and natural gas more efficiently. FBC considers this an energy management program, and hence a specified demand-side measure, as defined in Section 1 the DSM Regulation and subject to Section 4[13].

[12] 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

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

The **Community Energy Specialist Program** provides financial support to local municipal governments and regional districts, including Indigenous communities, and institutional customers to facilitate energy efficiency planning activities like the development of community energy plans, energy efficient design practices and organizational policies such as adopting advanced energy efficiency standards for the entities' own buildings. The planning must be targeted at reducing electricity usage and demand. FBC considers this an energy management program, and hence a specified demand-side measure, as defined in Section 1 the DSM Regulation and subject to Section 4[14].

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

8.1 Program Budget

Exhibit 15 shows the annual incentive, non-incentive, and total expenditures for the Enabling Activities broken down by initiative.

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

Exhibit 15 – Enabling Activities Expenditures by Activity ($000s)

Activity	Incentive Expenditures ($000s)						Non-Incentive Expenditures ($000s)						Total Expenditures ($000s)					
	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total
Trade Ally Network	-	-	-	-	-	133	166	184	147	152	152	801	166	184	147	152	152	801
Codes & Standards	176	251	365	474	616	1,882	247	254	268	255	287	1,311	422	505	633	729	903	3,192
Reporting Tool & Customer Application Portal	-	-	-	-	-	-	95	83	305	83	83	649	95	83	305	83	83	649
Commercial Energy Specialist Program	213	213	213	213	213	1,065	35	35	35	35	35	175	248	248	248	248	248	1,240
Community Energy Specialist Program	351	310	330	330	330	1,651	12	8	8	8	8	44	363	318	338	338	338	1,695
Customer Research	-	-	-	-	-	-	8	8	7	6	8	37	8	8	7	6	8	37
Labour	-	-	-	-	-	-	248	236	238	239	240	1,201	249	236	239	239	240	1,203
Total ($000s)	**739**	**774**	**908**	**1,017**	**1,159**	**4,598**	**811**	**807**	**1,008**	**777**	**813**	**4,216**	**1,550**	**1,580**	**$1,916**	**$1,794**	**$1,972**	**$8,811**

9 Innovative Technologies

Innovative Technologies funding supports the development of or increased use of technologies that can achieve significant energy use reductions. FBC supports feasibility studies, field studies, and pilots to validate customer acceptance and energy savings of innovative equipment and systems. Technologies that have potential are incorporated into DSM programs. Innovative technologies are a specified demand-side measure as defined in Section 1 of the DSM Regulation, which means that the program and the technologies are evaluated as part of the DSM portfolio[15].

As an example, in 2020, FBC funded a field study to assess the performance of cold climate heat pumps in partnership with Natural Resources Canada, BC Hydro, and EMLI. This study will be used to help increase adoption of heat pumps and improve energy savings assumptions for the technology.

For this DSM Plan, the major focus of the Innovative Technologies team and budget will be demand and capacity resources and a pilot project for deep retrofits.

Exhibit 16 shows the annual expenditures for the Innovative Technologies activities by expenditure type.

Exhibit 16 - Annual Innovative Technologies DSM Expenditures by Expenditure Type ($000s)

Expenditure Type	2023	2024	2025	2026	2027	Total
Incentive Costs	175	175	-	-	-	350
Non-Incentive Costs	225	410	150	200	150	1,135
Labour	85	89	94	98	102	468
Total ($000s)	**485**	**674**	**244**	**298**	**252**	**1,953**

[15] BC Utilities Commission Act, Demand-Side Measures Regulation (BC Reg. 326/2008) Section 4 amended March 24, 2017 technology innovation program

10 Demand Response

Demand response initiatives consist of interventions that focus on reducing peak demand impacts. In 2020, FBC completed the initial pilot phase of its Kelowna Demand Response (DR) program for large commercial and industrial customers that focussed on custom-dispatched DR. FBC is also currently running a residential demand response pilot in Kelowna, the "Peak Saver Pilot", that is expected to complete in early 2023. FBC plans to roll out permanent DR programs for both commercial and residential sectors.

The Residential Demand Response activities include completing the Peak Saver Pilot in early 2023 and expanding the automated DR offer to customers outside of the Kelowna area. Additional focus will be placed on incorporating demand response interventions for software-based electric vehicle (EV) charging and expanding the program to multi-unit residential buildings. The budget supports the DR platform licensing, program administration, marketing, and program incentives.

The Commercial and Industrial Demand Response activities including conducting the next phase of the commercial DR program, focusing on automated DR in 2023 and 2024, and adding industrial customers to the program. If successful, FBC would make the program permanent and expand to additional customers. The budget supports the DR platform licensing, program administration, marketing, and program incentives.

Exhibit 17 shows the incentive, non-incentive, and total expenditures for the Demand Response budget by program. Exhibit 18 shows the forecasted electricity demand savings and cost effectiveness expected from the DR programs.

Exhibit 17 – Demand Response Program Area Expenditures by Program ($000s)

Program Area	Incentive Expenditures ($000s)						Non-Incentive Expenditures ($000s)						Total Expenditures ($000s)					
	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total	2023	2024	2025	2026	2027	Total
Residential Demand Response	67	113	267	274	326	1,047	345	301	331	350	369	1,696	413	413	598	624	695	2,743
Commercial and Industrial Demand Response	-	-	70	110	157	337	31	26	243	262	281	843	31	26	312	372	438	1,179
Labour	-	-	-	-	-	-	330	346	363	378	395	1,812	330	346	363	378	395	1,812
Non-Program Specific Expenses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total ($000s)	**67**	**113**	**337**	**384**	**483**	**1,384**	**706**	**673**	**937**	**990**	**1045**	**4,351**	**773**	**785**	**1,273**	**1,375**	**1,528**	**5,736**

Exhibit 18 – Demand Response Demand Savings and Cost-Effectiveness by Program

Program Area	Net Forecasted Annual Demand Savings (MW)						NPV of Demand Savings ($000s)	TRC
	2023	2024	2025	2026	2027	Total		
Residential Demand Response	1.0	2.2	4.5	6.0	7.7	21.4	$3,100	1.1
Commercial and Industrial Demand Response	-	-	1.9	3.0	4.3	9.2	$1,300	0.8
Total	**1.0**	**2.2**	**6.4**	**9.0**	**12.0**	**30.6**	**$4,400**	**1.0**

11 Portfolio Level Activities

Portfolio level activities are required to properly plan and implement the proposed DSM programs and support efforts to meet the energy savings targets. Their expenses include provisions for planning and evaluation staff. These staff members perform DSM project due diligence, including savings verification, and oversee program evaluation studies; prepare long term DSM Plans and DSM Expenditure Plans; and undertake conservation potential and avoided costs studies.

In this DSM plan, there are evaluation, and portfolio level activities.

Evaluation studies are conducted to determine if FBC's DSM program objectives are being met and savings are being realized. Evaluation of energy efficiency programs provides internal and external accountability by reducing uncertainty in the estimates of energy and demand savings. Evaluation activities and studies are done in collaboration with FEI. The cumulative total for evaluation expenditures is $1.6 million. This represents 2.1% of this DSM plan's total expenditures.

Portfolio Level Activities reflects staff efforts to complete the forecasting and reporting of DSM activities and DSM studies which are completed on an ongoing basis to support the overall planning of DSM programs. These studies include the residential and commercial end use surveys, conservation potential review, and avoided cost studies.

Exhibit 19 shows the annual expenditures for DSM Studies, Evaluation, and Reporting portfolio activities.

Exhibit 19 - Annual Portfolio DSM Expenditures by Activity ($000s)

Activity	2023	2024	2025	2026	2027	Total
Evaluation	325	325	325	325	325	1,625
Portfolio Level Activities*	487	487	487	487	487	2,436
Total ($000s)	**813**	**813**	**813**	**813**	**813**	**4,063**

** 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 expenditure such as DSM support and portfolio level staff labour, some staff training and conferences, facilities and equipment, some industry association memberships, regulatory work and EECAG[16] activities.*

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

12 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 substantial cost-effective opportunities for energy efficiency within the FBC service territory. This remaining opportunity reflects, in part, how the continued technology cost and performance improvements have increased the availability of energy-efficiency options.

Overall, the portfolio of programs contained in the DSM Plan provide a TRC value of 1.3, a UCT value of 1.8, and a Levelized Cost of Electricity (LCOE) of $0.06 / kWh. The demand response programs are expected to save an estimated 62 MW of electricity demand over the DSM plan period.

13 Detailed Benefit-Cost Ratios

Exhibit 20 presents detailed benefit-cost ratios and the Levelized Cost of Electricity (LCOE) for the 2023 – 2027 DSM Plan at the program, program area, and portfolio levels.

Exhibit 20 – Benefit-Cost Ratios and Levelized Cost of Electricity by Portfolio, Program, and Program Area

	TRC	mTRC	UCT	PCT	RIM	LCOE $/kWh
OVERALL PORTFOLIO	**1.3**	**1.4**	**1.8**	**3.2**	**0.5**	**$0.06**
Residential						
Home Renovation	1.6	1.8	2.5	4.1	0.5	$0.05
New Home	1.0	1.1	1.6	2.9	0.5	$0.08
Residential Program Area	**1.4**	**1.6**	**2.3**	**3.9**	**0.5**	**$0.06**
Commercial						
Prescriptive	1.7	2.0	4.0	2.8	0.8	$0.03
Performance	1.1	1.3	2.9	2.7	0.6	$0.04
Rental Apartment	0.4	0.4	0.3		0.2	$0.34
Commercial Program Area	**1.4**	**1.6**	**3.3**	**2.8**	**0.7**	**$0.03**
Industrial						
Prescriptive	2.6	3.0	5.8	3.0	1.1	$0.02
Performance	1.5	1.7	1.6	3.2	0.6	$0.06
Strategic Energy Management	1.0	1.2	1.5	2.1	0.5	$0.07
Industrial Program Area	**2.1**	**2.4**	**3.4**	**3.0**	**0.8**	**$0.03**
Low Income						
Self Install	3.2	3.6	2.3	7.7	0.6	$0.04
Direct Install	0.7	0.9	0.5	2.5	0.3	$0.19
Prescriptive	1.3	1.4	1.0	2.7	0.4	$0.11
Performance	1.6	1.9	0.9	5.2	0.3	$0.13
Low Income Program Area	**1.2**	**1.3**	**0.9**	**3.0**	**0.4**	**$0.13**

Appendix B
FBC 2021 DSM ANNUAL REPORT

Diane Roy
Vice President, Regulatory Affairs

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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 Inc. (FBC)
Electricity Demand-Side Management (DSM) – 2021 Annual Report

Attached please find the Electricity DSM Program 2021 Annual Report for FBC (the Annual Report).

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

Sincerely,

FORTISBC INC.

Original signed:

Diane Roy

Attachment

FortisBC Inc.

Electricity
Demand-Side Management Programs
2021 Annual Report

March 31, 2022

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List of Appendices

Index of Tables and Figures

1. REPORT OVERVIEW

This Demand-Side Management (DSM) Annual Report (the Report) provides highlights of FortisBC Inc.'s (FBC or the Company) DSM programs for the year ended December 31, 2021 and provides a summary of results achieved in 2021. The Report reviews the progress of FBC's DSM programs in meeting the approved 2019-2022 DSM Plan[1] (Plan) by educating and incenting FBC's customers to conserve energy and improve the energy efficiency of their homes, buildings and businesses.

Section 1.1 contains a statement of financial results (Table 1-1); including the Total Resource Cost (TRC) benefit/cost ratio cost-effectiveness test results by Program Area for 2021. Section 1.2 sets out how FBC's DSM programs met the requirements of the British Columbia Demand-Side Measures Regulation (DSM Regulation) enacted under the Utilities Commission Act (UCA). Sections 2 through 9 of the Report provide an overview of DSM program activities in 2021 by Program Area, including program-level comparisons of actual energy savings and costs to Plan.

Consistent with previous DSM annual reports, additional details on 2021 program results, cost-effectiveness test results and levelized costs, as well as historical DSM program costs and energy savings are included in Appendix A-1 and Appendix A-2, respectively.

Throughout the Report, any difference in the totals between the DSM Portfolio Overview and Program Area tables are due to rounding. Where "zero" values occur, they may be a reflection of rounding to the nearest $000 expenditure level when expenditures were under $500.

1.1 *PORTFOLIO LEVEL RESULTS*

Table 1-1 provides an overview of FBC's 2021 energy savings, expenditures and TRC cost-effectiveness test results for all DSM programs, by Program Area and at the portfolio level. FBC achieved an overall portfolio TRC of 1.5 on DSM expenditures of $12.7 million, an increase of $2.5 million over 2020. Electricity savings totalled 29.7 GWh, an increase of 3.4 GWh compared to 2020. All of FBC's DSM programs passed the TRC test at the Program Area-level.

[1] 2019-2022 DSM Plan expenditures were accepted by the Commission pursuant to Order G-47-19.

Table 1-1: DSM Portfolio Summary Results for 2021

Program Area (Sector)	2021 Plan Savings (kWh)	2021 Actual Savings (kWh)	2021 Plan Including Carryover ($000s)	2021 Actual ($000s)	Benefit / Cost TRC
Residential	5,951,085	7,895,902	$ 2,519	$ 2,896	1.9
Low Income	1,216,882	734,623	$ 954	$ 842	1.3
Commercial	15,290,514	12,321,921	$ 3,277	$ 3,497	1.4
Industrial	10,113,556	8,700,452	$ 2,087	$ 2,653	2.3
Education and Outreach	-	-	$ 595	$ 599	-
Supporting Initiatives	-	-	$ 1,373	$ 1,093	-
Portfolio	-	-	$ 1,033	$ 793	-
Demand Response	-	-	$ 451	$ 311	-
Total	**32,572,038**	**29,652,898**	**$ 12,289**	**$ 12,683**	**1.5**

FBC's actual 2021 DSM expenditures were 103 percent of 2021 Plan including carryover and the DSM energy savings were 91 percent of Plan. While savings exceeded plan in the Residential program area, they were lower than expected in the Low Income, Commercial and Industrial areas.

1.2 *MEETING ADEQUACY REQUIREMENTS*

The 2019-2022 DSM Plan complies with the adequacy requirements of the DSM Regulation, including the most recent amendments that came into effect on March 24, 2017. The DSM Regulation adequacy requirements 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 either (i) assist residents of low-income households to reduce their energy consumption, or (ii) reduce energy consumption in housing owned or operated by a local government, specified societies and associations, or a governing body of a first nation, if the benefits of the reduction primarily accrue to low-income households occupying the housing, the prescribed housing providers or the first nation governing body if the households in its housing are primarily low-income;
>
> b) 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) 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; and

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.

In later sections of the Report, FBC provides further details on how its 2021 DSM activities meet these adequacy requirements. Section 3 of the Report discusses programs and incentives for low-income customers, including Energy Savings Kits (ESK), the Energy Conservation Assistance Program (ECAP) and the Non-Profit Custom Program. With regards to rental apartment buildings, FBC's offers include the Rental Apartment Efficiency Program (RAP), detailed in Section 2.5. Tenants can also access ECAP and ESK offers available to qualifying rental properties.

FBC funded a variety of initiatives for K-12 students, including Energy Leaders, Energy is Awesome and Energy Champions. Work to support virtual learning during the Covid-19 pandemic, including translating Energy Leaders lessons into French, was completed in 2021. In collaboration with FEI, FBC also funded post-secondary student education initiatives (UBC Okanagan research chair and the UBC Okanagan and Okanagan College Green Construction Research and Training Centre's Wilden Living Lab 2 project).

FBC provided resources indicated by clause (e) for Codes and Standards (Section 7.5), which are fulfilled through third party funding arrangements. A total of $109 thousand was invested, which represents 1 percent of the overall Plan for 2021.

FBC supported BC Energy Step Code (the "Step Code") adoption through its New Home Program (Section 2.3) and provided progressive rebates to align with the Step Code. It also provided funding for Community Energy Specialists to support energy conservation behaviour campaigns (organizational and community-based) and to promote the Step Code to municipal building inspection staff and local builders and developers (Section 7.3).

1.3 *FUNDING TRANSFERS AND CARRYOVER*

The BCUC Decision and Order G-47-19 on FBC's 2019-2022 DSM Plan filing continues the practice of funding transfers between Program Areas and furthermore allows the Company to carry over unspent Plan amounts to the subsequent fiscal year.

The practice of transferring expenditure amounts within FBC'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 FBC 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.

Carryover refers to any approved Program Area expenditure amount that was not spent in a given year (after accounting for funding transfers between Program Areas) and can therefore be carried over to the following year(s) within the approved DSM Plan time frame. These amounts are 'carried over' into the next years' annual approved spending limit. The ability to carry funds over from one year to the next also provides flexibility for FBC to manage uncertainties and external factors that can impact program development and delivery – in this case by making unspent expenditure amounts from the reporting year available to benefit customers in the following Plan years.

Order G-47-19 directs FBC "to continue filing DSM annual reports with the BCUC in the manner and form of previous years, but to also include information that clearly identifies all funding transfers that occur between Program Areas within a year, and the amounts to be rolled over to the following year for each Program Area". Furthermore, "[Only] In cases where a proposed transfer into or out of an approved Program Area is greater than twenty five percent of that Program Area's accepted expenditures for the year in question, prior BCUC approval is required."

The following Table 1-2 shows the 2021 funding transfers between Program Areas and carryover expenditure amounts available by Program Areas for 2022. FBC notes that all funding transfers completed in 2021 were within the prescribed 25 percent of Program Area Plan threshold. All carryover amounts from 2019 and 2020 were used prior to utilizing funding transfers from other Program Areas.

Table 1-2: 2021 DSM Funding Transfers and Carryover Amounts ($000s)

A	B	C	D	E	F	G	H	I
Program Area (Sector)	2021 Plan as Filed	Carried Over from 2020 Underspend	2021 Transfers Between Program Areas	2021 Plan after Carryover and Transfers	2021 Actual	Variance (F-E)	Plan Amount Carried Over to 2022	Transfer as a percent of Plan as Filed D/B
Residential	2,519	-	236	2,755	2,896	141	(141)	9%
Low Income	899	55	(112)	842	842	-	-	-12%
Commercial	3,052	225	100	3,377	3,497	119	(119)	3%
Industrial	1,813	274	300	2,387	2,653	265	(265)	17%
CEO	595	-	4	599	599	-	-	1%
Supporting Initiatives	1,024	349	(256)	1,117	1,093	(24)	24	-25%
Portfolio	1,019	14	(240)	793	793	-	-	-24%
Demand Response	130	321	(33)	419	311	(108)	108	-25%
Total	**11,051**	**1,238**	**-**	**12,289**	**12,683**	**394**	**(394)**	**-**

Table 1-2 identifies a total expenditure of $394 thousand above the approved amount for 2021. However, both the Supporting Initiatives and Demand Response Program Areas had additional carryover totalling $132 thousand ($24 thousand and $108 thousand, respectively) after the 25 percent inter-program transfer limit that will be used to support program activities in those areas in 2022. Thus, after inter-program transfers, FBC has an over expenditure in the Residential, Commercial, and Industrial Program Areas totalling $526 thousand ($141 thousand, $119 thousand, and $265 thousand, respectively).

FBC did not anticipate exceedances in the Residential, Commercial, and Industrial Program Areas prior to year-end. The Program Area summary sections of the Report explain the reason for unanticipated exceedances. As such, in Table 1-3 below, FBC has allocated negative dollar amounts totalling $526 thousand to three Program Areas (Residential, Commercial, and Industrial) to be carried over into 2022, reducing spending in those areas. FBC is requesting approval to carry forward these negative amounts to the final year of the 2019-2022 DSM Plan period as part of a separate application filed concurrently with the Report.

Table 1-3: 2022 DSM Budget Including Carryover Amounts

Program Area (Sector)	2022 Plan ($000s)	2021 Carryover ($000s)	2022 Budget incl. Carryover ($000s)
Residential	$ 2,795	$ (141)	$ 2,654
Low Income	$ 930	$ -	$ 930
Commercial	$ 3,047	$ (119)	$ 2,927
Industrial	$ 1,815	$ (265)	$ 1,549
CEO	$ 666	$ -	$ 666
Supporting Initiatives	$ 1,044	$ 24	$ 1,069
Portfolio	$ 956	$ -	$ 956
Demand Response	$ 133	$ 108	$ 240
Total	**$ 11,385**	**$ (394)**	**$ 10,991**

1.4 *COLLABORATION & INTEGRATION*

FBC continues to collaborate and integrate DSM programming among BC's large 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.

FBC, FortisBC Energy Inc. (FEI), and BC Hydro and Power Authority (BC Hydro) (collectively, 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.

FBC, FEI and the British Columbia Ministry of Energy, Mines and Low Carbon Innovation (EMLI)[2], continued to collaborate in 2021. FBC's collaboration with EMLI on CleanBC initiatives includes administering incentives and enabling applications for CleanBC rebates through FBC's application processes to provide a streamlined customer experience.

Although collaborative activities are captured in Program Area sections, the tables contained throughout the Report include only expenditure and savings information for FBC's expenditure portfolio.

1.5 *PORTFOLIO SUMMARY*

FBC's DSM portfolio met the goal of cost effectiveness, with a portfolio level TRC Benefit/Cost ratio of 1.5 in 2021. FBC believes that both energy savings accounted for in the portfolio and the resulting TRC are conservative, thus likely understated.

In addition to the direct energy benefits accounted for in the TRC, benefits from additional activities, such as CEO and Supporting Initiatives, play an important role in supporting the development and delivery of programs, while helping facilitate market transformation in British Columbia.

[2] Formerly known as the Ministry of Energy, Mines and Petroleum Resources (MEMPR).

2. RESIDENTIAL PROGRAM AREA

2.1 *OVERVIEW*

The Residential Program Area achieved aggregate electricity savings of 7.9 GWh, a 9 percent increase over 2020, and an overall TRC of 1.9. Approximately $2.9 million was invested in Residential energy efficiency programs in 2021, compared to $2.3 million in 2020, and 79 percent of those expenditures were incentives to customers. The energy savings achieved from Residential programs were 133 percent of Plan.

The Residential Program Area predominantly includes residential customers living in detached dwellings, townhomes, mobile homes, and rental apartments. Program offers include retrofit and new home applications. Residential programs, in combination with education and outreach activities, play an important role in driving the culture of conservation in British Columbia.

Table 2-1 summarizes the actual expenditures for the Residential Program Area in 2021 compared to Plan, including incentive and non-incentive spending, and annual electric savings.

Table 2-1: 2021 Residential Program Area Results Summary

Program	Savings (kWh)		Plan ($000s)	Actual Expenditures ($000s)		
	Plan	Actual	Total	Total	Incentive	Non-Incentive
Home Renovation	4,267,137	4,083,454	$ 1,505	$ 1,654	$ 1,644	$ 9
New Home	570,530	350,798	$ 308	$ 422	$ 389	$ 33
Lighting	965,225	3,428,272	$ 137	$ 219	$ 209	$ 10
Rental Apartment	148,193	33,379	$ 54	$ 59	$ 44	$ 15
Labour and Expenses	-	-	$ 515	$ 542	-	$ 542
Total	**5,951,085**	**7,895,902**	**$ 2,519**	**$ 2,896**	**$ 2,287**	**$ 608**

2.2 *HOME RENOVATION*

The Home Renovation Rebate (HRR) 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 EMLI's CleanBC Better Homes program.

Notable highlights for the year include:

- 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. Heat pump water heater availability to consumers continued

to be challenging due to a limited supply chain and shortage of experienced contractors in the Kelowna area.

- Point-of-sale retail rebates were also captured under the HRR Program Area. This included a comprehensive suite of measures including weatherization, water savers, communicating thermostats and bathroom fans. Lighting measures were also included in this campaign and are described in Section 2.4.

- FBC and program partners continue to support the evolving Home Performance industry through trades outreach, training, development of program registered 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 Section 7.4 Enabling Activities, Trade Ally Network (TAN).

2.3 *NEW HOME*

FBC's new home incentives 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 the BC Utilities' ability to provide incentives for builders who adopt and comply with the Energy Step Code in municipalities across BC.

The New Home Program saw participants grow at the top tiers of the BC Energy Step Code as well as further uptake of appliance incentives. FBC continues to collaborate with FEI, BC Hydro, EMLI, and BC Housing to provide education to builders and energy advisors, and support policy regarding the construction of High Performance Homes in BC.

As part of FBC's COVID-19 Recovery Support Plan, the New Home program provided enhanced incentives that 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.

2.4 *RESIDENTIAL LIGHTING*

Two successful retail campaigns ran in spring and fall, offering point-of-sale rebates for lighting and other qualifying retails products. The combined initiatives resulted in exceeding planned savings by 255 percent and expenditures by 60 percent. Continued revisions of program design, with an earlier campaign launch in the spring, resulted in robust participation in point-of-sale rebates for LED lightbulbs, fixtures, and lighting controls.

2.5 *RENTAL APARTMENT*

There are three components to the RAP:

1. To provide direct install in-suite energy efficiency measures for occupants (renters) in multi-family rental properties;

2. To provide rental building owners and/or property management companies with energy assessments recommending building level energy efficiency upgrades, such as common area lighting upgrades; and

3. To provide support in implementing the recommended upgrades and applying for rebates.

The program is offered jointly by FEI and FBC in the shared service territory (SST)[3] and by FEI outside the SST. Participation in 2021 was lower than anticipated due to the ongoing impacts of the COVID-19 pandemic.

2.6 *SELECTED HIGHLIGHTS*

The Residential Program Area realized 7.9 GWh of energy savings with actual expenditures of $2.9 million, and achieved a TRC of 1.9. In 2021, the Home Renovation and Lighting programs provided the majority of energy savings results to the Residential Program Area.

FBC's Residential programs enabled customers to upgrade lighting and appliances, and to capture ongoing energy savings. The combination of financial incentives, policy support, contractor outreach, and education is instrumental to the success of these programs in generating energy savings and fostering market transformation in the residential sector.

[3] The Shared Service Territory is the overlapping service territories of FBC and FEI where both natural gas and electricity are supplied.

3. LOW INCOME PROGRAM AREA

3.1 OVERVIEW

FBC worked collaboratively with FEI and BC Hydro to deliver programs to Low Income customers, including Indigenous communities, non-profit housing providers and charities serving low income families and individuals. In 2021, FBC invested $842 thousand, an increase from the $818 thousand invested in 2020, and achieved 0.7 GWh in energy savings. The TRC achieved for 2021 was 1.3.

Table 3-1 summarizes the Plan and actual expenditures for the Low Income Program Area.

Table 3-1: 2021 Low Income Program Results Summary

Program	Savings (kWh)		Plan ($000s)	Actual Expenditures ($000s)		
	Plan	Actual	Total	Total	Incentive	Non-Incentive
Self Install (ESK)	249,401	93,119	$ 74	$ 41	$ 35	$ 6
Direct Install (ECAP)	872,107	377,345	$ 705	$ 413	$ 289	$ 124
Social Housing Support	95,374	264,159	$ 52	$ 195	$ 190	$ 5
Labour and expenses	-	-	$ 67	$ 193	$ -	$ 193
Total	**1,216,882**	**734,623**	**$ 899**	**$ 842**	**$ 513**	**$ 329**
Plan including 2020 carryover of $55			**$ 954**			

3.2 SELF INSTALL

The Self Install Program is a program whereby low income participants receive an ESK that includes energy saving measures along with an instruction booklet and directions to access online "How To" videos. All measures are easy-to-install measures that participants install themselves. The Self Install program is a partnership program with FEI.

The Self Install Program achieved 55 percent of Plan expenditures and 37 percent of Plan savings. In addition to the kits that were delivered to customers, expenditures were driven by ongoing promotional activities and investment in measure inventory. The Self Install Program was promoted through on-line digital promotions, bill inserts and customer contract centre referrals. FBC also continued its partnership with the Ministry of Social Development and Social Innovation to promote ESKs to their clientele. In 2021, FBC saw a decline in participation despite the completion of promotional activities consistent with prior years. This decline may be attributed to shifting customer priorities as a result of the ongoing COVID-19 pandemic, extreme weather events, or to the competing offers in market which saw higher incentives offered for various measures.

3.3 DIRECT INSTALL

The Direct Install Program is a program whereby low income participants receive an in-home visit from a program contractor to install basic measures (e.g. LED lighting, high efficiency showerheads, etc.) and provide customized energy efficiency coaching. Additionally, some participants also qualify to receive more robust measures such as fridges and insulation. Partners in the Direct Install Program include FEI and BC Hydro.

The Direct Install Program achieved 59 percent of Plan expenditures and 43 percent of Plan savings. Expenditures were driven by ongoing investment in program development and program promotion and outreach. The Direct Install Program was promoted to low income customers through one-to-one outreach efforts, partner referrals, customer contact centre referrals, and through direct mail to past participants of the Self Install Program. In 2021, the COVID-19 pandemic impeded the Direct Install Program. Safety protocols, designed to keep customers and contractors safe, impacted outreach efforts and placed limits on performing installations in customers' homes. Extreme weather events also negatively impacted the program.

3.4 SOCIAL HOUSING SUPPORT

This Program Area currently encompasses:

- Rebates for commercial measures, funding for energy studies, and implementation support for non-profit housing providers and charities;
- Rebates for residential measures and funding for enabling measures, including offers targeted to Indigenous communities through the Indigenous Communities Conservation Program (ICCP) and the Indigenous Communities New Home Program (ICNHP); and
- Energy efficiency training for people facing barriers to employment through the Residential Energy Efficiency Works (REnEW) initiative, a collaborative effort with FEI.

The Social Housing Support Program achieved 372 percent of Plan expenditures and 277 percent of Plan savings. The expenditures exceeded the savings in part due to the higher installation rates of enabling measures. In 2021, the Social Housing Support Program far surpassed Plan expenditures and savings, largely due to the sustained uptake of offers by Indigenous communities. The Social Housing Support Program was primarily promoted through one-to-one outreach efforts and partner referrals.

3.5 SELECTED HIGHLIGHTS

Overall, 2021 was a difficult year to achieve the participation goals of FBC's Low Income Program Area. Both the Self Install and Direct Install Programs were hindered by the COVID-19 pandemic and extreme weather events. These programs typically account for a larger portion of the Low Income Program Area expenditures and savings. FBC continued to invest in development work and maintaining both the Self Install and Direct Install Programs in market for continuity purposes. For example, within the Direct Install Program, FBC invested in developing more robust

measures, such as draftproofing and insulation for customers living in manufactured/mobile homes. On a positive note, the performance of the Social Housing Support Program indicates the continued successful uptake of offers by Indigenous communities which helped to offset the shortfall in the other Program Areas.

4. COMMERCIAL PROGRAM AREA

4.1 OVERVIEW

Commercial DSM programs encourage commercial customers, including institutions and government, to reduce overall consumption of electricity and associated energy costs. The Commercial programs produced aggregate electricity savings of 12.3 GWh, compared to 11.1 GWh in 2020, and achieved an overall TRC of 1.4 in 2021. Commercial program expenditures totalled $3.5 million, of which 79 percent was in the form of incentives.

Table 4-1 summarizes Plan and actual expenditures for the Commercial programs, including incentive and non-incentive spending, and annual energy savings achieved.

Table 4-1: 2021 Commercial Program Results Summary

Program	Savings (kWh)		Plan ($000s)	Actual Expenditures ($000s)		
	Plan	Actual	Total	Total	Incentive	Non-Incentive
Commercial Custom	6,048,000	5,215,201	$ 1,006	$ 1,081	$ 1,068	$ 13
Commercial Prescriptive	9,242,514	7,106,720	$ 1,177	$ 1,767	$ 1,701	$ 66
Labour and expenses	-	-	$ 869	$ 649	$ -	$ 649
Total	**15,290,514**	**12,321,921**	**$ 3,052**	**$ 3,497**	**$ 2,769**	**$ 728**
Plan including 2020 carryover of $225			**$ 3,277**			

4.2 CUSTOM PROGRAM

FBC and FEI provide incentives to encourage participants to pursue a performance based approach to achieve electricity savings in new and existing commercial 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. For new buildings, FBC and FEI offered custom program pathways for support of both BC Energy Step Code-aligned buildings and non-aligned buildings.

FBC, FEI, and BC Hydro jointly operate the Continuous Optimization recommissioning offer, which identifies building operational improvements. FBC and FEI also completed the pilot recommissioning offer in the FBC service territory with 13 participants. The pilot was used to inform updates to the Continuous Optimization offer.

4.3 PRESCRIPTIVE PROGRAM

This program provides rebates for the installation of high efficiency electric equipment in various applications including lighting, space heating, commercial kitchen, commercial laundry and refrigeration. Simple rebates are provided for equipment that meets specific performance standards, as opposed to the Custom Program, which requires more detailed analysis of measures as installed. The program makes use of midstream and downstream rebate delivery

approaches, as warranted by the specifics of each appliance type and the market it is intended to serve.

The Commercial Prescriptive Program increased its incentive expenditures compared to 2020 primarily due to enhanced rebate offers in the form of FBC's COVID-19 recovery offers to support commercial customers in an economic downturn. The increased rebates were offered for a limited time and ended on December 31, 2021.

4.4 *SELECTED HIGHLIGHTS*

The Commercial Program Area activity in 2021 resulted in 12.3 GWh of electricity savings. These programs enabled commercial and institutional customers to conduct both simple and comprehensive energy efficiency upgrades at their buildings.

FEI and FBC launched a limited time COVID-19 recovery offer to both Prescriptive and Custom Programs to encourage customers to invest in energy efficiency during 2021's challenging economic climate. The limited-time COVID-19 recovery offers for both programs expired in 2021. The COVID-19 recovery offer has yielded increased participation in the Prescriptive Program and has identified additional retrofit opportunities in the Custom Program that were implemented in 2021 and will continue to be implemented into 2022. As a result, FBC experienced an increase in total incentive expenditure and savings at the Commercial portfolio level compared to 2020.

5. INDUSTRIAL PROGRAM AREA

5.1 OVERVIEW

The Industrial DSM programs continued to encourage industrial customers to consume electricity more efficiently. The Industrial programs achieved an overall TRC of 2.3, with electricity savings of 8.7 GWh, 1.8 GWh more than 2020 savings. Actual Industrial expenditures in 2021 totalled $2.7 million, compared to $1.8 million in 2020, of which 87 percent were incentives.

Table 5-1 summarizes the Plan and actual expenditures for the Industrial Program Area in 2021, including incentive and non-incentive spending, and annual electricity savings.

Table 5-1: 2021 Industrial Program Results Summary

Program	Savings (kWh)		Plan ($000s)	Actual Expenditures ($000s)		
	Plan	Actual	Total	Total	Incentive	Non-Incentive
Industrial Custom	8,226,000	4,828,760	$ 1,308	$ 1,841	$ 1,833	$ 9
Industrial Prescriptive	1,887,556	3,871,692	$ 311	$ 487	$ 466	$ 21
Labour and expenses	-	-	$ 195	$ 324	$ -	$ 324
Total	**10,113,556**	**8,700,452**	**$ 1,813**	**$ 2,653**	**$ 2,299**	**$ 354**
Plan including 2020 carryover of $274			**$ 2,087**			

The Industrial Program Area is characterized by large intermittent projects that generally occur less frequently and take much longer to complete, so the realization of energy savings may shift to the following year(s).

5.2 CUSTOM PROGRAM

This program provides incentives to encourage participants to pursue a performance-based approach to achieve electricity savings in new and existing industrial facilities. 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 Industrial Custom Program increased its incentive expenditures compared to 2020 primarily due to enhanced rebate offers in the form of FBC's COVID-19 recovery offers to support industrial customers in an economic downturn. The increased rebates were offered for a limited time and ended on December 31, 2021. FBC is currently conducting a pilot that extends the FEI Strategic Energy Management cohort offer to seven customers in the FBC service territory. The FBC Strategic Energy Management cohort pilot activities are expected to be complete by May 2023. At that point, FBC will assess the results to determine if the pilot can be transitioned into a program.

5.3 PRESCRIPTIVE PROGRAM

This program provides rebates for the installation of high efficiency electric equipment in various applications including lighting, space heating, irrigation, variable speed drives and certain compressed air equipment. Simple rebates are provided for equipment that meets specific performance standards, as opposed to the Custom Program, which requires more detailed analysis of measures as installed. The program makes use of midstream and downstream rebate delivery approaches, as warranted by the specifics of each appliance type and the market it is intended to serve.

In 2021, a prescriptive rebate for horticultural LED lighting was developed to address the increasing demand for indoor agricultural LED lighting projects, specifically for the cannabis and traditional greenhouse sectors. This new prescriptive rebate offer launched in January 2022.

5.4 SELECTED HIGHLIGHTS

Industrial Energy Efficiency Program Area activity in 2021 resulted in 8.7 GWh/year of electricity savings. These programs enabled industrial customers to conduct both simple and comprehensive energy efficiency upgrades at their buildings. Due to FBC seeing a significant increase in indoor agricultural LED lighting projects for both cannabis and traditional greenhouse applications, FBC developed a prescriptive rebate for indoor agricultural LED lighting projects that launched in January 2022.

FEI and FBC launched limited time COVID-19 recovery offers to encourage customers to invest in energy efficiency during 2021's challenging economic climate. The limited-time COVID-19 recovery offers expired in 2021. The COVID-19 recovery offer has helped additional retrofit opportunities to be identified and implemented in the Custom Program by FBC's industrial customers.

6. CONSERVATION EDUCATION AND OUTREACH

6.1 *OVERVIEW*

The Conservation Education and Outreach (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 (who are future customers), remains a strong priority. FBC is continuing to ensure steps are taken to make the information provided relevant and timely.

FBC continued its collaboration with FEI in 2021 to maximize efficiencies across both utilities. Costs continue to be shared on school, residential, and commercial outreach, as applicable.

Actual expenditures were 101 percent of Plan and are summarized below in Table 6-1.

Table 6-1: 2021 Conservation and Outreach Results Summary

Program	Plan ($000s)	Actual ($000s)
Residential Education Program	$ 229	$ 134
Residential Customer Engagement Tool	$ 264	$ 179
Commercial Education Program	$ 29	$ 160
School Education Program	$ 72	$ 127
Total	**$ 595**	**$ 599**

6.2 *RESIDENTIAL EDUCATION*

FBC continued with its “We’ve got rebates” general marketing campaign throughout the heating season, which continued to raise awareness of its rebate programs. FBC and FEI continued to enhance the municipal landing page to further support municipalities’ efforts to promote FBC and FEI rebates and behavioural changes to promote energy conservation. FBC engaged residential customers and promoted energy conservation though activities such as Fresh Air Cinema Events and outreach at South Okanagan food banks. Due to the COVID-19 pandemic, FBC paused its home show outreach activities and reduced its general advertising. As a result, the Residential Education Program’s expenditures were lower than originally budgeted.

6.3 *RESIDENTIAL CUSTOMER ENGAGEMENT TOOL*

My Energy Use is an enhancement to Account Online to provide customers better understanding of their home’s energy use. The tool was launched for FBC electric customers in June 2021. Through the My Energy Use portal, customers can receive personalized insights into their individual home energy use and earn incentives for participating in energy-savings activities. FBC

is then able to use the data collected to enhance program recruitment. In addition to the portal, FBC mailed home energy reports four times to approximately 12,000 electric 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 recommendations.

Lower than anticipated expenditures can be primarily attributed to the program launching later in the year than expected, resulting in fewer than anticipated reports being sent out and lower than anticipated customer incentives being provided.

6.4 *COMMERCIAL EDUCATION*

The eighth annual Efficiency in Action awards were held virtually and delivered jointly by FEI and FBC. These awards recognize FEI and FBC commercial customers that have most effectively used C&EM programs and achieved natural gas and electricity energy savings.

CEO continued to provide information to customers and the public on electricity conservation and energy literacy. In collaboration with FEI, FBC funded 335 small to medium-sized business energy assessments in interior BC communities serviced by FBC. Customers received advice on saving energy and were informed of rebates on high-efficiency upgrades. With evolving COVID-19 pandemic restrictions, FBC worked with its vendor to deliver the program both virtually and in-person to ensure continued support to the business community. Customers were enrolled in the program through the customer contact centre and by outbound calling by the vendor.

FBC's commercial education program partnership with FEI and BC Hydro continued in 2021. This included collaboration on the Energy Wise Network Program, which helps engage workplaces to save energy through training, peer networking, campaign toolkits, and energy coaching.

Expenditures were higher than planned to drive program participation and awareness of Commercial rebate programs with emphasis on small to medium-sized businesses.

6.5 *SCHOOL EDUCATION*

FBC's Energy Leaders initiative offers curriculum-connected lesson plans for grades K-12. 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 learn about the Energy Leaders lesson materials.

To further support teachers during the pandemic, the BC Lions Energy Champions and FBC's Energy is Awesome programs were delivered virtually.

For students enrolled in post-secondary institutions, FBC continued to deliver virtual presentations. This presentation speaks to demand side management policies and programs in

British Columbia, as well as employment opportunities within the energy management area. Additionally, FBC co-sponsored a UBC Okanagan research chair to explore building energy efficiency.

Expenditures were higher than planned to reflect the additional development work completed to support teachers, parents and students during the pandemic.

6.6 *CEO HIGHLIGHTS*

FBC continued its collaboration with FEI in 2021 to maximize efficiencies across both utilities. Costs continue to be shared on school, residential and commercial outreach, as applicable. The Commercial, Residential, and School Education Programs are not incentive-based programs and therefore FBC does not attribute direct savings to them. CEO expenditures are included at the Portfolio level and incorporated into the overall DSM Portfolio cost-effectiveness results.

The initiatives described in CEO are designed to foster a culture of energy conservation through activities and messaging that promotes overall conservation awareness, support energy efficiency literacy, and help increase program participation.

7. SUPPORTING INITIATIVES

7.1 OVERVIEW

Supporting Initiatives support the goals of conservation and energy management in a variety of ways, from co-funding Energy Specialist positions, to promoting energy conservation at community events.

The majority of Supporting Initiative activities are comprised of non-incentive based programs (with the exception of the Commercial and Community Energy Specialist Programs), therefore FBC has not attributed any direct savings to them. Supporting Initiatives costs are included at the portfolio level and incorporated into the overall portfolio cost-effectiveness results. Non-Program Area specific costs, such as office expenditures and tracking system expenses, are also reported herein.

Actual expenditures were 98 percent of Plan and are summarized below in Table 7-1.

Table 7-1: 2021 Supporting Initiatives Results Summary

Program	Plan ($000s)	Actual Expenditures ($000s)		
	Total	Total	Incentive	Non-Incentive
Commercial Energy Specialist	$ 62	$ 173	$ 173	$ -
Community Energy Specialist	$ 260	$ 224	$ 224	$ -
Trade Ally Network	$ 208	$ 119	$ -	$ 119
Codes and Standards	$ 122	$ 109	$ -	$ 109
Reporting Tool & Customer Portal	$ 64	$ 153	$ -	$ 153
Labour and Expenses	$ 308	$ 315	$ -	$ 315
Total	**$ 1,024**	**$ 1,093**	**$ 397**	**$ 695**
Plan including 2020 carryover of $349	**$ 1,373**			

7.2 COMMERCIAL ENERGY SPECIALIST PROGRAM

The Commercial Energy Specialist Program is a joint initiative between FBC and FEI that co-funds Energy Specialist positions in large commercial organizations, including institutional and local government customers. FBC provides up to $40 thousand per year in an annual contract, with a matching amount provided by FEI for Energy Specialist, Energy Analyst or a Thermal Energy Manager positions.

The key priorities of these positions are to identify and implement opportunities for their organization to participate in FBC's and FEI's DSM programs, while also identifying and implementing non-program specific opportunities to use electricity and natural gas more efficiently. There were seven participants in the SST in 2021. FBC considers this an energy management program, and a specified demand-side measure, as defined in the DSM Regulation.

This program is funded as an enabling activity but claims energy savings for any project completed by Energy Specialists that are not claimed by another FBC DSM program. There were no additional verified savings for 2021 beyond those already accounted for in other DSM programs.

The 2021 program expenditures were higher than forecast due to more positions being funded at more organizations than anticipated in the Plan.

7.3 *COMMUNITY ENERGY SPECIALIST PROGRAM*

The Community Energy Specialist Program funds positions in local municipal governments and regional districts to facilitate energy efficiency planning activities. These activities include:

- Coordinating development of community energy plans;
- Developing and promoting community-level energy policies;
- Marketing initiatives to promote conservation and efficiency at the community level; and
- Adopting energy efficient design practices and policies in government and regional districts buildings.

There were five participants in the SST in 2021, including a participant from the Okanagan Nation Alliance. Some participants had their Community Energy Specialists in place for only part of the year due to the COVID-19 pandemic; hence, the Plan expenditures were not fully realized.

7.4 *TRADE ALLY NETWORK*

The Trade Ally Network (TAN) is FBC's contractor network whose main objective is to advance energy efficiency messaging and to promote the Company's DSM programs. The TAN is comprised of contractors, electricians, distributors and Point of Sale partners who offer rebates at the point of sale to commercial and industrial customers. FBC recognizes the important role these industry groups play when it comes to influencing residential and commercial customers when making energy efficiency decisions.

TAN is a key initiative under Enabling Activities that supports and supplements DSM program development and delivery, by providing FBC with a direct communication channel with the industry stakeholders. TAN also supports the interests of FBC by:

- Providing trade allies with co-op funding for advertising delivering targeted messaging about energy efficiency, and to promote C&EM rebate programs; and
- 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 FBC's current rebate programs.

In 2021, TAN contractors were responsible for 73 percent of the 2021 Residential Heat Pump rebates. To further support Point of Sale Partners and advance commercial DSM programs, work was undertaken in 2021 to build an online search tool on the FBC 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 supply-chain disruptions caused by the COVID-19 pandemic, trade allies' participation in co-op advertising programs was lower than expected. In addition, due to COVID-19 restrictions, TAN member events were executed virtually, and expenses typically associated with in-person events were not incurred. FBC continued to develop and offer training focused on the best practices for installing high-efficiency electric appliances and education that allows TAN members to maintain competitiveness and flexibility to continue selling energy efficient upgrades.

FBC continued to support an optional contractor accreditation initiative in partnership with BC Hydro and EMLI's CleanBC Better Homes. Accreditation involved contractors taking part in best practices training and quality assurance on a sampling of their work. This initiative began with heat pump and insulation contractors and has expanded to fenestration contractors, HVAC contractors, and Energy Advisors in 2021. FBC's funding to the Home Performance Stakeholder Council (HPSC) in 2021 was lower than previous years which contributed to the lower than planned expenditures in the TAN portfolio.

7.5 *CODES AND STANDARDS*

FBC has signed a three-year funding agreement with the Canadian Standards Association (CSA) to support relevant codes and standards work. This funding supports a number of projects including:

- Review and updates to a document for CSA EXP-07: Load-based and climate-specific testing and rating procedures for heat pumps and air conditioners; and
- Development of a document for CSA EXP-10: Load-based and climate-specific testing and rating procedures for split system air-to-water heat pumps for domestic hot water heat pumps for domestic hot water service.

FBC was also part of several committees to guide and contribute to the development of codes and standards, including CSA Communities and the CSA Technical Committee on Heating Ventilation Air Conditioning and Refrigeration. FBC plans to continue participating in these projects and committees in 2022.

7.6 *REPORTING TOOL & CUSTOMER APPLICATION PORTAL*

The reporting tool and customer application portal is a joint initiative between FBC and FEI. The tool launched seven residential programs in 2020 and 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 with 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.

8. PORTFOLIO EXPENDITURES

8.1 *OVERVIEW*

Portfolio expenditures consist largely of Planning & Evaluation (P&E) activities, include staffing costs and consultant fees for the various studies, plus Innovative Technology pilots undertaken. The actual Portfolio expenditures for 2021 were $0.8 million, 78 percent of Plan.

Table 8-1: 2021 Portfolio Expenditures Results Summary

Program	Plan ($000s)	Actual ($000s)
Monitoring and Evaluation	$ 107	$ 101
DSM Studies	$ 182	$ 118
Innovative Technologies	$ 156	$ 15
Labour and Expenses	$ 574	$ 560
Total	**$ 1,019**	**$ 793**
Plan including 2020 carryover of $14	**$ 1,033**	

Portfolio expenses also include any costs incurred to engage the Energy Efficiency and Conservation Advisory Group (EECAG). EECAG members provide insight and feedback on FBC's Portfolio of DSM activities and important feedback on future DSM planning.

EECAG provides input on both the electric and natural gas portfolios for FBC and FEI. The EECAG met over four partial day engagement sessions in 2021, one key topic included the drafted FBC DSM expenditure plan.

8.2 *PROGRAM EVALUATION ACTIVITIES*

Primary types of Evaluation, Measurement and Verification (EM&V) activities include the following:

- Process evaluations, where surveys and interviews of participants and trade allies are used to assess customer satisfaction and program success;
- Impact evaluations, to measure the achieved energy savings attributable from the program, including free-ridership and spill-over4 impacts; and
- Measurement & Verification (M&V) activities, to confirm project specific energy savings associated with measures undertaken by customers.

[4] Free-ridership refers to participants who would have participated in the absence of the program and spillover refers to additional reductions in energy consumption or demand that are due to program influence.
Reference: National Renewable Energy Laboratory, https://www.nrel.gov/docs/fy17osti/68578.pdf

FBC was involved in several shared evaluations and undertook one solo evaluation in 2021. FBC's impact evaluation activities that took place in 2021 will be finalized and reported in 2022.

Table 8-2 provides a list of the 2021 DSM Program evaluation and research activities undertaken by FBC in collaboration with utility partners as shown, chiefly FEI and BC Hydro.

Table 8-2: 2021 DSM Program Evaluation and Research Activities[5]

Evaluation Name	Program Area	Type of Evaluation	Evaluation Partners	Evaluation Status
Energy Audit 2020 Update	Enabling Activities	Process & Impact	FortisBC Energy Inc. & FortisBC Inc.	The study is an update to an energy savings audit to verify energy savings from projects completed in 2021. **Completed June 2021 by Prism Engineering. Preliminary results provided in 2020 Annual Report.**
Energy Specialist Program Evaluation 2021	Enabling Activities	Process & Impact	FortisBC Energy Inc. & FortisBC Inc.	The evaluation study includes program and industry stakeholder surveys and an energy savings audit on a subset of completed 2021 projects. **To be completed Q2 2022**
Community Energy Specialist Program Evaluation 2021	Enabling Activities	Process	FortisBC Energy Inc. & FortisBC Inc.	Program evaluation consisting of a process evaluation and interviews with internal and external stakeholders in order to gather feedback for future program design. **To be completed Q2 2022**
Insulation Measures Characterization Analysis	Residential	Market Study	FortisBC Energy Inc., FortisBC Inc. & BC Hydro	Characterization analysis of insulation measures incented as part of the Home Renovation Rebate Program. **Completed December 2021**
New Home Program Evaluation	Residential	Process & Impact	FortisBC Energy Inc. & FortisBC Inc.	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. **To be completed Q2 2022**
Participant and Building Owner Surveys	Residential / Commercial	Process	FortisBC Energy Inc. & FortisBC Inc.	Surveys conducted with building owners and tenants to assess customer satisfaction, program awareness, and gather feedback for future program design. **2020 results: Completed April 2021 2021 results: To be completed Q2 2022**
Direct Install Quality Assurance	Low Income	Evaluation Study	FortisBC Energy Inc., FortisBC Inc. & BC Hydro	Ongoing quality assurance to ensure direct install measures are installed according to program policies and procedures.

[5] Table 8-2 does not include Prefeasibility Studies. Please refer to the Innovative Technologies section (Section 8.4) for details.

Evaluation Name	Program Area	Type of Evaluation	Evaluation Partners	Evaluation Status
Customer Feedback Surveys	Low Income	Process	FortisBC Energy Inc., FortisBC Inc. & BC Hydro	Ongoing surveys with Direct Install program participants to gather feedback on their customer experience, satisfaction with the program and the program representatives. **2021 Survey results completed February and March 2021.**
Customer Engagement Tool Evaluation	CEO	Impact	FortisBC Energy Inc. & FortisBC Inc.	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**
Partnership Program Evaluation Study	Portfolio	Market Study	FortisBC Energy Inc. & FortisBC Inc.	Research study to gather feedback from industry experts, documentation review of guidelines and best practices for Partnership programs. **Completed May 2021**
Compliance Site Inspections	Commercial and Industrial	Compliance	FortisBC Inc.	Site inspections to verify installation rate of rebated Commercial and Industrial equipment, **Completed December 2021**

8.3 *DSM STUDIES*

DSM studies undertake key research, (e.g. end-use surveys), and support long-term planning such as Conservation Potential Reviews (CPR). The Company's 2021 DSM studies included the 2020 CPR, to update the achievable potential available for FBC's DSM programs. The 2020 CPR update was completed in the second quarter of 2021 and filed with FBC's 2021 Long Term Electric Resource Plan (LTERP).

8.4 *INNOVATIVE TECHNOLOGIES*

Innovative technology funding supports the development, or increased use, of a "technology, a system of technologies, or a building or industrial facility design that could achieve significant reductions of energy usage or significantly more efficient use of energy"6. FBC uses innovative technology funding to support feasibility studies, technology pilots, and field studies to assess the potential for these technologies.

In 2021, FBC funded a number of innovative technology studies, including:

- In partnership with FEI, an update to a Connected Homes study to characterize the energy and non-energy benefits of connected home technologies and estimate their energy savings potential in the FBC and FEI service area. The study is also meant to

[6] Technology innovation program defined in the Demand-Side Measures Regulation 326/2008 (amended Mar. 24, 2017).

inform a potential pilot project to investigate the use of connected home technologies as DSM measures.

- In partnership with FEI, a study on residential hybrid heating system controls as a DSM opportunity. This study assessed the market opportunity, technical characteristics, and energy savings potential of these controls. This study looked at both integrated controls, such as those built into modern air source heat pumps, and dual-fuel thermostats.

- In partnership with BC Hydro and the Centre for Energy Advancement through Technological Innovation (CEATI), FBC contributed to a study investigating the interactive effects of horticultural LEDs with HVAC controls in greenhouse and warehouse operations. The study will take place in 2022.

- FBC has begun a hydronic additive field study for commercial electric customers. Hydronic additives are chemical additives to non-potable heating systems that improve the system's heat transfer efficiency. Hydronic additives have seen success in natural gas hydronic applications in the past, and FEI currently offers a prescriptive rebate for this technology. The goal of this pilot is to investigate the magnitude of energy savings for electrically heated hydronic additive systems, including hydronic systems with heat pumps. Another goal of the pilot is to determine the impact of hydronic additives during the cooling season. This study will begin customer recruitment in 2022.

9. DEMAND RESPONSE

9.1 *OVERVIEW*

FBC implemented the next pilot phase in its Kelowna demand response pilot, testing the viability of automated demand response for residential customers.

Table 9-1: 2021 Demand Response Results Summary

Program	Plan ($000s)	Actual Expenditures ($000s)		
	Total	Total	Incentive	Non-Incentive
Demand Response	$ 130	$ 311	$ -	$ 311
Plan including 2020 carryover of $321	**$ 451**			

The 2021 expenditures totaling $311 thousand exceeded the Plan budget of $130 thousand, but was covered with carryover from previous years. Retaining the demand-response implementer and developing pilot-specific marketing materials were the main drivers of demand response expenditures in 2021.

9.2 *KELOWNA AREA DEMAND RESPONSE PILOT*

Following the completion of the commercial and large loads phase of the Kelowna Area Demand Response Pilot, FBC began designing the Kelowna Residential Demand Response Pilot. The scope of the pilot includes investigating voluntary demand response interventions for electric space heating, electric water heating, air conditioning, pool pump, and electric vehicle chargers.

In Q2 2021, FBC completed a procurement process and retained an implementer to set up the residential demand response back-end software, smart device integration, and demand response controller installation network for hot water and pool pumps. Activities for the remainder of the year were focussed on customizing the IT back end for the pilot, developing marketing materials, and working with the equipment suppliers to enable their devices to work on the pilot.

Recruitment of Kelowna participants began on January 31, 2022 and the pilot will complete in early 2023.

10. SUMMARY

In 2021, FBC achieved 115 percent of its total approved DSM expenditures and 91 percent of its annual energy savings target for the year, based on the 2019-2022 DSM Plan. Customer incentives were the largest cost component, making up 65 percent of the overall portfolio expenditures. The total energy savings of 29.7 GWh was largely made up of Commercial savings of 12.3 GWh, Industrial savings of 8.7 GWh, and Residential savings of 7.9 GWh.

This 2021 Annual Report details how FBC delivered its energy conservation programs in a cost effective manner, achieving an overall Benefit/Cost (TRC) ratio of 1.5. After intra-program transfers, all of which complied with the maximum 25 percent transfer limit, FBC has allocated negative dollar amounts totalling $526 thousand to three Program Areas (Residential, Commercial, and Industrial) to be carried over into 2022. FBC is requesting approval to carry forward these negative amounts to the final year of the 2019-2022 DSM Plan period as part of a separate application filed concurrently with the Report.

FBC was able to increase its incentive expenditures and associated energy savings over 2020 while maintaining strong COVID-19 safety protocols in accordance with provincial health directives. The Company continues to offer a robust portfolio of DSM programming accessible to all customer rate classes, while meeting the adequacy requirements of the DSM Regulation and operating according to the Company's DSM Guiding Principles.

Appendix A
DETAILED BENEFIT-COST RATIOS

Appendix A-1

DSM PROGRAMS COST AND SAVINGS SUMMARY REPORT FOR 2021

APPENDIX A - DETAILED BENEFIT-COST RATIOS

Table A-1: FBC DSM Summary Report for Year Ended December 31, 2021

	Utility Expenditures ($000s)				Annual Electricity Savings (MWh)		Cost Effectiveness Tests (Benefit/Cost Ratio)			
Program Area	**Incentive**	**Non-Incentive**	**Total**	**Plan**	**Plan**	**Actual**	**TRC**	**UCT**	**RIM**	**Levelized cost (¢/kWh)**
Residential										
Home Renovation	1,644	9	1,654	1,505	4,267	4,083	1.5	2.4	0.6	8.5
New Home	389	33	422	308	571	351	3.0	3.5	1.4	13.3
Lighting	209	10	219	137	965	3,428	5.0	11.5	0.6	2.3
Rental Apartment	44	15	59	54	148	33	-	0.5	0.3	5.0
Labour and expenses	-	542	542	515	-	-	-	-	-	-
Residential Total	**2,287**	**608**	**2,896**	**2,519**	**5,951**	**7,896**	1.9	2.7	0.6	7.4
Low Income							-	-	-	-
Self Install (ESK)	35	6	41	74	249	93	6.1	1.8	0.6	2.9
Direct Install (ECAP)	289	124	413	705	872	377	2.9	0.9	0.4	7.2
Social Housing Support	190	6	195	52	95	264	2.2	1.9	0.7	5.9
Labour and expenses	-	193	193	67	-	-	-	-	-	-
Low Income Total	**513**	**329**	**842**	**899**	**1,217**	**735**	1.3	1.0	0.5	9.0
Commercial							-	-	-	-
Commercial Custom	1,068	13	1,081	1,006	6,048	5,215	1.1	5.0	0.9	10.2
Commercial Prescriptive	1,701	66	1,767	1,177	9,243	7,107	1.9	5.5	1.2	6.7
Labour and expenses	-	649	649	869	-	-	-	-	-	-
Commercial Total	**2,769**	**728**	**3,497**	**3,052**	**15,291**	**12,322**	1.4	4.3	1.0	8.6
Industrial							-	-	-	-
Industrial Custom	1,833	9	1,841	1,308	8,226	4,829	2.2	2.6	1.0	5.3
Industrial Prescriptive	466	21	487	311	1,888	3,872	2.8	10.6	1.6	4.4
Labour and expenses	-	324	324	195	-	-	-	-	-	-
Industrial Total	**2,299**	**354**	**2,653**	**1,813**	**10,114**	**8,700**	2.3	3.7	1.2	5.2
Conservation Education and Outreach	-	599	599	595	-	-	-	-	-	-
Supporting Initiatives	397	695	1,093	1,024	-	-	-	-	-	-
Portfolio Expenditures	-	793	793	1,019	-	-	-	-	-	-
Demand Response	-	311	311	130	-	-	-	-	-	-
Total Portfolio	**8,265**	**4,418**	**12,683**	**11,051**	**32,572**	**29,653**	**1.5**	**2.7**	**0.8**	**8.2**

Appendix A-2

HISTORICAL SUMMARY OF DSM COST AND ENERGY SAVING RESULTS (2016-2020)

	Expenditures ($000s)										Energy Savings (MWh)									
	2020		2019		2018		2017		2016		2020		2019		2018		2017		2016	
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Residential																				
HRR/Home Improvements	1,357	1,348	1,200	1,487	140	136	348	196	884	225	3,916	3,551	3,264	3,227	301	225	364	187	3,106	243
Heat Pumps	-	-	-	-	327	357	298	307	302	249	-	-	-	-	1,297	1,127	781	976	1,618	753
Residential Lighting	163	238	157	218	202	141	190	380	189	360	1,122	3,401	2,284	3,141	3,337	3,255	2,735	8,125	1,547	8,607
New Home Program	227	215	184	90	76	36	151	61	390	39	439	251	340	112	169	54	126	45	1,179	31
Appliances	-	-	-	-	159	204	133	337	96	245	-	-	-	-	215	303	126	494	288	242
Water Heating	-	-	-	-	25	25	-	-	-	-	-	-	-	-	38	38	-	-	-	-
Low Income (2015-2017)	-	-	-	-	-	-	-	-	952	1,111	-	-	-	-	-	-	2,739	693	2,598	1,214
Behavioral	-	-	-	-	165	16	200	5	106	79	-	-	-	-	240	67	3,097	20	1,048	587
Rental Apartment Program	54	37	54	33	53	19	206	77	-	137	148	-	148	21	306	87	508	295	576	840
Watersavers	-	-	-	-	-	-	30	1	430	72	-	-	-	-			17	12	948	21
Labour & Related Expenses	503	501	491	362	610	468	1,161	529	-	-	-	-	-	-	-	-	-	-	-	-
Residential Total	2,304	2,339	2,086	2,190	1,757	1,402	2,717	1,893	3,349	2,517	5,625	7,203	6,036	6,501	5,903	5,156	10,493	10,847	12,908	12,538
Low Income (Since 2018)																				
Low Income	-	-	-	-	731	396	-	-	-	-	-	-	-	-	1,229	687	-	-	-	-
Self Install (ESK)	74	75	74	143	-	-	-	-	-	-	249	287	249	527	-	-	-	-	-	-
Direct Install (ECAP)	687	343	665	519	-	-	-	-	-	-	881	224	891	636	-	-	-	-	-	-
Social Housing Support	46	286	41	60	-	-	-	-	-	-	83	285	72	186	-	-	-	-	-	-
Labour & Related Expenses	65	114	64	217	-	282	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Low Income Total	872	818	844	939	731	678	-	-	-	-	1,213	796	1,212	1,349	1,229	687	-	-	-	-
Commercial																				
Lighting	-	-	-	-	1,750	1,751	2,322	2,749	1,519	1,192	-	-	-	-	13,620	17,635	10,592	12,580	7,616	5,694
Building and Process Improvements	-	-	-	-	988	247	784	371	842	574	-	-	-	-	5,290	1,763	2,931	605	3,452	1,234
Computers	-	-	-	-	-	-	-	-	55	-	-	-	-	-	-	-	-	-	378	-
Municipal (Water Handling)	-	-	-	-	-	-	-	-	79	4	-	-	-	-	-	-	-	-	759	-
Sm Business Direct Install	-	-	-	-	-	382	-	862	-	556	-	-	-	-	-	3,224	-	2,634	-	1,139
Irrigation	-	-	-	-	-	180	25	12	69	13	-	-	-	-	255	249	144	59	490	61
MURB New Construction	-	-	-	-	32	42	-	29	-	-	-	-	-	-	-	1,073	-	237	-	-
Commercial Custom	964	619	980	1,274	-	-	-	-	-	-	5,346	3,554	4,428	6,588	-	-	-	-	-	-
Commercial Prescriptive	1,218	1,513	1,371	1,505	-	-	-	-	-	-	10,121	7,596	11,114	8,375	-	-	-	-	-	-
Labour & Related Expenses	848	674	828	606	822	864	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Total	3,030	2,806	3,179	3,385	3,592	3,466	3,131	4,023	2,564	2,339	15,467	11,150	15,542	14,963	19,165	23,944	13,667	16,115	12,695	8,128
Industrial																				
Industrial Efficiencies	-	-	-	-	305	240	309	206	209	300					1,188	1,615	1,566	876	1,585	2,099
Industrial Custom	1,308	1,092	1,288	640	-	-	-	-	-	-	8,226	4,491	8,226	1,868	-	-	-	-	-	-
Industrial Prescriptive	290	455	290	282	-	-	-	-	-	-	1,781	2,304	1,811	1,110	-	-	-	-	-	-
Labour & Related Expenses	190	220	185	174	72	157	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Industrial Total	1,788	1,767	1,763	1,096	377	397	309	206	209	300	10,007	6,795	10,037	2,978	1,188	1,615	1,566	876	1,585	2,099
Programs Total	**7,994**	**7,730**	**7,872**	**7,610**	**6,457**	**5,943**	**6,157**	**6,122**	**6,122**	**5,156**	**32,312**	**25,944**	**32,827**	**25,791**	**27,485**	**31,402**	**25,726**	**27,838**	**27,188**	**22,765**
Supporting Initiatives	838	818	1,218	869	742	537	674	674	675	657	-	209	-	-	-	-	-	-	-	-
Planning & Evaluation	-	-	-	-	743	743	777	994	735	718	-	-	-	-	-	-	-	-	-	-
Conservation Education and Outreach	497	566	566	575	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Portfolio Expenditures	913	911	776	762	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Demand Response	324	135	477	264	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**10,566**	**10,160**	**10,909**	**10,080**	**7,942**	**7,223**	**7,608**	**7,790**	**7,532**	**6,531**	**32,312**	**26,153**	**32,827**	**25,791**	**27,485**	**31,402**	**25,726**	**27,838**	**27,188**	**22,765**

In the 2019-2022 DSM Expenditures Plan, several existing DSM programs were reorganized and/or consolidated into new programs:

Residential: The Residential Home Improvements program name changed to the Home Renovation Rebate (HRR) program. Heat pumps, water heaters and appliances were consolidated into the HRR program.

Low Income: The Low Income program was seperated into Self-Install, Direct Install and Social Housing Support.

Commerical: The Commercial Custom and Prescriptive programs both include lighting. MURB New Construction was moved into the Custom program and Building and Process Improvements was moved into the Prescriptive program.

Industrial: The Industrial Efficiences program was separated into both the Industrial Custom and Prescriptive programs.

Portfolio Expenditures: Planning & Evaluation was moved into this portfolio.

Appendix C
DRAFT ORDER

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Utilities Commission

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ORDER NUMBER
G-xx-xx

IN THE MATTER OF
the *Utilities Commission Act*, RSBC 1996, Chapter 473

and

FortisBC Inc.
Application for Approval of 2023-2027 Demand Side Management Expenditures Plan

BEFORE:
[Panel Chair]
Commissioner
Commissioner

on Date

ORDER

WHEREAS:

A. On August 24, 2021, FBC filed its 2021 Long Term Electric Resource Plan and Long Term Demand Side Management (2021 LT DSM) Plan. The 2021 LT DSM Plan included an assessment of the energy efficiency and conservation potential for FBC customers and identifies FBC's preferred DSM scenario for long term planning purposes;

B. On June 6, 2022, FBC filed its Application for Approval of 2023-2027 Demand Side Management Expenditures Plan (DSM Plan);

C. FBC seeks acceptance, pursuant to section 44.2 of the *Utilities Commission Act* (UCA) of DSM total expenditures as set out in Table 4-2 of the Application of $82.583 million (inflation adjusted) for 2023 through 2027;

D. FBC also seeks approval changes to its existing funding transfer and carryover rules, a new variance allowance rule on total portfolio expenditures, and a rate base deferral account to capture the regulatory costs, as set in Section 7 of the Application;

E. The Commission has reviewed FBC's DSM Plan and requested approvals for DSM expenditures for 2023 to 2027 and concludes that the requested expenditure schedules should be accepted.

NOW THEREFORE the Commission orders as follows:

1. Pursuant to section 44.2(a) of the UCA, the Commission accepts the FBC DSM expenditure schedule of total DSM expenditures of $82.583 million for 2023 through 2027 on the DSM program areas described in the DSM Plan.

2. FBC's proposed changes to the funding transfer rules between program areas is approved.

3. FBC's proposed changes to the funding carryover rules between plan years is approved.

4. FBC's request for a variance allowance on total portfolio expenditures in the final year of the DSM Plan is approved.

5. FBC's request for a rate base deferral account to capture the regulatory costs associated with the review 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
FBC CONSERVATION POTENTIAL REVIEW (CPR)

FortisBC Electric Conservation Potential Review

Prepared for:

FORTIS BC™
Energy at work

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July 2021

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Disclaimer

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Executive Summary

FortisBC Inc. engaged Lumidyne Consulting Inc. in 2020 to prepare a Conservation Potential Review (CPR) that estimates electric energy and demand savings potential from a broad collection of energy-saving measures in FortisBC's electric service territory. This effort builds on the data and methodology from the previous CPR that began in 2015 and finalized its results in 2018. The CPR identifies energy-efficient equipment and building practices, operational and maintenance activities, and end-user behaviors that reduce electric energy consumption, which often leads to the secondary benefit of reducing electric peak demand.

The analysis estimated the technical, economic and market potential for each conservation measure. Market potential is the focus of this report because it incorporates barriers to adoption stemming from delays in stock turnover, customers' awareness and willingness to adopt, and substitutive effects among efficient measures serving the same application. FortisBC can use this analysis to inform conservation goals, demand side management (DSM) program planning, load forecasting, and integrated resource planning.

Approach

The 2021 CPR follows a similar methodological approach to that used in Navigant's 2017 technical and economic potential assessment and Navigant's 2018 market potential assessment, where the combination formed FortisBC's 2016 CPR.[1,2] We refer the reader to those documents for an in-depth description of the underlying methodology. This report provides a high-level methodological summary, and it highlights notable updates or enhancements relative to the previous CPR.

The main components of the analysis were:

- development of a 2019 *Base Year* accounting of building stocks, end use intensity and energy consumption;
- development of a 2020-2040 *Reference Case* forecast of building stocks, end use intensity and energy consumption;
- development of savings profiles for monthly energy savings and peak-coincidence factors for summer and winter demand savings;
- update and expansion of the measure characterization; and
- estimation of savings potential.

Each of these tasks is briefly described below.

Base Year

Estimation of the *Base Year* began with 2019 actual sector-level customer counts and annual energy consumption for FortisBC's direct and indirect customers.[3] The team allocated sector-level consumption to customer segments and end uses based on data and trends observed in FortisBC's end use surveys and Natural

[1] Navigant's 2017 technical and economic potential report can be found in Appendix A (p. 513) of FortisBC's "2016 Long Term Electric Resource Plan (LTERP) and Long Term Demand Side Management Plan (LT DSM Plan)," accessible at https://fbcdotcomprod.blob.core.windows.net/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/161130_fbc_2016_lterp_ltdsm_plan.pdf.

[2] Navigant's 2018 market potential report can be found in Appendix B (p. 86) of FortisBC's "Application for Acceptance of Demand Side Management (DSM) Expenditures Plan for the period covering 2019 to 2022," accessible at https://fbcdotcomprod.blob.core.windows.net/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/electric-utility/180802_fbc_2019-2022_dsm_expenditures_application_ff.pdf.

[3] Indirect customers purchase electricity from wholesalers who purchase their electricity from FortisBC. Indirect customers are eligible to participate in FortisBC's DSM programs, so their consumption is considered in the CPR.

Resource Canada's Comprehensive Energy Use Database (NRCan CEUD). The *Base Year* estimates include the following:

Residential

- Number of households by archetype
- End use intensity by customer segment and end use
- Annual energy consumption by customer segment and end use

Commercial

- Number of multi-unit residential building units by height category
- Floor space by customer segment
- End use intensity by customer segment and end use
- Annual energy consumption by customer segment and end use

Industrial

- Floor space for cannabis facilities
- End use intensity for cannabis facilities
- Annual energy consumption by customer segment and end use

The team calibrated all assumptions listed above to ensure that the summation of *Base Year* energy consumption over customer segments and end uses in each sector was identical to the actual 2019 sectoral load. As a result, the *Base Year* avoids double-counting DSM savings previously achieved by FortisBC programs.

Reference Case

The *Reference Case* is a forecast of consumption-related indicators from 2020 through 2040 that uses the 2019 *Base Year* as the starting point for forecast changes in the market. All indicators from the *Base Year*—such as building stocks, end use intensities, and annual consumption—and the addition of industrial output activity have associated forecasts in the *Reference Case*.

Forecast trends in industrial output activity—and thus consumption—relied on output indicators used in FortisBC's 2021 Long Term Electric Resource Plan (LTERP). Trends in residential and commercial end use intensity came from integration of data from end use surveys, NRCan's CEUD, and long-term trends identified in FortisBC's 2016 CPR.

Lumidyne calibrated the *Reference Case's* consumption forecasts to the LTERP "Reference" scenario's sector-level consumption forecasts after removing the impact of electric vehicles and planned DSM savings. To align components of the *Reference Case's* consumption with the LTERP, the team chose to calibrate the most uncertain assumptions. For the commercial sector, the team calibrated floor space estimates to ensure that the multiplication of the CPR's floor space and EUI forecasts aligned with the LTERP's commercial consumption forecast. The industrial sector's consumption forecasts relied on calibrated industrial output indicators, while the residential sector used calibrated customer growth rates.

To summarize, the *Reference Case* stems from actual 2019 consumption captured by the *Base Year*, follows the LTERP's sector-level consumption forecast, and includes observed trends in EUIs from multiple data sources. Since the *Reference Case* forms the scaling basis for per-measure savings, the team carefully developed the *Reference Case* to create a solid foundation for savings potential estimates.

Measure Characterization

The study considers 167 distinct conservation measures, most of which are further differentiated and tailored to their applicable customer segments. The measures pertain to 24 customer segments and 19 end uses, resulting in 973 measure-and-segment combinations. Compared with the previous CPR, the team made several measure additions and removals:

Measure additions

- Cannabis lighting, dehumidification, and heating/ventilation/air conditioning (HVAC)
- BC Energy Step Codes for residential and commercial new building construction

Measure removals

- Measures that are now minimum code: commercial LED exit lights and general service CFL lamps.
- Measures substituted with BC Energy Step Codes: ENERGY STAR home, R-2000 Standard home, passive house, net-zero home, apartment new construction 30% above code.
- Measures associated with the "Oil & Gas" and "Metal Mining" customer segments.
- Measures tracking savings from already-implemented building codes or appliance standards that FortisBC did not administer or incentivize: general service lamp, reflector lamp, metal halide lamp, refrigerator, freezer, and packaged terminal AC/HP codes and standards.

Additionally, the team implemented many updates to the measure characterizations to account for current equipment saturation and penetration levels, end use intensities, costs and efficiency levels. Sources for these updates include FortisBC program evaluation data, end use surveys, literature review, market research and the *Base Year* analysis. Notably, the characterizations of commercial and industrial lighting measures offered through FortisBC's programs were updated to align the CPR's incremental savings and costs with findings from FortisBC's evaluation studies.

Monthly Savings Profiles & Peak-Coincidence Factors

To provide FortisBC with more visibility into the timing of savings, Lumidyne generated monthly energy savings profiles and differentiated demand savings for summer and winter peak coincidence. The analysis used measured and simulated hourly load profiles for dozens of customer segments and end uses from similar climate zones to construct a bottoms-up representation of hourly loads. The team scaled the hourly end use profiles to align with the *Base Year's* annual energy consumption by end use and customer segment. Next, Lumidyne aggregated the hourly loads to the sector level and calibrated them against each sector's 2019 actual monthly consumption. This process included steps to keep the monthly relationships between average daily temperature and space heating and cooling loads, and it preserved the relationship between hours of daylight and lighting loads.

After calibrating all customer segment and end use hourly load shapes, the team aggregated the load estimates to the system level and compared it with FortisBC's systemwide actual 2019 hourly load. This validation exercise confirmed that there was sufficient alignment—in diurnal load shapes and summer and winter peak coincidence—between the aggregated load shape estimates and actual hourly load. The output from this analysis is monthly allocation factors for energy savings (expressed as the percentage of annual savings occurring in each month) and peak-coincident demand factors (expressed as kW of summer or winter peak savings per kWh/year of energy savings). Multiplication of these factors by the study's annual energy savings potential provides insight into the timing of energy savings and the associated peak demand savings.

Estimation of Savings Potential

The study estimated electric energy savings and electric summer/winter peak demand savings, along with gas energy savings for dual-fuel measures and those having interactive effects with gas-consuming end uses. All results in the report reflect cumulative at-the-meter savings, which exclude savings from avoided line losses. Additionally, most results show gross savings, unless they explicitly say they include the effects of natural change. Potential after natural change is analogous to net savings, and it accounts for changes in equipment saturation and end use intensities that are forecast to naturally occur absent any DSM program support or incentivization.

The report's focus is on market savings potential, but the analysis began by estimating technical and economic potential. Technical potential is the hypothetical savings for each end use application, where the CPR measure having the highest efficiency immediately replaces its corresponding low-efficiency or minimum-code baseline measure wherever it is technically feasible. Economic potential is the subset of technical potential that has a benefit-cost ratio of 1.0 or higher. Commercial and industrial economic potential used a total resource cost (TRC) benefit-cost ratio for economic screening, while residential potential used a modified total resource cost (mTRC) benefit-cost ratio. The mTRC was similar to the TRC, except that it included a 15 percent increase to avoided costs. The 15 percent increase in avoided costs captured non-energy benefits, as allowed by British Columbia DSM Regulation.[4] Applying the mTRC increased residential market potential by less than 4 percent, indicating that most residential potential was economic under the TRC test.

Market potential is a subset of economic potential, and its intent is to capture real-world dynamics influencing measure adoption. For example, equipment turnover of replace-on-burnout measures constrains the market potential by limiting the opportunities for replacing failed inefficient equipment with efficient equipment. Market potential requires customer awareness and familiarity with efficient measures before adoption occurs. Lastly, relative economic attractiveness—after considering utility bill savings, incremental costs, operation and maintenance costs, and incentives—among high- and low-efficiency measures influences customers' purchasing decisions that drive market potential.

Importantly, market potential differs from program potential. Program potential considers various methods of administering DSM programs, constraints on program staffing, limited budgets for administration and incentives, and other factors influencing program design and goalsetting. Additionally, program potential excludes measures such as ENERGY STAR household electronics like televisions, which are regulated by government codes and standards and not typically incented under utility programs.

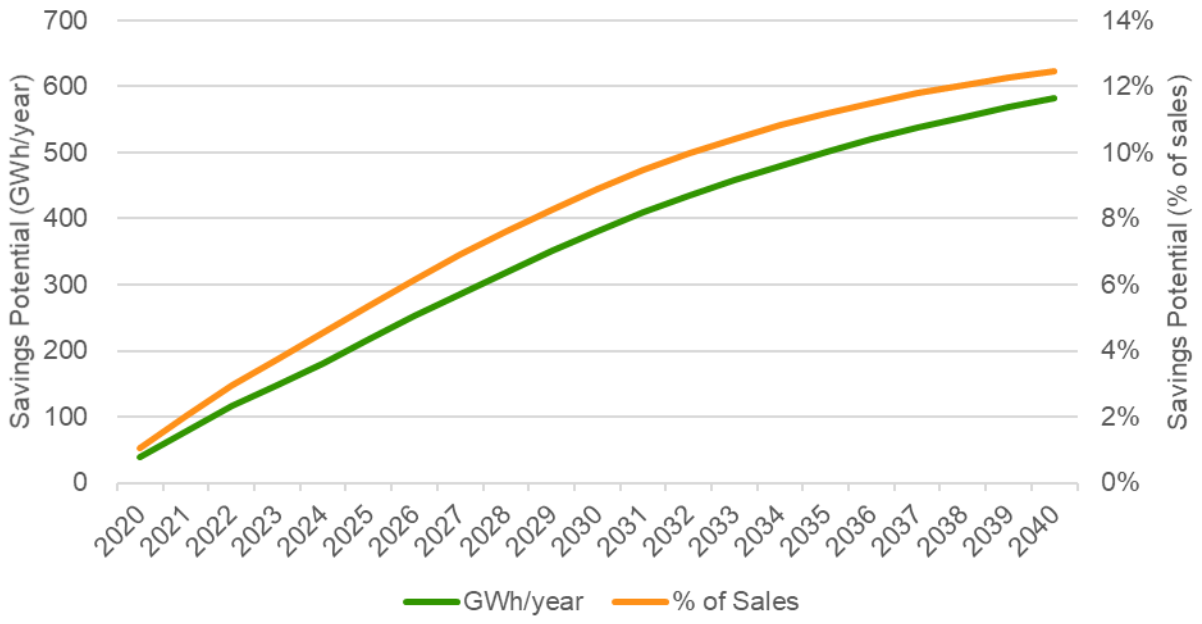
Market potential omits these components and instead focuses on a less-constrained assessment of savings based on customers' expected sensitivity to cost and plausible adoption rates. In practice, program designers often use market potential studies to investigate new conservation opportunities and to provide directional guidance as they tailor detailed plans for program implementation and goalsetting.

[4] Under British Columbia Utilities Commission DSM Regulation s4.(1.1)(c), the modified total resource cost rules allow for a 15 percent increase for non-energy benefits, up to a limit of 10 percent of the electric DSM portfolio expenditure.

Findings

The analysis found cumulative electric energy market potential to begin at 38 GWh/year in 2020 and grow to 583 GWh/year by 2040, as shown in Figure 1. The average incremental annual savings over the horizon is slightly less than 28 GWh/year. Incremental annual savings slowly decline over time due to efficient measures saturating the replace-on-burnout and retrofit markets and due to Step Codes' raising of the minimum-code baseline in the new construction markets, which leads to a corresponding reduction in incremental savings from efficient measures. Energy savings in 2020 equate to 1 percent of FortisBC's total energy sales to direct and indirect customers. By 2040, the cumulative market potential is 12.5 percent of sales.

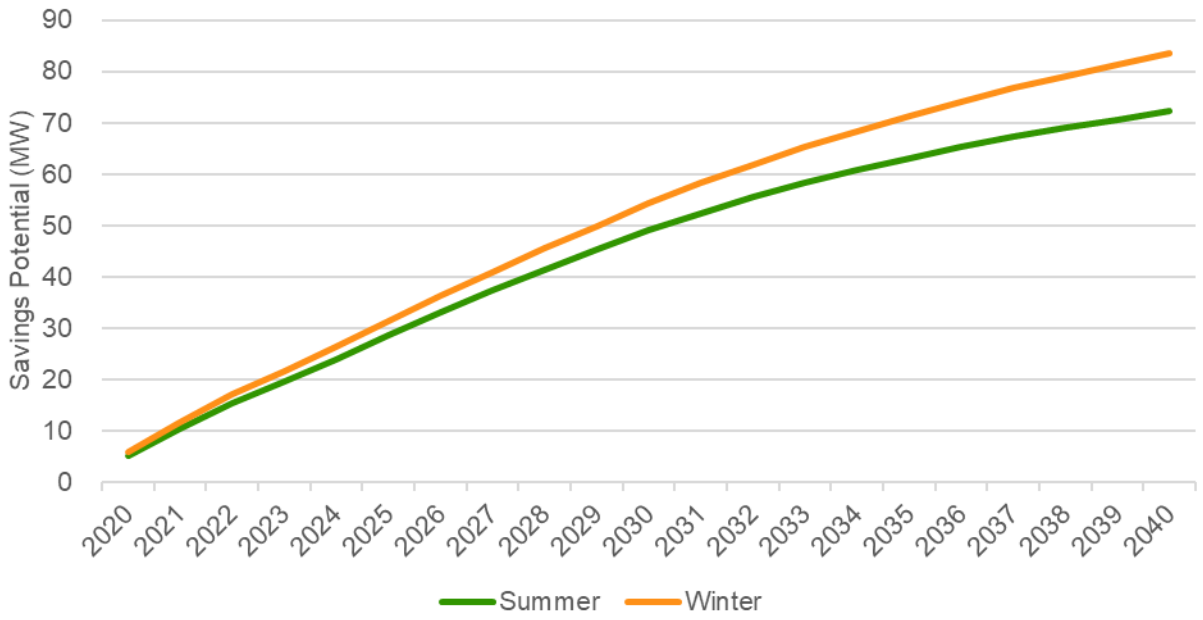
Figure 1. Total Cumulative Electric Energy Savings Market Potential (GWh/year, % of Sales)



Source: Lumidyne

The forecast of cumulative electric winter demand market potential, shown in Figure 2, begins at 6 MW and reaches 84 MW by 2040. The market potential for summer demand is slightly lower, starting at 5 MW and reaching 72 MW. Winter potential corresponds to demand savings averaged between 5:00pm and 7:00pm in January and February. Summer potential averages demand savings between 5:00pm and 7:00pm in July and August. Though the analysis estimated demand savings across the two peakiest months in the summer and winter seasons, Lumidyne's load shape analysis suggests that the demand savings would be similar for adjacent months (e.g., December, March, June and August).

Figure 2. Total Cumulative Electric Demand Savings Market Potential (MW)



Source: Lumidyne

As a percentage of the FortisBC 2021 LTERP's forecast summer and winter peak loads before DSM and losses, the market potential begins at about 0.8 percent of peak loads and grows to just under 8 percent by 2040. This is true for both winter and summer demand savings market potential. However, FortisBC set a new summer peak record in 2021, so it is possible that summer peak loads might grow faster than the 2021 LTERP had forecast.

Comparing this CPR's market potential with the previous CPR, the average incremental energy savings are similar in magnitude. However, this CPR's average incremental winter demand savings are about 33 percent lower than the previous CPR. The lower winter demand savings mostly result from the use of bottom-up hourly load profiles, which apply greater rigor to the estimation of demand savings via calibration with actual FortisBC systemwide hourly load.[5] In contrast, the previous CPR made no attempt to reconcile demand savings estimates with the temporal diversity observed in actual FortisBC loads.

[5] Lumidyne's development of bottom-up hourly load profiles started with load shapes at the equipment and end use levels for each customer segment. After aggregating to the end-use level for each customer segment, the team scaled the profiles to ensure that the resulting annual consumption aligned with *Base Year's* end use intensities. To confirm the reasonableness of the hourly profiles, Lumidyne aggregated all profiles across end uses and customer segments and compared it with FortisBC's 2019 actual systemwide hourly loads. Compared with the 2019 actual hourly loads, the CPR's aggregate hourly loads showed similar summer and winter peaks, seasonal variations and monthly diurnal shapes.

1 Introduction

FortisBC Inc. engaged Lumidyne Consulting Inc. in 2020 to prepare a Conservation Potential Review (CPR) that estimates electric energy and demand savings potential from a broad collection of energy-saving measures in FortisBC's electric service territory. This effort builds upon the data and methodology from the previous CPR that began in 2016 and finalized its results in 2018. The CPR identifies energy-efficient equipment and building practices, operational and maintenance activities, and end-user behaviors that reduce electric energy consumption, which often leads to the secondary benefit of reducing electric peak demand.

The analysis estimated the technical, economic and market potential for each conservation measure. Market potential is the focus of this report because it incorporates barriers to adoption stemming from delays in stock turnover, customers' awareness and willingness to adopt, and substitutive effects among efficient measures serving the same application. FortisBC can use this analysis to inform conservation goals, demand side management (DSM) program planning, load forecasting, and integrated resource planning.

1.1 Report Organization

The remainder of this report follows the outline below:

- ***Section 1***: describes methodological changes from the previous CPR and highlights the study's caveats and limitations.
- ***Section 2***: details the approach to estimating savings potential, with discussion on the *Base Year*, *Reference Case*, monthly savings profiles and peak-coincident factors, and technical, economic and market potential.
- ***Section 3***: provides market potential results at different levels of aggregation, along with cost effectiveness by sector and portfolio.
- ***Appendices***: supplies tabular data associated with the report's charts and figures.

1.2 Changes from Previous CPR

The 2021 CPR follows a similar methodological approach to that used in 2016 FBC CPR technical and economic potential assessment and the subsequent FBC market potential assessment.[6,7] We refer the reader to those documents for an in-depth description of the underlying methodology. Lumidyne devoted most of its efforts toward updating data assumptions to reflect current market conditions, rather than changing the methodological approach. As such, this report provides a more concise methodological summary highlighting notable updates or enhancements relative to the previous CPR.

The remainder of this section describes this study's most significant changes compared with the 2016 CPR.

[6] FBC's 2016 technical and economic potential report can be found in Appendix A (p. 513) of FortisBC's "2016 Long Term Electric Resource Plan (LTERP) and Long Term Demand Side Management Plan (LT DSM Plan)," accessible at https://fbcdotcomprod.blob.core.windows.net/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/161130_fbc_2016_lterp_ltdsm_plan.pdf.

[7] FBC's 2016 market potential report can be found in Appendix B (p. 86) of FortisBC's "Application for Acceptance of Demand Side Management (DSM) Expenditures Plan for the period covering 2019 to 2022," accessible at https://fbcdotcomprod.blob.core.windows.net/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/electric-utility/180802_fbc_2019-2022_dsm_expenditures_application_ff.pdf.

Base Year

Estimation of the *Base Year* used 2019 actual sector-level customer counts and annual energy consumption for FortisBC's direct and indirect customers, while the previous CPR relied on 2014 data.[8] The revision led to a 10 percent decrease in residential households—with an increase in the share of households associated with multi-unit residential buildings (MURBs) compared with single-family homes—and a 15 percent decrease in residential electricity consumption.

Commercial floor space estimates increased by 45 percent and consumption increased by 30 percent. Though speculative, this appreciable change might be attributed to having better data in this analysis to allocate indirect customers to their respective sectors. Additionally, this study classified as commercial buildings any facility on large power electric rates that had characteristics similar to commercial building types—for example, colleges, universities, hospitals, hotels and public office buildings. It is possible that the 2016 CPR treated all customers on large power electric rates as industrial customers.

Industrial consumption decreased by 9.5 percent, mostly stemming from the loss of load from the "metal mining" segment. Additionally, this CPR did not evaluate the "oil and gas" segment because FortisBC has no customers in that industry.

Reference Case

Where useful, Lumidyne calibrated the *Reference Case's* consumption forecasts to FortisBC's 2021 Long Term Electric Resource Plan (LTERP) "Reference" scenario's sector-level consumption forecasts after removing the impact of electric vehicles and planned DSM savings. The 2016 CPR performed a similar calibration process to FortisBC's 20-Year Load Forecast from an unspecified year, which FortisBC likely developed around 2016.

This CPR's reference case projected that total direct and indirect electricity consumption would grow at an average annual rate of 0.94 percent per year, while the 2016 CPR assumed a 0.98 percent per year average growth rate.

Monthly Savings Profiles & Peak-Coincident Demand Factors

To provide FortisBC with more visibility into the timing of savings, Lumidyne generated monthly energy savings profiles and differentiated demand savings for summer and winter peak coincidence. The analysis used measured and simulated hourly load profiles for dozens of customer segments and end uses from similar climate zones to construct a bottoms-up representation of hourly loads. The output from this analysis was monthly allocation factors for energy savings (expressed as the percentage of annual savings occurring in each month) and peak-coincident demand factors (expressed as kW of summer or winter peak savings per kWh/year of energy savings). Multiplication of these factors by the study's annual energy savings potential provided insight into the timing of energy savings and the associated peak demand savings.

Comparing this CPR's market potential with the 2016 CPR, the average incremental winter demand savings are about 33 percent lower than the previous CPR. The lower winter demand savings mostly resulted from the use of bottoms-up hourly load profiles, which applied greater rigor to the estimation of demand savings via calibration with actual FortisBC systemwide hourly load. In contrast, the previous CPR made no attempt to reconcile demand savings estimates with the temporal diversity observed in actual FortisBC loads.

[8] Indirect customers purchase electricity from wholesalers who purchase their electricity from FortisBC. Indirect customers are eligible to participate in FortisBC's DSM programs, so their consumption is considered in the CPR.

Measure Characterization

This CPR's measure characterization was founded on much of the prior characterizations compiled for the 2016 CPR. Beginning with the prior database, the team made several measure additions and removals:

Measure additions

- Cannabis lighting, dehumidification, and heating/ventilation/air conditioning (HVAC)
- BC Energy Step Codes for residential and commercial new building construction

Measure removals

- Measures that are now minimum code: commercial LED exit lights and general service CFL lamps.
- Measures substituted with BC Energy Step Codes: ENERGY STAR home, R-2000 Standard home, passive house, net-zero home, apartment new construction 30% above code.
- Measures associated with the Oil & Gas and Mining & Metal customer segments.
- Measures tracking savings from already-implemented building codes or appliance standards that FortisBC did not administer or incentivize: general service lamp, reflector lamp, metal halide lamp, refrigerator, freezer, and packaged terminal AC/HP codes and standards.

Additionally, the team implemented many updates to the measure characterizations to account for current equipment saturation and penetration levels, end use intensities, costs and efficiency levels. Sources for these updates include FortisBC program evaluation data, end use surveys, literature review, market research and the *Base Year* analysis.

For example, FortisBC provided evaluation data for program measures analogous to the CPR measures listed below. The evaluation data included average incremental savings and costs from incented projects, and Lumidyne used that information, along with saturation and penetration data from the CEUS, to update the measure characterizations. The commercial measures that experienced the largest positive change in TRC benefit-cost ratios were lighting controls and LED luminaires or retrofit kits, while high bay LED's TRC ratios decreased relative to the 2016 CPR. For industrial measures, the high bay lighting TRC ratios improved significantly, and the remaining measures experienced slight improvements.

- Commercial Interior LED
- Commercial LED Luminaire or Retrofit Kit Replacing HID
- Commercial High Bay LED
- Commercial LED Backlit Signage
- Commercial Photocell
- Commercial Interior Lighting Controls
- LED Street Lighting
- Industrial Efficient High Bay Lighting
- Industrial Efficient Low Bay Lighting
- Industrial Lighting Controls

Economic Assumptions

Lumidyne updated the key economic assumptions influencing benefit-cost tests, and the differences between the starting assumptions in 2016 CPR (2016 start year) and the current CPR (2020 start year) appear in Table 1 below. For economic metrics that changed over time, the annual escalation rates differed minimally between studies.

Table 1. Comparison of Economic Assumptions

Economic Assumption	2016 CPR (2016 nominal values)	2021 CPR (2020 nominal values)
Long-Run Marginal Cost	$100/MWh	$89/MWh
Deferred Capital Expenditures	$80/kW-year	$51/kW-year
Discount Rate	8.12%	7.90%
Electric Rates	Residential: 13.3 cents/kWh Commercial: 9.7 cents/kWh Industrial: 8.1 cents/kWh	Residential: 13.9 cents/kWh Commercial: 10.2 cents/kWh Industrial: 8.2 cents/kWh
Gas Rates	Residential: $7.7/GJ Commercial: $5.2/GJ Industrial: $4.3/GJ	Residential: $8.5/GJ Commercial: $7.4/GJ Industrial: $6.8/GJ

Source: FortisBC

The study's cost effectiveness tests used the long-run marginal cost for electric energy avoided costs, and the tests applied deferred capital expenditures as the electric demand avoided costs.

1.3 Caveats and Limitations

Customary for any forecasting activity, especially one as expansive as a CPR, this study's approach and findings have caveats and limitations. The commentary below describes the most important issues to consider when interpreting the results of the analysis.

Gross versus Net Savings

All savings potential results, except those shown in Section 3.2.5, are gross savings and are premised on the assumption that any increase in customer adoption of CPR measures is directly attributable to DSM programs. Section 3.2.5 shows savings after natural change, which is analogous to net savings and assumes that some of the increase in customer adoption may occur naturally in the absence of DSM programs. Of note, this aspect of gross versus net savings is separate from the program-level free-rider and spillover effects applied to DSM reporting.

At-the-Meter versus At-the-Generator Savings

All savings potential results are at-the-meter savings and do not include savings from avoided delivery losses. However, the cost effectiveness analysis appropriately used at-the-generator savings when calculating avoided costs. One can convert at-the-meter savings to at-the-generator savings by dividing by *1 – Loss Percentage*, where the annual average loss percentage at the time of this study was 7.6 percent.[9]

Data Availability

The granularity of a CPR requires a large number of input assumptions, many of which cannot be furnished by the considered utility and do not exist for the geographic area. As such, analysts look to similar utilities and

[9] Loss percentage from FortisBC 2020-2024 MRP Application, Appendix B3 – FBC Losses Study (p. 65), accessible at https://www.bcuc.com/Documents/Proceedings/2019/DOC_53565_B-1-1-FortisBC-2020-2024-Multi-YearRatePlan-Appendices.pdf.

geographic areas for data on which the team can benchmark uncertain input assumptions. In these circumstances, analysts make use of many sources of data to triangulate a reasonable estimate for unavailable data. When presented with these challenges during the development of the *Base Year, Reference Case* and measure characterization, Lumidyne took great effort to calibrate input assumptions to be consistent with actual, surveyed or vetted data specific to FortisBC and its customer base.

Measure Representation

The suite of measures included in this analysis is, by design, not exhaustive. Data and resources available for the measure characterization limit the list to measures meeting the following requirements:

- There is sufficient data and/or industry experience to characterize the measure within a reasonable confidence interval.
- The technical savings potential is sufficiently large that customer adoption would meaningfully reduce energy consumption.
- Expected TRC ratios have the potential to be larger than 1.0 for the upper bound of likely avoided cost scenarios.
- Feasible delivery mechanisms exist for staff to administer the measure through DSM programs.

Emerging technologies not yet commercialized will undoubtedly present new opportunities with lower costs, novel applications, and increased savings over the forecast horizon. Moreover, unforeseen structural changes in commerce and societal changes in energy consumption may arise. These speculative scenarios, nevertheless, are outside the scope of this study.

Interactive Effects

When a customer installs two or more efficient measures in the same building, there is a possibility that the combined savings are less than the sum of each measure's savings in isolation. This outcome stems from interactive effects, whereby a measure like better wall insulation reduces the heating/cooling requirements of a building, and therefore an efficient heating/cooling system's incremental savings slightly decline. This study does not consider the interactive effects among distinct CPR measures due to the exponential number of measure combinations that are possible. However, the CPR does include distinct measures that represent bundles of measures—for example, whole-facility Step Codes—and the team generally estimated the savings from those measures using building energy simulation tools that do account for interactive effects.

Adoption Rates and Customer Sensitivity to Price

Researchers have studied product diffusion for many decades and have developed a plethora of models for simulating customer adoption. In an ideal situation, analysts would gather a large quantity of market data for every measure under consideration, use the data to parameterize multiple adoption models, and select the model that shows the best predictive ability for each measure. Given the size of this CPR—which has 973 measure-and-segment combinations—the analysis relied on modeling approaches for adoption rates and customer sensitivity to price that respond well across diverse measures and customer types without requiring an impractical amount of data and labor. Additionally, Lumidyne calibrated the market potential's adoption models to coincide with actual participation in FortisBC DSM programs, and, for practicality, these calibrations pertained to aggregations of actual measure adoption.

Market Potential versus Program Potential

Lastly, market potential differs from program potential. Program potential considers various methods of administering DSM programs, constraints on program staffing, limited budgets for administration and incentives, and other factors influencing program design and goalsetting. Additionally, program potential excludes measures

such as ENERGY STAR household electronics like televisions, which are regulated by government codes and standards and not typically incented under utility programs.

Market potential omits these components and instead focuses on a less-constrained assessment of savings based on customers' expected sensitivity to cost and plausible adoption rates. In practice, program designers often use market potential studies to investigate new conservation opportunities and to provide directional guidance as they tailor detailed plans for program implementation and goalsetting.

2 Methodological Approach

This section describes the study's methodological approach to:

- development of a 2019 *Base Year* accounting of building stocks, end use intensity and energy consumption;
- development of a 2020-2040 *Reference Case* forecast of building stocks, end use intensity and energy consumption;
- development of savings profiles for monthly energy savings and peak-coincidence factors for summer and winter demand savings;
- update and expansion of the measure characterization; and
- estimation of technical, economic and market savings potential.

2.1 Base Year Calibration

Estimation of the *Base Year* began with 2019 actual sector-level customer counts and annual energy consumption for FortisBC's direct and indirect customers. Indirect customers belonged to the municipal utilities of Penticton, Nelson, Summerland and Grand Forks, all of whom purchase wholesale electricity from FortisBC and resell it to their respective customers. The team included electricity consumption from indirect customers in the CPR because they are eligible to participate in FortisBC DSM programs.

A key task in developing the *Base Year* was to allocate 2019 actual consumption to customer segments and end uses within each sector. Data availability by sector influenced the allocation process that Lumidyne applied. Regardless of the sector, it was imperative to ensure that underlying assumptions like household counts, floor space and end use intensities (EUIs) were internally consistent with the allocation of consumption to customer segments. The following subsections describe Lumidyne's approach to allocating electricity consumption to each customer segment and end use.

2.1.1 Residential Base Year

The richness of data available for the residential sector allowed a highly detailed *Base Year* calibration. In particular, the 2012 and 2017 FortisBC Residential End Use Surveys (REUSs) supplied sufficient information for Lumidyne to develop household counts and a bottoms-up accounting of equipment loads by residential customer segment.

The first step used trends between the 2012 and 2017 share of residential dwelling units by customer segment to extrapolate 2019 shares. After estimating the 2019 share of dwellings in each customer segment, Lumidyne split the 2019 actual total number of direct and indirect residential dwellings into counts by customer segment.

Next, the team developed a bottoms-up accounting of equipment loads. Figure 3 illustrates how this analysis used REUS equipment saturation and penetration survey results, REUS Conditional Demand Analysis' unit energy consumption (UEC) and EUI estimates, and other sources providing equipment efficiencies to calibrate segment-specific UEC and EUI.

Lumidyne performed a calibration with REUS data for all residential customer segments and MURBs (i.e., apartments and condominiums), and for both 2012 and 2017 REUS years. By evaluating both years, it was possible to identify trends in EUIs and overall consumption. The team extrapolated those trends to the 2019 *Base Year* to arrive at initial end use intensities for all residential customer segments and end uses.

Figure 3. Bottoms-Up Accounting of Equipment Loads for Single-Family Detached Homes for 2017

Equipment Type	End Use	Saturation (units/home)	Equipment Share (% of equipment)	Penetration (% of homes)	Efficiency or Intensity	Efficiency/Intensity Units	Estimated TTD (kWh/year-unit)	Estimated UEC (kWh/year-unit)	Estimated EUI (kWh/year-home)	CDA UEC (kWh/year-unit)	CDA EUI (kWh/year-home)
Forced air furnace	Primary Space Heating	Null	37.84%	11.13%	100%	%	7,608	7,608	847	Null	Null
Wired-in electric baseboards	Primary Space Heating	Null	25.14%	7.39%	100%	%	7,608	7,608	562	Null	Null
Heat pump - air source	Primary Space Heating	Null	25.48%	7.49%	200%	%	7,608	3,804	285	Null	Null
Heat pump - geothermal	Primary Space Heating	Null	4.08%	1.2%	300%	%	7,608	2,536	30	Null	Null
Wired-in electric wall heater (fan forced)	Primary Space Heating	Null	2.38%	0.7%	100%	%	7,608	7,608	53	Null	Null
Electric radiant heat (floors, walls, and/or ceilings)	Primary Space Heating	Null	2.38%	0.7%	100%	%	7,608	7,608	53	Null	Null
Portable electric heaters	Primary Space Heating	Null	2.72%	0.8%	100%	%	7,608	7,608	61	Null	Null
Segment/End Use Average	Primary Space Heating	Null	Null	28%	Null	Null	7,608	6,432	1,892	6,432	Null
Sector/End Use Average	Primary Space Heating	Null	Null	41%	Null	Null	5,924	5,117	1,767	4,749	1,934
Forced air furnace	Secondary Space Heating	Null	2.95%	1.41%	100%	%	1,664	1,664	23	Null	Null
Wired-in electric baseboards	Secondary Space Heating	Null	29.07%	13.9%	100%	%	1,664	1,664	231	Null	Null
Heat pump - air source	Secondary Space Heating	Null	15.9%	7.6%	200%	%	1,664	832	63	Null	Null
Heat pump - geothermal	Secondary Space Heating	Null	1.05%	0.5%	300%	%	1,664	555	3	Null	Null
Wired-in electric wall heater (fan forced)	Secondary Space Heating	Null	7.95%	3.8%	100%	%	1,664	1,664	63	Null	Null
Electric radiant heat (floors, walls, and/or ceilings)	Secondary Space Heating	Null	10.46%	5%	100%	%	1,664	1,664	83	Null	Null
Portable electric heaters	Secondary Space Heating	Null	32.63%	15.6%	100%	%	1,664	1,664	260	Null	Null
Segment/End Use Average	Secondary Space Heating	Null	Null	32%	Null	Null	1,664	1,520	727	1,520	Null
Sector/End Use Average	Secondary Space Heating	Null	Null	25%	Null	Null	1,425	1,325	557	1,427	361
Low Efficiency	Furnace Fan (Gas Furnace)	Null	64.13%	39.12%	100%	Relative Consumption ...	Null	184	72	Null	Null
High Efficiency	Furnace Fan (Gas Furnace)	Null	35.87%	21.88%	63%	Relative Consumption ...	Null	116	25	Null	Null
Segment/End Use Average	Furnace Fan (Gas Furnace)	Null	Null	61%	Null	Null	Null	159	97	159	Null
Sector/End Use Average	Furnace Fan (Gas Furnace)	Null	Null	49%	Null	Null	Null	175	80	163	81
Central air conditioner	Space Cooling	0.55	67.07%	53.4%	314.85%	%	2,688	854	456	Null	Null
Portable air conditioner	Space Cooling	0.11	13.41%	9.5%	234.47%	%	1,617	690	66	Null	Null
Room window air conditioner	Space Cooling	0.16	19.51%	11.5%	336.84%	%	1,617	480	55	Null	Null
Segment/End Use Average	Space Cooling	Null	Null	Null	Null	Null	2,335	759	577	Null	Null
Sector/End Use Average	Space Cooling	Null	Null	Null	Null	Null	2,061	672	531	Null	512
Segment/CentralAC Average	Space Cooling	Null	Null	53%	Null	Null	Null	854	456	854	Null
Sector/CentralAC Average	Space Cooling	Null	Null	28%	Null	Null	Null	783	381	774	367
Sector/Room-Portable Average	Space Cooling	Null	Null	47%	Null	Null	Null	515	150	515	145
Conventional storage tank	Water Heating	0.93	92.08%	46.28%	90%	%	2,739	3,043	1,408	Null	Null
On-demand (tankless)	Water Heating	0.04	3.96%	1.94%	99%	%	2,739	2,766	54	Null	Null
Combined space and water heater	Water Heating	0.03	2.97%	1.31%	99%	%	2,739	2,766	36	Null	Null
Hybrid heat pump heater (tank)	Water Heating	0.01	0.99%	0.47%	200%	%	2,739	1,369	6	Null	Null
Segment/End Use Average	Water Heating	Null	Null	50%	Null	Null	2,739	3,007	1,505	3,007	Null
Sector/End Use Average	Water Heating	Null	Null	41%	Null	Null	2,536	2,785	1,203	2,874	1,187

Source: Lumidyne

Note: Blue cells highlight where Lumidyne calibrated the CPR's estimated UECs to the REUS's Conditional Demand Analysis of UECs. This figure shows five of the eleven REUS end uses considered in the residential REUS calibration, and the six remaining end uses applied a similar approach.

The final step reconciled differences between 2019 actual electricity consumption for the residential sector and the implied consumption derived from initial residential EUI estimates and the customer segment dwelling counts. This final calibration applied a uniform scaling factor to all EUIs such that the CPR's total residential consumption matched the actual values. The final residential *Base Year* data appears in **Error! Not a valid bookmark self-reference.** and The total residential dwellings count decreased by 10 percent compared with the 2016 CPR, and residential consumption decreased by 15%. The change in dwellings stems from having better data from wholesale utilities, permitting more accuracy in assigning indirect customers to their respective sectors.

Table 3.

Table 2. Base Year 2019 Residential Housing Stocks and Annual Consumption (dwellings, GWh/year)

Customer Segment	Residential Dwellings	Consumption (GWh/year)
Single Family Detached	93,332	1,169
Single Family Attached/Row	14,926	122
Other Residential	8,575	81
Apartments <= 4 Storeys	35,270	276
Apartments > 4 Storeys	2,811	21
Total	154,914	1,669

Source: Lumidyne analysis of multiple data sources[10]

The total residential dwellings count decreased by 10 percent compared with the 2016 CPR, and residential consumption decreased by 15%. The change in dwellings stems from having better data from wholesale utilities, permitting more accuracy in assigning indirect customers to their respective sectors.

Table 3. Base Year 2019 Residential End Use Intensity (kWh/year-dwelling)

End Use	Single Family Detached	Single Family Attached/Row	Other Residential	Apartments <= 4 Storeys	Apartments > 4 Storeys	Weighted Average
Appliances	3,069	2,727	2,790	1,947	1,964	2,745
Electronics	1,076	478	534	778	784	915
Hot Water	1,459	859	1,410	468	434	1,154
Lighting	1,281	984	770	560	519	1,046
Other	1,275	386	696	989	574	1,080
Space Cooling	559	400	948	341	316	511
Space Heating	2,539	1,529	1,678	1,911	2,114	2,244
Ventilation	1,169	699	518	810	786	999
Totals	12,523	8,175	9,411	7,826	7,521	10,772

Source: Lumidyne analysis of multiple data sources[11]

Across customer segments and end uses, the total residential energy intensity decreased by 5.8 percent from the previous CPR. Less electricity consumption from lighting, electronics and space heating drove this reduction, though the reduction was partly offset by an increase in consumption from space cooling and ventilation.

2.1.2 Commercial Base Year

Calibration of the commercial sector started with the customer segment and end use data applied in the previous CPR. New information from the 2019 FortisBC Commercial End Use Study (CEUS) and Natural Resource

[10] Data sources include: FortisBC 2012 and 2017 REUS; FortisBC, Penticton, Nelson, Grand Forks and Summerland actual consumption and customer counts; and NRCan Comprehensive End Use Database.
[11] Data sources include: FortisBC 2012 and 2017 REUS; FortisBC, Penticton, Nelson, Grand Forks and Summerland actual consumption and customer counts; and NRCan Comprehensive End Use Database.

Canada's Comprehensive End Use Database (NRCan CEUD) informed updates to floor space estimates and end use intensities.

Next, Lumidyne identified FortisBC customers on industrial rates that corresponded to building types more typical of the commercial sector. These included colleges/universities, hospitals, hotels and public office buildings, so their actual 2019 consumption and floor space was added to the corresponding commercial customer segments. The team summed the 2019 actual consumption from direct and indirect commercial customers—including additions of commercial-like customers on industrial rates—to compare against the estimated consumption resulting from revised floor space and EUI data. A final scaling factor adjusted floor space estimates to ensure the *Base Year* consumption matched actual consumption at the sector level. Table 4 and Table 5 provide the commercial *Base Year's* floor space, annual consumption and end use intensities.

Table 4. Base Year 2019 Commercial Floor Space and Annual Consumption (1000m^2, GWh/year)

Customer Segment	Floor Space (1000m^2)	Consumption (GWh/year)
Accommodation	1,566	159
Colleges & Universities	264	46
Food Service	359	96
Hospital	215	43
Logistics & Warehouses	712	55
Long Term Care	391	42
Office	1,820	214
Other Commercial	2,066	187
Retail - Food	298	106
Retail - Non Food	1,991	217
Schools	595	45
Streetlights/Traffic Signals	NA	14
Totals	10,279	1,225

Source: Lumidyne analysis of multiple data sources[12]

Total commercial floor space estimates increased 45 percent relative to the previous CPR, and total commercial consumption increased 30 percent. The inclusion of commercial-like customers on industrial electric rates was one factor driving the increase. Another difference was the availability of sector-specific actual customer counts and consumption from wholesalers allowed Lumidyne to assign indirect load more accurately to the proper sectors.

[12] Data sources include: FortisBC 2015 and 2019 CEUS; FortisBC, Penticton, Nelson, Grand Forks and Summerland municipal utilities 2019 consumption and customer counts; NRCan Comprehensive End Use Database; and the 2016 CPR.

Table 5. Base Year 2019 Commercial End Use Intensity (MWh/1000m^2)

Customer Segment	Cooking	Hot Water	HVAC Fans/Pumps	Lighting	Office Equipment	Other	Refrigeration	Space Cooling	Space Heating	Totals
Accommodation	0.8	3.2	24.0	45.8	8.3	7.5	1.5	6.9	3.9	101.9
Colleges & Universities	1.2	3.9	64.4	70.2	11.5	10.5	1.1	5.4	4.5	172.8
Food Service	11.4	23.3	47.3	86.9	1.0	43.1	10.3	38.8	5.7	267.8
Hospital	3.0	0.3	56.5	63.9	3.2	49.7	2.3	13.1	9.5	201.5
Logistics & Warehouses	0.4	1.2	10.6	36.1	1.5	16.2	6.3	2.9	2.5	77.6
Long Term Care	2.4	3.3	27.4	43.9	2.3	10.1	2.1	4.9	11.9	108.2
Office	0.4	2.0	33.1	49.7	8.1	12.9	0.4	9.1	2.0	117.8
Other Commercial	0.3	1.8	35.2	27.2	0.6	8.0	11.2	4.0	2.1	90.4
Retail - Food	1.4	3.2	34.4	98.2	0.1	23.8	187.3	5.0	1.0	354.4
Retail - Non Food	0.4	0.9	17.0	58.4	1.9	21.4	0.7	6.1	2.1	108.9
Schools	0.5	0.5	20.3	32.4	1.9	15.0	0.1	2.7	2.5	75.9
Weighted Average	1.0	2.6	28.3	47.6	3.9	15.1	9.1	7.1	3.1	117.8

Source: Lumidyne analysis of multiple data sources[13]

Across all commercial segments and end uses, total commercial energy intensity decreased 9.5 percent. Lighting and "other" end uses were responsible for most of the decrease. Space cooling was the only end use that increased, with a gain of 8.8 percent.

2.1.3 Industrial Base Year

Development of the industrial *Base Year* profited from detailed data on actual industrial customer consumption by industry type. Lumidyne mapped this information to the CPR's industrial customer segments for both direct and indirect customers. The final segment-specific industrial consumption excluded commercial-like customers on industrial electric rates whose consumption was re-allocated to commercial segments. Importantly, the analysis' industrial consumption does not subtract electricity that Kraft Pulp and Paper customers offset through self-generation. The team did not exclude self-generation because a portion of those customers' consumption is eligible for FortisBC DSM programs.

The second step allocated industrial consumption to end uses, relying largely on the previous CPR's end use allocations. Actual FortisBC DSM program data highlighted end uses whose consumption was likely to have changed since the last CPR. Accordingly, Lumidyne adjusted those end uses to reflect expected end use consumption in 2019, while ensuring that totals across end uses matched the 2019 segment-level consumption. Table 6 shows the final industrial *Base Year* consumption data.

[13] Data sources include: FortisBC 2015 and 2019 CEUS; FortisBC, Penticton, Nelson, Grand Forks and Summerland actual consumption and customer counts; NRCan Comprehensive End Use Database; and FortisBC's 2016 CPR.

Table 6. Base Year 2019 Industrial Consumption (GWh/year)

End Use	Agriculture	Cannabis	Food & Beverage	Manufacturing	Pulp & Paper - Kraft	Wood Products	Other Industrial	Totals
Compressed Air	5.3	0.0	0.9	8.0	14.6	18.6	12.7	60.1
Fans & Blowers	8.6	0.0	0.9	10.7	54.8	25.1	17.1	117.1
Industrial Process	1.6	0.0	2.3	29.4	136.0	65.8	46.7	281.7
Lighting	15.4	0.0	2.4	19.2	6.8	8.3	30.5	82.6
Material Transport	1.1	0.0	0.1	2.5	7.4	17.2	4.0	32.3
Product Drying	0.0	0.0	0.0	0.0	0.0	8.4	0.0	8.4
Pumps	11.8	0.0	1.0	4.8	146.0	0.4	7.6	171.5
Refrigeration	8.0	0.0	4.2	1.0	0.0	0.5	1.6	15.3
Space Heating	0.5	0.0	0.4	7.2	0.0	3.1	11.5	22.7
Totals	52.3	0.0	12.1	82.8	365.5	147.3	131.7	791.7

Source: Lumidyne analysis of multiple data sources[14]

Note: There were no industrial Cannabis customers in FortisBC's territory in 2019, but the Reference Case included forecast consumption from this customer segment.

Relative to the last CPR, this analysis did not include consumption from "Oil & Gas" and "Metal Mining" customer segments because FortisBC no longer served those customers. This study also moved consumption from commercial-like customers on large electric power rates into the commercial sector's consumption. Customer segments that experienced increases in consumption were "Agriculture" and "Other Industrial", where data centres, including cryptocurrency mining, spurred significant growth in "Other Industrial". On net across the industrial sector, this CPR found a 9.5 percent decrease in consumption.

2.2 Reference Case Forecast

The *Reference Case* is a forecast of consumption-related indicators from 2020 through 2040 that uses the 2019 *Base Year* as the starting point for forecast changes in the market. All indicators from the *Base Year*—such as building stocks, end use intensities, and annual consumption—and the addition of industrial output activity have associated forecasts in the *Reference Case*.

In brief, the *Reference Case* stems from actual 2019 consumption captured by the *Base Year*, follows FortisBC's 2021 Long Term Electric Resource Plan's (LTERP's) sector-level consumption forecast, and includes observed trends in EUIs from multiple data sources. Since the *Reference Case* forms the scaling basis for per-measure savings, the team carefully developed the *Reference Case* to create a solid foundation for savings potential estimates.

The following sections further describe each sector's *Reference Case*.

2.2.1 Residential Reference Case

The residential *Reference Case* began with total direct and indirect customer counts, to which the team applied forecast customer growth rates from FortisBC's 2021 LTERP. Lumidyne used segment-specific growth trends appearing in the 2012 and 2017 REUSs to temporally modify the *Base Year's* allocation of customers among

[14] Data sources include: FortisBC, Penticton, Nelson, Grand Forks and Summerland actual consumption; FortisBC actual DSM program data; and FortisBC's 2016 CPR.

customer segments. The resulting forecast of shares of customers by segment provided a method for allocating total residential customer counts to each customer segment—as shown in Table 7—while maintaining the same sector-wide growth rate as the LTERP.

Table 7. Residential Housing Stock Forecast (dwellings)

Customer Segment	2020	2025	2030	2035	2040
Apartments <= 4 Storeys	35,852	39,352	42,253	44,502	46,236
Apartments > 4 Storeys	2,857	3,136	3,367	3,546	3,685
Other Residential	8,585	8,702	8,871	9,051	9,222
Single Family Attached/Row	15,194	16,840	18,228	19,306	20,131
Single Family Detached	93,617	95,787	98,234	100,595	102,723
Total	156,105	163,818	170,953	177,000	181,996

Source: Lumidyne analysis of multiple data sources[15]

The forecast showed apartments and single-family detached homes growing faster than other segments. Given the lower energy intensity of these dwelling types, the change in the shares of dwelling types would lead to lower average residential household consumption—even if EUI's did not change over time.

To estimate trends in residential EUI's, the team again relied on trends observed in the 2012 and 2017 REUSs. The analysis converted the trends into expected annual rates of change and used the rates to modify the *Base Year's* EUIs over time. Multiplication of the housing stock and EUI forecasts resulted in the consumption forecasts shown in Table 8.

Table 8. Residential Consumption Forecast (GWh/year)

Customer Segment	2020	2025	2030	2035	2040
Apartments <= 4 Storeys	278	305	328	347	361
Apartments > 4 Storeys	21	24	25	27	28
Other Residential	82	82	84	86	88
Single Family Attached/Row	125	137	149	158	165
Single Family Detached	1,167	1,182	1,209	1,237	1,264
Total	1,674	1,730	1,795	1,854	1,906

Source: Lumidyne analysis of multiple data sources[16]

Embedded in the residential consumption forecast were time-changing EUIs, which declined by a little over 3 percent from 2020 to 2040, when averaged across end uses and customer segments. Although the analysis found that lighting energy intensities were quickly decreasing, there was nearly an equal increase in space cooling and electronics intensities. Over the forecast period, total residential consumption increased by almost 14 percent.

It is worth noting that the residential sector was the only sector for which the team chose not to directly calibrate *Reference Case* consumption with the LTERP's consumption forecasts. Lumidyne took this approach because the analysis made use of well-informed and plausible trajectories for EUIs and customer shares among segments—which created a reliable and internally-consistent framework for estimating residential consumption at a granular level. To gauge the impact of this decision, the team compared the CPR's consumption forecast for residential direct customers to the LTERP's and found that the CPR's 2040 residential consumption was about 8

[15] Data sources include: FortisBC's 2012 and 2017 Residential End Use Surveys; NRCan's CEUD; FortisBC's 2021 LTERP; and FortisBC's 2017/2018 CPR.
[16] Data sources include: FortisBC's 2012 and 2017 Residential End Use Surveys; NRCan's CEUD; FortisBC's 2021 LTERP; and FortisBC's 2017/2018 CPR.

percent higher than the LTERP. This difference stemmed from the LTERP's implication that EUIs would decrease faster than the CPR's in the near term.

2.2.2 Commercial Reference Case

The study used NRCan CEUD data and insights about long-term trends identified in the 2016 CPR to estimate annual rates of change for the commercial *Reference Case*'s EUIs and floor space. The team applied the rates of change to the commercial *Base Year*'s values to develop forecasts of segment-specific EUIs and floor space. Multiplying these forecasts generated an uncalibrated forecast of consumption. After temporarily removing consumption from indirect customers and commercial-like customers on industrial rates, the team compared the resulting uncalibrated consumption to the LTERP's consumption forecast. To align the two consumption forecasts at the sector-level, Lumidyne uniformly applied scaling factors to all customer segment's floor space estimates. The same floor space scaling factors were then applied to indirect customers and commercial-like customers on industrial rates. The final commercial building stock and consumption forecasts are shown in Table 9 and Table 10, respectively.

Table 9. Commercial Floor Space Forecast (1000 m^2)

Customer Segment	2020	2025	2030	2035	2040
Accommodation	1,579	1,937	2,228	2,533	2,865
Colleges & Universities	266	320	362	406	452
Food Service	361	434	490	547	608
Hospital	218	270	314	360	411
Logistics & Warehouses	703	773	799	816	830
Long Term Care	399	524	642	773	925
Office	1,818	2,118	2,317	2,509	2,702
Other Commercial	2,059	2,369	2,561	2,740	2,915
Retail - Food	296	337	360	381	402
Retail - Non Food	1,973	2,192	2,295	2,387	2,470
Schools	595	693	760	828	897
Total Floor Space	**10,267**	**11,966**	**13,128**	**14,279**	**15,475**
Streetlights/Traffic Signals*	1.03	1.14	1.22	1.30	1.37

Source: Lumidyne analysis of multiple data sources[17]

**Data for Streetlights/Traffic Signals represent a dimensionless growth indicator.*

Long term care, hospitals and accommodation segments grew at the fastest rates, which coincided with expectations related to age demographics in FortisBC's service territory. Across all segments, the commercial floor space grew 50 percent during the 20-year forecast.

[17] Data sources include: FortisBC's 2015 and 2019 Commercial End Use Surveys; NRCan's CEUD; FortisBC's 2021 LTERP; and FortisBC's 2017/2018 CPR.

Table 10. Commercial Consumption Forecast (GWh/year)

Customer Segment	2020	2025	2030	2035	2040
Accommodation	158	184	206	228	254
Colleges & Universities	45	52	57	62	68
Food Service	96	111	123	136	150
Hospital	43	51	57	64	72
Logistics & Warehouses	54	56	56	56	56
Long Term Care	42	52	61	71	82
Office	212	239	257	276	295
Other Commercial	184	204	217	229	242
Retail - Food	103	108	110	111	113
Retail - Non Food	211	220	221	223	225
Schools	44	49	51	54	57
Streetlights/Traffic Signals	14	14	14	14	14
Total	1,207	1,341	1,430	1,525	1,629

Source: Lumidyne analysis of multiple data sources[18]

Across all customer segments and end use, the electric energy intensity of the commercial sector decreased by 10 percent from 2020 to 2040. Lighting, “other”, and refrigeration end uses drove most of the reduction, despite being partly offset by increasing energy intensity of HVAC fans/pumps and space cooling end uses. Total commercial consumption increased by 35% throughout the forecast horizon.

2.2.3 Industrial Reference Case

FortisBC provided Lumidyne with short term industrial consumption forecasts by customer that extended through 2024. Additionally, the FortisBC LTERP included industrial output indicators through 2040. The combination of this data allowed Lumidyne to grow the short-term forecasts according to the industrial output indicators, which resulted in LTERP-calibrated consumption forecasts by industrial customer segment.

Next, the team adjusted the industrial *Base Year’s* allocations of consumption by end use to reflect expectations about time-changing end use intensities. Lastly, a scaling of the industrial output indicators ensured that the resulting consumption forecast appropriately captured changes in end use allocations and aligned with the LTERP consumption. Table 11 and Table 12 show the final industrial output indicators and consumption forecasts.

[18] Data sources include: FortisBC’s 2015 and 2019 Commercial End Use Surveys; NRCan’s CEUD; FortisBC’s 2021 LTERP; and FortisBC’s 2016 CPR.

Table 11. Industrial Output Indicators (dimensionless)

Customer Segment	2020	2025	2030	2035	2040
Agriculture	1.01	1.07	1.14	1.22	1.31
Food & Beverage	1.01	1.04	1.14	1.25	1.38
Manufacturing	1.02	1.05	1.13	1.23	1.34
Other Industrial*	0.83	1.09	1.21	1.33	1.45
Pulp & Paper - Kraft	0.99	0.98	0.96	0.92	0.88
Wood Products	1.06	1.14	1.08	1.02	0.97
Cannabis**	2.7	23.8	25.4	26.9	28.4

Source: Lumidyne analysis of multiple data sources[19]

**Note: Other Industrial includes data centers and cryptocurrency mining.*
***Note: data for Cannabis represent floor space in 1000 m^2.*

Table 12. Industrial Consumption Forecast (GWh/year)

Customer Segment	2020	2025	2030	2035	2040
Agriculture	53	54	57	60	63
Food & Beverage	12	12	13	15	16
Cannabis	10	83	86	89	92
Manufacturing	84	85	90	97	104
Other Industrial	109	141	153	166	179
Pulp & Paper - Kraft	361	359	349	336	321
Wood Products	155	167	158	149	140
Total	784	901	906	910	915

Source: Lumidyne analysis of multiple data sources[20]

Consumption in the cannabis and the "other industrial" segments grew fastest, with the expectation of acquiring a single large customer in the "other industrial" segment driving a significant amount of that growth. Conversely, consumption from wood-related segments declined. The total industrial consumption increased 17% during the forecast period.

To conclude this section on the *Reference Case*, it is worth noting that there was less than 1 percent difference in total 2040 consumption between the CPR and the LTERP—when normalized for self-generation, losses, electric vehicle consumption and planned DSM savings. However, the CPR's consumption forecasts were not perfectly aligned with the LTERP at the sector level. The key drivers for sector-level differences were as follows:

- The LTERP data did not specify the sector for indirect customers' consumption, so the CPR allocated 2019 indirect consumption to each sector—based on wholesale utilities' actual sector-specific consumption—and grew it according to each sector and segment's respective growth trajectory.
- The CPR intentionally allowed the residential forecast to differ from the LTERP because reliable end use intensity and housing stock data were available at a granular level.
- The CPR removed commercial-like customers on large power electric rates from the industrial sector and added them to the commercial sector.

2.3 Monthly Savings Profiles & Peak-Coincidence Factors

To provide FortisBC with more visibility into the timing of savings, Lumidyne generated monthly energy savings profiles and differentiated demand savings for summer and winter peak coincidence. The analysis used measured

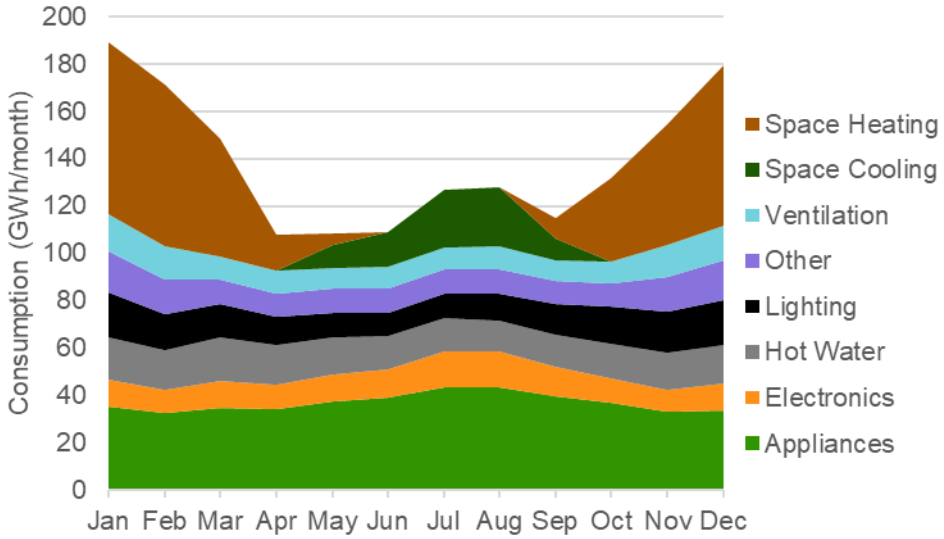
[19] Data sources include: FortisBC's 2021 LTERP; NRCan's CEUD; and FortisBC's 2017/2018 CPR.
[20] Data sources include: FortisBC's 2021 LTERP; NRCan's CEUD; and FortisBC's 2017/2018 CPR.

and simulated hourly load profiles for dozens of customer segments and end uses from similar climate zones to construct a bottoms-up representation of hourly loads. The team scaled the hourly end use profiles to align with the *Base Year's* annual energy consumption by end use and customer segment. Next, Lumidyne aggregated the hourly loads to the sector level and calibrated them against each sector's 2019 actual monthly consumption. This process included steps to keep the monthly relationships between average daily temperature and space heating and cooling loads, and it preserved the relationship between hours of daylight and lighting loads.

After calibrating all customer segment and end use hourly load shapes, the team aggregated the load estimates to the system level and compared it with FortisBC's systemwide actual 2019 hourly load. This validation exercise confirmed that there was sufficient alignment—in diurnal load shapes and summer and winter peak coincidence—between the aggregated load shape estimates and actual hourly load. The output from this analysis is monthly allocation factors for energy savings (expressed as the percentage of annual savings occurring in each month) and peak-coincident demand factors (expressed as kW of summer or winter peak savings per kWh/year of energy savings). Multiplication of these factors by the study's annual energy savings potential provides insight into the timing of energy savings and the associated peak demand savings.

Figure 4 illustrates the *Base Year's* residential monthly consumption by end use. Of all sectors, the residential sector showed the most seasonal variability, with winter space heating loads playing the largest role in the variability.

Figure 4. Base Year 2019 Residential Monthly Consumption Shape by End Use (GWh/month)

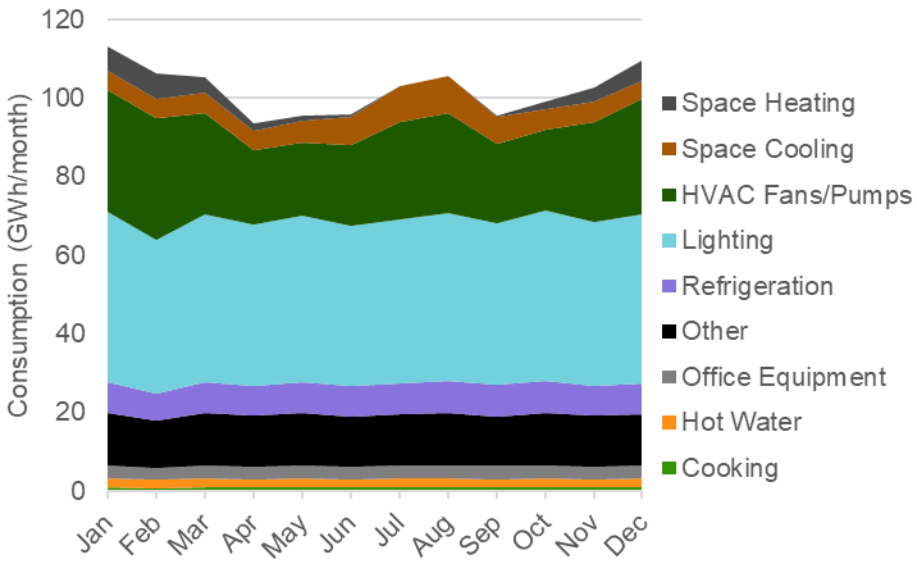


Source: Lumidyne analysis of multiple data sources[21]

[21] Data sources include: FortisBC 2019 actual consumption by month; all sources listed for residential *Base Year* analysis; California Investor Owned Utility Load Shapes, accessible at https://ww2.energy.ca.gov/2019publications/CEC-500-2019-046/CEC-500-2019-046.pdf; and US Department of Energy Reference Building Models, accessible at https://openei.org/doe-opendata/dataset/commercial-and-residential-hourly-load-profiles-for-all-tmy3-locations-in-the-united-states.

For the commercial sector, Figure 5 shows that the difference between summer and winter consumption was appreciably smaller than the residential sector. Additionally, the figure highlights the large contribution from commercial lighting.

Figure 5. Base Year 2019 Commercial Monthly Consumption Shape by End Use (GWh/month)

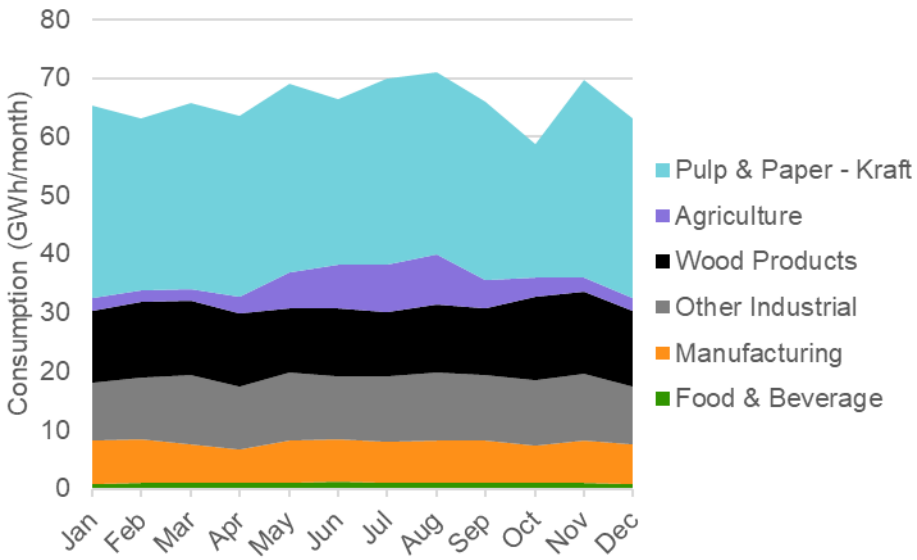


Source: Lumidyne analysis of multiple data sources[22]

[22] Data sources include: FortisBC 2019 actual consumption by month; all sources listed for commercial *Base Year* analysis; California Investor Owned Utility Load Shapes, accessible at https://ww2.energy.ca.gov/2019publications/CEC-500-2019-046/CEC-500-2019-046.pdf; and US Department of Energy Reference Building Models, accessible at https://openei.org/doe-opendata/dataset/commercial-and-residential-hourly-load-profiles-for-all-tmy3-locations-in-the-united-states.

Viewing the industrial sector's *Base Year* monthly consumption by customer segment provides insight into the various industries' roles in overall consumption. Figure 6 shows that industrial consumption was relatively flat across seasons. The drop in October may have been an operational anomaly that occurred in 2019 in the pulp and paper segment. Notably, the consumption from this segment is prior to reductions from self-generated electricity, and thus it does not reflect the net load that FortisBC served.

Figure 6. Base Year 2019 Industrial Monthly Consumption Shape by Customer Segment (GWh/month)



Source: Lumidyne analysis of multiple data sources[23]

2.4 Measure Characterization

The study considered 167 distinct conservation measures, most of which were further differentiated and tailored to their applicable customer segments. The measures pertain to 24 customer segments and 19 end uses, resulting in 973 measure-and-segment combinations. Table 13 provides a list of the key parameters that the CPR considered for each measure.

Table 13. Key Measure Characterization Parameters

Parameter (units)	Description	Examples
Efficient measure	description of efficient measure	heat pump storage water heater (2.0 EF)
Baseline measure	description of baseline measure	electric storage water heater (0.9 EF)
Replacement type	applicable installation type	retrofit (RET), replace-on-burnout only (ROB), new construction only (NEW), ROB & NEW

[23] Data sources include: FortisBC 2019 actual consumption by month; all sources listed for industrial *Base Year* analysis; California Investor Owned Utility Load Shapes, accessible at https://ww2.energy.ca.gov/2019publications/CEC-500-2019-046/CEC-500-2019-046.pdf; and US Department of Energy Reference Building Models, accessible at https://openei.org/doe-opendata/dataset/commercial-and-residential-hourly-load-profiles-for-all-tmy3-locations-in-the-united-states.

Parameter (units)	Description	Examples
Unit basis	unit of measurement for savings, costs and saturation	lamp, refrigerator, home, 1000m^2, kWh of measure consumption, kWh of end use consumption, etc.
Scaling basis	type of forecast used to scale per-unit savings across applicable customers	Nº of homes, 1000m^2, kWh/year of end use consumption, kWh/year of customer segment consumption
End use category	applicable end use category	space heating, lighting, hot water, etc.
Customer segment	applicable customer segment	offices, apartments, agriculture, etc.
Sector	applicable sector	residential, commercial, industrial, street lighting
Competition group	group name for 2 or more efficient measures competing for the same baseline replacement	water heaters, reflector lamps, general service lamps, compressors, etc.
Efficient lifetime (years)	expected useful life of the efficient measure	10 years
Baseline lifetime (years)	expected useful life of the baseline measure	10 years
Remaining useful life (years)	expected life remaining for functioning measures that can be retrofit	4 years
Efficient cost ($/unit basis)	cost of the efficient measure per unit basis, or the incremental cost if the baseline cost is not readily available	$2/lamp, $2000/heat pump, $100/home, $1.50/kWh of end use consumption, etc.
Baseline cost ($/unit basis)	cost of the baseline measure per unit basis, which is always zero for retrofit measures	$1/lamp, $1000/heater, $80/home, $1.10/kWh of end use consumption, etc.
Efficient electricity consumption (kWh/year-unit basis)	annual electricity consumption of efficient measure per unit basis	5 kWh/yr-lamp, 2300 kWh/yr-heat pump, 500 kWh/yr-home, 0.8 kWh/yr per kWh/yr of customer segment consumption, etc.
Baseline electricity consumption (kWh/year-unit basis)	annual electricity consumption of baseline measure per unit basis	18 kWh/yr-lamp, 3000 kWh/yr-heater, 900 kWh/yr-home, 1 kWh/yr per kWh/yr of customer segment consumption, etc.
Efficient electric peak-coincident demand (kW/unit basis)	peak-coincident demand of efficient measure per unit basis, derived from load shape analysis	0.02 kW/lamp, 3 kW/heat pump, 2 kW/home, 0.001 kW per kWh/yr of customer segment consumption, etc.
Baseline electric peak-coincident demand (kW/unit basis)	peak-coincident demand of baseline measure per unit basis, derived from load shape analysis	0.04 kW/lamp, 4 kW/heater, 3 kW/home, 0.003 kW per kWh/yr of customer segment consumption, etc.
Efficient gas consumption (MJ/year-unit basis)	annual indirect gas consumption of efficient measure per unit basis, for interactive effects	800 MJ/yr-home, 950 MJ/yr-1000m^2, etc.
Baseline gas consumption (MJ/year-unit basis)	annual indirect gas consumption of baseline measure per unit basis, for interactive effects	820 MJ/yr-home, 1000 MJ/yr-1000m^2, etc.
Total efficient + baseline saturation (unit basis/scaling basis)	saturation/prevalence of relevant equipment per scaling basis	40 lamps/home, 1.2 refrigerator/home, 0.3 kWh/yr of measure consumption per kWh/yr of end use consumption.
Technical suitability (%)	percentage of baseline measures technically suitable for replacement by efficient measures	75%
Initial efficient penetration (%)	percentage of equipment that is the efficient measure in forecast's start year	20%
Initial baseline penetration (%)	percentage of equipment that is the baseline measure in forecast's start year	80%

Source: Lumidyne

Section 1.2 has already described the measures that this study removed relative to the last CPR, so the remainder of this section describes the new cannabis and BC Energy Step Code measures.

Cannabis Measures

To address the expectation of significant growth in the cannabis market, the team performed a literature review on the cannabis industry to understand the main drivers of energy consumption and to characterize measures with the best savings potential. The review clarified that there are appreciable differences between growing facilities using warehouses versus those using greenhouses. Greenhouses tend to be significantly larger, and British Columbia surveys suggested greenhouses had six to fifty-five times as much floor space as warehouses. The team estimated that, on average, warehouse's end use intensity per square-meter of floor space was 54 percent higher than greenhouses. FortisBC anticipated that warehouse-based growing facilities would likely represent about 90 percent of cannabis electricity consumption, with greenhouses making up the remaining 10 percent. An estimate of composite end use intensities, as shown in Table 14, helped the analysts focus their attention on the biggest loads.

Table 14. Cannabis End Use Intensity in 2019 Base Year (MWh/1000m^2)

End Use	EUI
Air Conditioning	184
CO2 Injection	55
Drying	54
Lighting	1,348
Space Heat	758
Ventilation & Dehumidification	1,100
Water Handling	103
Total	3,602

Source: Lumidyne analysis of multiple sources[24]

Relying on the end use intensities, the study identified lighting, space heating/cooling, dehumidification as the best opportunities for energy savings. The team addressed these high consumption end uses by characterizing three new measures, and descriptions of each are presented in Table 15.

[24] References considered in the literature review and cannabis analysis were: American Council for and Energy-Efficient Economy, Trends and Observations of Energy Use in the Cannabis Industry, 2017; BOTEC Analysis Corporation & UC Berkeley, Environmental Risks and Opportunities in Cannabis Cultivation, 2013; Cube Resources, Boulder County Energy Impact Offset Fund (BCEIOF) Demand Side Management Study Phase 1, 2018; Desert Aire, Application Note 27, HVAC Systems and Grow Room Energy Usage, 2019; Mills, E. 2012. "The Carbon Footprint of Indoor Cannabis Production." Energy Policy 46: 58–67; New Frontier Data, The 2018 Cannabis Energy Report; Northwest Power and Conservation Council, Electric Seventh Power Plan - Appendix E: Demand Forecast, 2016.

Table 15. Cannabis Measures

End Use	Efficient Measure	Baseline Measure
Lighting	LED Composite of: LED 630W, 1850 PPF, 1.75 PPE Grow Light Canopy LED 645W, 1550 PPF, 2.46 PPE Grow Light Canopy	High Pressure Sodium 1000 W Double-Ended
Space Heating/ Air Conditioning	High-Efficiency Ductless Split-System Heat Pump/Air Conditioning Unit	Standard Practice Composite of: Air Cooled Chiller Packaged Terminal Air Conditioner Rooftop HVAC Unit Split System Window Units
Dehumidification	ENERGY STAR Portable Dehumidifier 3.3 L/kWh	Standard Portable Dehumidifier 2.8 L/kWh

Source: Lumidyne

The team characterized non-lighting cannabis measures to only be applicable to warehouse facilities that did not include an integrated HVAC and dehumidification system. The research suggested larger facilities would likely use integrated HVAC and dehumidification systems that would be more efficient and provide fewer savings opportunities.

BC Energy Step Codes

The Province of British Columbia established the BC Energy Step Code to provide a performance-based approach to ensuring new buildings meet efficiency targets. The codes provide builders with more flexibility in building design, rather than prescribing minimum efficiency levels of specific building equipment and systems.[25] FortisBC requested that Lumidyne model the impact of these Step Codes in lieu of several measures included in the last CPR: ENERGY STAR home, R-2000 Standard home, passive house, net-zero home, and apartment new construction 30% above code. The customer segments impacted by the BC Energy Step Code can be split into two categories: residential occupancies (Part 9) and commercial occupancies (Part 3). Residential buildings include single-family detached, single-family attached and low-rise apartments. Part 3 buildings include high-rise apartments, hotels, offices, and retail. While not all commercial buildings are currently subject to the BC Energy Step Code, those excluded segments have equivalent Steps based on their savings compared with the BC Building Code.

Though there are targeted compliance dates for the various steps, there was—at the time of this analysis—much uncertainty about when local jurisdictions would adopt the codes and whether compliance would be strongly enforced. Accordingly, the team extended the compliance dates by five years to account for any lag time. Upon a modelled compliance year, the potential analysis updated the minimum code baseline to reflect the newly enacted Step Code level, which implied that lower-level Step Codes could no longer generate additional market potential.

[25] Information about BC Energy Step Codes can be accessed at: https://energystepcode.ca/.

Savings estimates for the Step Code measures relied on FortisBC's residential analysis and a large database of simulated performance for various commercial Step Code configurations.[26] Lumidyne chose commercial Step Code configurations that focused primarily on electric savings and had the best economics for each level of the Step Codes. Table 16 shows the modelled saving as a percentage of electricity consumption from baseline new construction relying heavily on electric appliances and systems. Additionally, the table provides the modelled compliance years.

Table 16. BC Energy Step Code Measures

Sector	Step Code Level	Approx. Savings %	Applied Compliance Year
Residential	Step 2	2%	NA
Residential	Step 3	10-20%	2027
Residential	Step 4	40%	2032
Residential	Step 5	60%	2037
Commercial	Step 2	10-20%	NA
Commercial	Step 3	20-30%	2027
Commercial*	Step 4	40-45%	2032

Source: Lumidyne

**Commercial Step Code 4 only applies to Accommodation and Apartments.*

Lastly, the team implemented many updates to the CPR's other measure characterizations to account for current equipment saturation and penetration levels, end use intensities, costs and efficiency levels. Sources for these updates include FortisBC program evaluation data, end use surveys, literature review, market research and the *Base Year* analysis. Notably, the team updated most commercial lighting measures to reflect recent cost and savings estimates from FortisBC program evaluation data.

2.5 Estimation of Savings Potential

The study estimated electric energy savings and electric summer/winter peak demand savings, along with gas energy savings for dual-fuel measures and measures having interactive effects with gas-consuming end uses. For each CPR measure, the analysis calculated technical, economic, and market potential. The remainder of this section describes the approach to estimating all forms of savings potential.

2.5.1 Technical Potential

Technical potential is the hypothetical savings when each CPR measure immediately replaces its corresponding low-efficiency or minimum-code baseline measure wherever it is technically feasible. Not all baseline measures are technically suitable for an efficient replacement. For example, the ground-source heat pumps' ability to replace electric furnaces is significantly constrained by the availability of land that can be used for a ground-loop heat exchanger. In comparison, an air-source heat pump has higher technical suitability for electric furnace replacements. In situations where two or more efficient measures compete for the same baseline replacement, the measure that offers the most total savings potential appears in the technical potential. Thus, using the air-source versus ground-source heat pump example, the air source heat pump's technical potential might be larger than the ground-source heat pump's potential, despite the ground-source heat pump's higher efficiency. As such,

[26] The Step Code database was a product of BC Housing's "2018 Metrics Research: Full Report Update." The report is accessible at: https://www.bchousing.org/research-centre/library/residential-design-construction/energy-step-code-2018-full-report.

only the savings from the air-source heat pump would be included in the technical potential. This approach ensures that savings from competing CPR measures are not double counted.

Furthermore, technical potential ignores stock turnover dynamics that delay potential from replace-on-burnout (ROB) measures, which in practice are only replaced upon failure of the baseline equipment. Instead, technical potential treats ROB measures like retrofit measures that can be replaced immediately regardless of operating status. For new construction measures, technical potential is only realized in years when new buildings are constructed in a given customer segment.

2.5.2 Economic Potential

Economic potential is the subset of CPR measure that have a benefit-cost ratio of 1.0 or higher. Like technical potential, when two or more economic measures compete for the same baseline replacement, the economic potential only includes the competing measure that offers the most economic savings. Economic potential also ignores stock turnover dynamics of ROB measures.

Commercial and industrial economic potential used a total resource cost (TRC) benefit-cost ratio for economic screening, while residential potential used a modified total resource cost (mTRC) benefit-cost ratio. The mTRC is similar to the TRC, except that it includes a 15 percent increase to avoided costs. The 15 percent increase in avoided costs captures non-energy benefits, as allowed by British Columbia DSM Regulation.[27] Equation 1 shows the formulas that the analysis applied for each cost test.

Equation 1. Benefit-Cost Tests for Economic Measure Screening

Sector	Benefit-Cost Ratio
Commercial* & Industrial	$TRC = \frac{NPV(DiscountRate,\ AvoidedCost_{year} + OMSavings_{year})}{NPV(DiscountRate,\ IncrementalCost_{year})}$
Residential	$mTRC = \frac{NPV(DiscountRate,\ AvoidedCost_{year} * 115\% + O\&MSavings_{year})}{NPV(DiscountRate,\ IncrementalCost_{year})}$

**MURBs were treated as commercial customer segments.*

Where…

TRC: the benefit-cost ratio for the Total Resource Cost test

$mTRC$: the benefit cost ratio for the modified Total Resource Cost test

$NPV()$: the net present value formula that sums discounted cash flows over time

$DiscountRate$: the discount rate applied to future cash flows

$AvoidedCost$: FortisBC's avoided energy and demand costs generated through conservation

$O\&MSavings$: operating and maintenance cost savings from installation of efficient measures

$IncrementalCost$: the efficient measure's incremental equipment cost relative to the baseline measure

$year$: each year of the measure's expected useful life

[27] Under British Columbia Utilities Commission DSM Regulation s4.(1.1)(c), the modified total resource cost rules allow for a 15 percent increase for non-energy benefits, up to a limit of 10 percent of the electric DSM portfolio expenditure.

The economic screening used cost tests that excluded program administrative costs because measure-specific administrative costs are difficult to assess. It is generally more insightful to include administrative costs when evaluating aggregate cost effectiveness for an entire program or sector, as is done in Section 3.3, rather than burdening measure-level cost effectiveness with uncertain administrative costs. Additionally, measure-specific administrative costs are highly dependent on program implementation, which is outside the scope of this study.

2.5.3 Market Potential

Market potential is the focus of this report because it incorporates barriers to adoption stemming from delays in stock turnover, customers' awareness and willingness to adopt, and substitutive effects among efficient measures serving the same application. This section's discussion on market potential covers:

- Customer adoption dynamics
- Treatment of behavioural measures
- Approach to incentivizing measures
- Accounting of utility spending
- Treatment of re-participation
- Calibration of market potential

2.5.3.1 Adoption Dynamics

Market potential is a subset of economic potential, and its intent is to capture real-world dynamics influencing measure adoption. For example, equipment turnover of replace-on-burnout measures constrains the market potential by limiting the opportunities for replacing failed inefficient equipment with efficient equipment. Market potential requires customer awareness and familiarity with efficient measures before adoption occurs. Lastly, relative economic attractiveness—after considering utility bill savings, incremental costs, operation and maintenance costs, and incentives—among high- and low-efficiency measures influences customers' purchasing decisions that drive market potential.

In contrast with technical and economic potential, market potential accounts for equipment turnover over time in the calculation of replace-on-burnout potential. Measure lifetimes dictate the rates at which measures fail and are eligible for replacement. If failed equipment is replaced by baseline-efficiency equipment, then, on average, that replacement is not eligible for another replacement until the replacement's lifetime has expired. This coincides with the conservation industry referring to ROB measures as being "lost opportunity" measures.

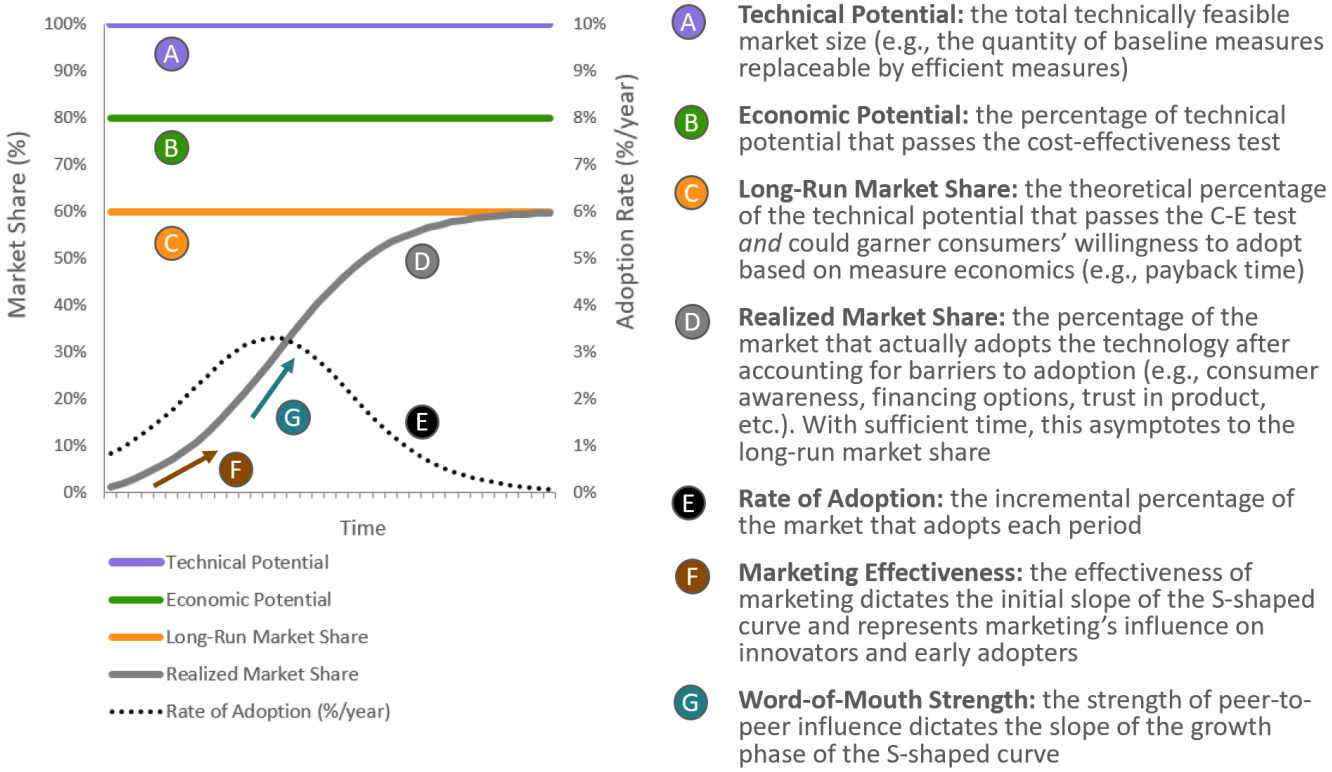
Market potential relies on payback acceptance curves to estimate the percentage of customers who would be willing to adopt a high-efficiency measure based entirely on economic payback. When two or more efficient measures compete for the same baseline replacement, the relative economics of each measure determines each measure's share of the total replacements. This approach allows a mix of efficient measures to replace the same baseline measure, which is more robust than the technical and economic potentials' approach of selecting a single efficient measure. Since the payback curves do not account for non-economic barriers to adoption, the resulting percentage of willing customers represents what could be achieved in the long run after market barriers are removed. This long-run market potential is the upper bound on market savings—and determining how quickly the market can reach that upper bound is where product diffusion models provide insight.

The analysis used a Bass diffusion model to forecast the trajectory on which the customer adoption reaches the long-run market potential. The Bass diffusion model generates the S-shaped curve widely observed in the uptake of products. The steepness of the S-curve and the speed at which realized adoption can reach the long-term market potential is a function of two key considerations: marketing effectiveness and word-of-mouth strength. Marketing effectiveness mostly dictates how quickly consumers become aware of or familiar with a product when

the product is just beginning to enter the market. Word-of-mouth strength influences the rate at which adopters of a product spread information about the product, which in turn inspires others to purchase the product and continue the spread of information.[28]

Figure 7 illustrates the relationships between technical, economic, long-run market, and realized market potential. Realized market potential is analogous to the market potential results described and presented throughout this report. For clarity, the graph represents potential as the share of all baseline measures that are suitable for replacement by an efficient measure, and it portrays a scenario where economic and long-run market shares are static over time. Lastly, the figure is illustrative of the diffusion dynamics of new construction and retrofit measures, but not replace-on-burnout measures.

Figure 7. Bass Diffusion Model's Relationship to Efficient Measures' Market Share



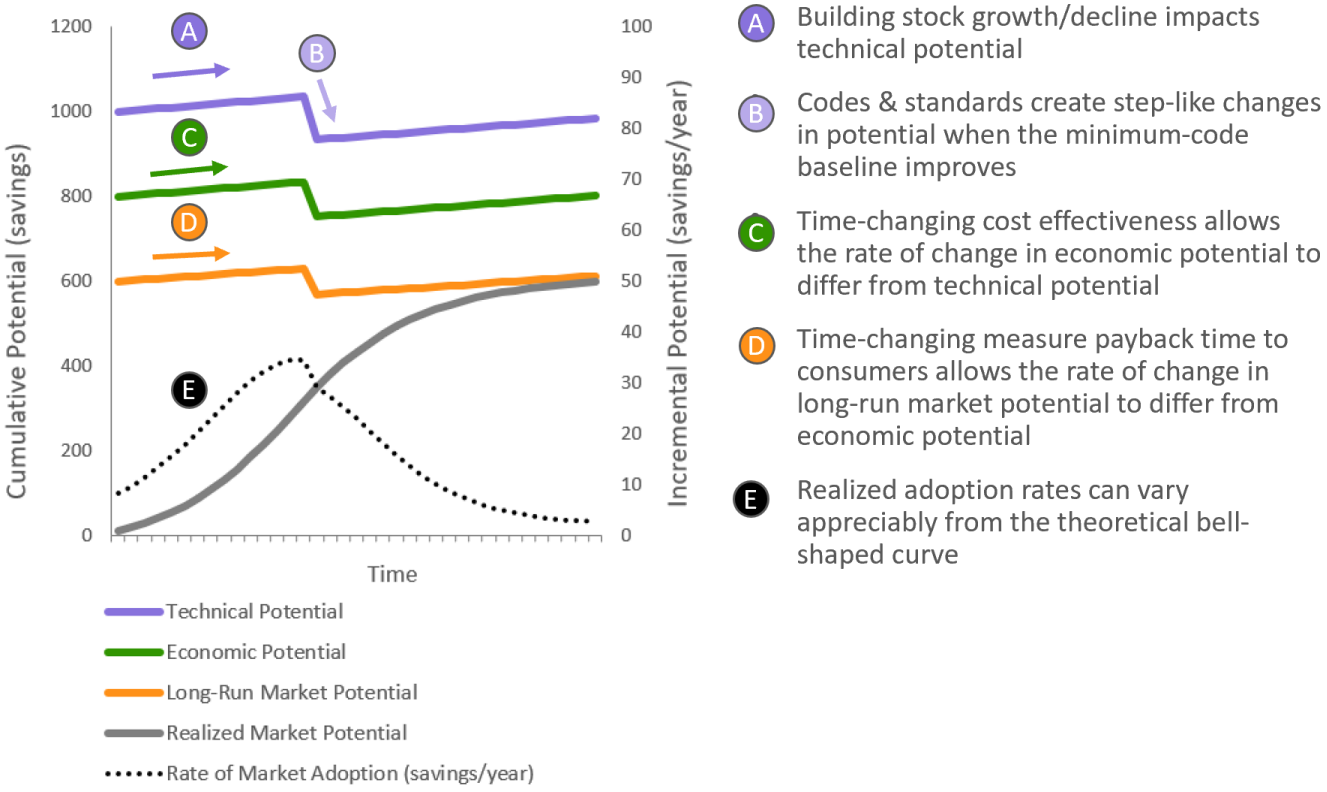
Source: Lumidyne

Note: "Rate of Adoption (%/year)" corresponds to the rightmost vertical axis.

[28] Bass, Frank M. 1969. 'A New Product Growth Model for Consumer Durables', Management Science, 15: 215-27.

One can expand on the diffusion example above by translating it into savings potential, as shown in Figure 8, and incorporating more real-world dynamics like time-changing building stocks, baseline efficiencies, benefit-cost ratios and payback times.

Figure 8. Dynamic Bass Diffusion Model Translated to Savings Potential

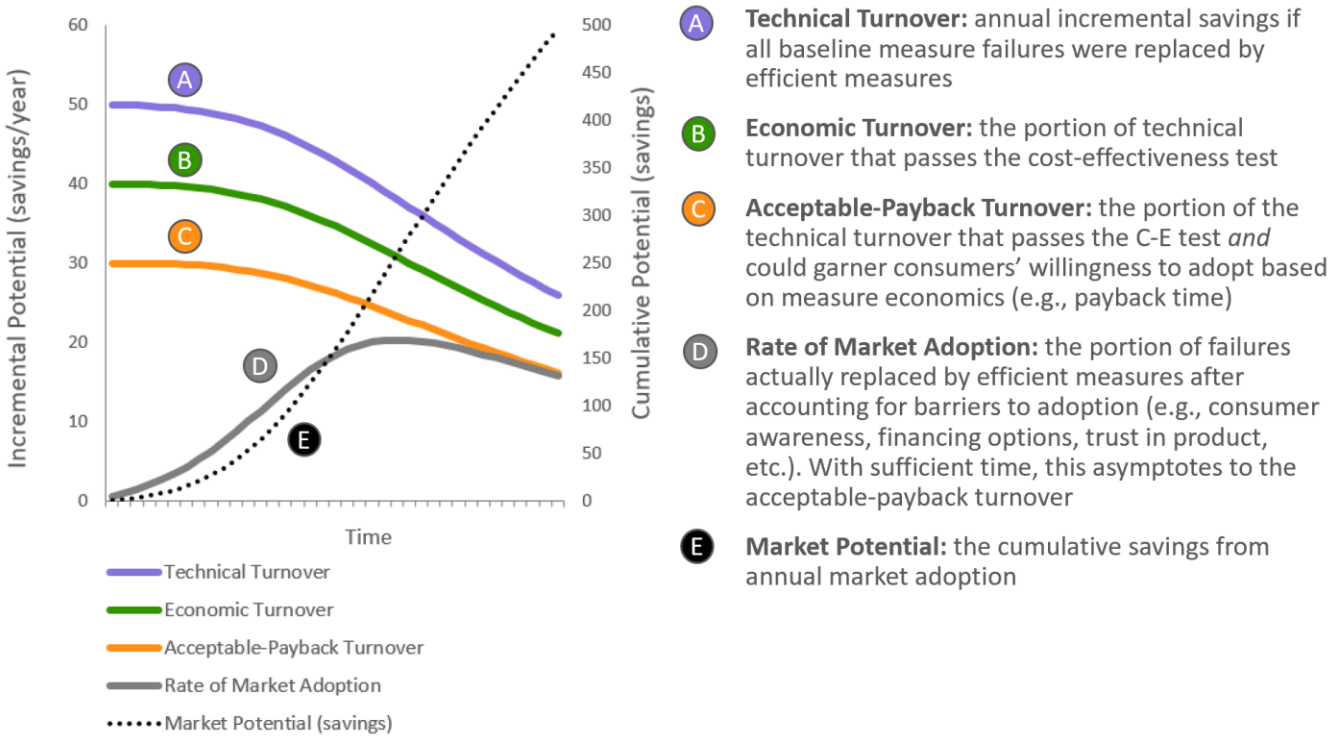


Source: Lumidyne

Note: "Rate of Market Adoption (savings/year)" corresponds to the rightmost vertical axis.

Figure 9 is the last adaptation of this example, and it shows the diffusion dynamics for replace-on-burnout measures. In this case, adoption rates are constrained by both baseline equipment turnover and market barriers implied by Bass diffusion. When consumers replace failed baseline equipment with efficient measures, the turnover of baseline measures declines because there are fewer of those measures remaining and able to fail.

Figure 9. Bass Diffusion for Replace-on-Burnout Measures



Source: Lumidyne

Note: "Market Potential (savings)" corresponds to the rightmost vertical axis.

FortisBC provided Lumidyne with the model used in the 2016 CPR, which Navigant developed and delivered to FortisBC. Lumidyne populated the model with revised data and ran the savings potential simulations for this CPR. Navigant described its model as follows:

> *DSMSim™ is a bottom-up technology diffusion and stock tracking model implemented using a System Dynamics framework. The model explicitly accounts for different types of efficient measures such as retrofit, replace-on-burnout, and new construction and the impacts these measures have on savings potential. The model then reports the technical and economic potential savings in aggregate by service territory, sector, customer segment, end-use category, and highest-impact measures.*[29]

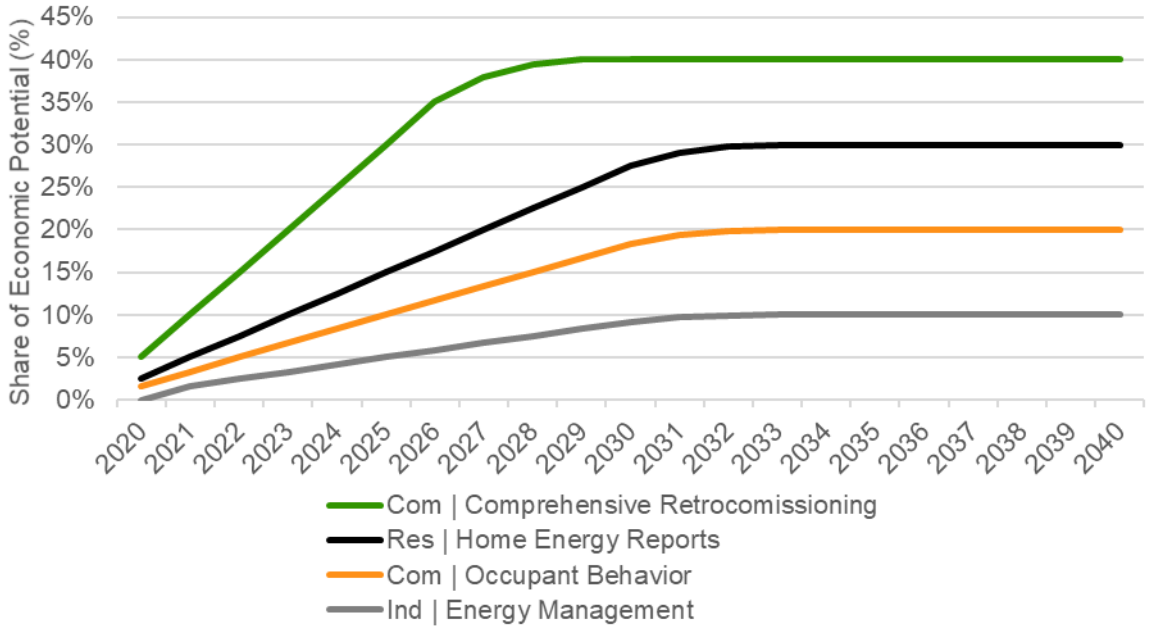
[29] Sourced from Navigant's "British Columbia Conservation Potential Review" dated August 2017.

For more information about Navigant's model and methodology, we refer the readers to FortisBC's 2016 CPR assessments.[30,31]

2.5.3.2 Behavioural Measures

The study included behavioural measures that required different treatment from other measures. Differing from a piece of equipment or an installed system, participants in behavioural programs generally do not incur an upfront capital cost. As such, potential models cannot use payback acceptance curves to estimate adoption of behaviour measures. Instead, utility incentives and recruitment efforts influence the adoption rates. The team developed adoption targets as a percentage of economic potential to address this dynamic, as shown in Figure 10. Specifying the adoption targets in this way ensured that market potential dynamically responded to changes in economic potential.

Figure 10. Behavioural Measure Adoption as a Percentage of Economic Potential (%)



Source: Lumidyne

2.5.3.3 Incentivization Approach

Incentive levels played a role in the market potential forecasts by improving the customer payback times and increasing customers' willingness to adopt CPR measures. Consistent with the 2016 CPR, the team specified incentive levels as dollars per net present value (NPV) of energy savings (e.g., $/kWh), where the NPV accounts

[30] FBC's 2016 technical and economic potential report can be found in Appendix A (p. 513) of FortisBC's "2016 Long Term Electric Resource Plan (LTERP) and Long Term Demand Side Management Plan (LT DSM Plan)," accessible at https://fbcdotcomprod.blob.core.windows.net/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/161130_fbc_2016_lterp_ltdsm_plan.pdf.

[31] FBC's market potential report can be found in Appendix B (p. 86) of FortisBC's "Application for Acceptance of Demand Side Management (DSM) Expenditures Plan for the period covering 2019 to 2022," accessible at https://fbcdotcomprod.blob.core.windows.net/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/electric-utility/180802_fbc_2019-2022_dsm_expenditures_application_ff.pdf.

for a measure's savings across its expected useful lifetime. Compared with an incentive approach based on first-year savings or a percentage of incremental costs, the advantage of using a dollar-per-NPV-of-savings incentive is that it favours measures with greater lifetime savings. A beneficial side-effect of this incentive approach is that the NPV of avoided costs increases, which improves the TRC and mTRC benefit-cost tests across the portfolio. Though challenging to implement this incentive approach in actual program design, it results in a market potential portfolio that maximizes TRC and mTRC, which can be instructive for program planners.

For illustration, assume there are two measures having identical incremental costs, operations and maintenance (O&M) savings, and annual energy savings, as shown in Table 17. If one measure has a ten-year lifetime and the other has a five-year lifetime, the participant's cost per lifetime savings (as defined in Equation 2 below) is lower for the ten-year measure. If both measures are incentivized at the same dollar-per-NPV-of-savings rate, then the incentive represents a larger percentage of participant costs for the 10-year measure. By reducing a larger percentage of the 10-year measure's participant costs, the participant's payback time improves, which leads to greater adoption of that measure relative to the shorter-lived measure. Though the participant economics are more favourable for the longer-lived measure, from the utility's perspective both measures are compensated equally per present value of savings.

Table 17. Illustration of Incentivization Approach

	10-Year Measure	5-Year Measure	Symbol	Calculation
Measure Lifetime (years)	10	5	A	
Incremental Cost ($)	100	100	B	
O&M Savings ($/year)	0	0	C	
Annual Energy Savings (kWh/year)	500	500	D	
NPV of Participant Costs ($)	100	100	E	= B
NPV of Savings (kWh)	3,372	2,002	F	= PV(DiscountRate, D, A)
Participant Cost of Lifetime Savings ($/kWh)	0.03	0.05	G	= E / F
Incentive per NPV of Savings ($/kWh)	0.02	0.02	H	
Incentive Percentage of Participant Cost (%)	67%	40%	I	= H / G

Source: Lumidyne

Equation 2. Participant Cost of Lifetime Electric Energy Savings ($/kWh)

$$SavingsCost = \frac{NPV(DiscountRate,\ IncrementalCost_{year} - OMSavings_{year})}{NPV(DiscountRate,\ AnnualSavings_{year})}$$

Where…

$SavingsCost$: the participant's cost, prior to incentives, per discounted kWh of electric energy savings across the measure lifetime

$NPV( )$: the net present value formula that sums discounted cash flows over time

$DiscountRate$: the discount rate applied to future cash flows

$IncrementalCost$: the efficient measure's incremental equipment cost relative to the baseline measure

$O\&MSavings$: operating and maintenance cost savings from installation of efficient measures

$AnnualSavings$: the incremental annual savings of the measure for each year of the measure lifetime

$year$: each year of the measure lifetime

2.5.3.4 Utility Spending

Since the focus of the CPR was market potential instead of program potential, incentive and administrative spending was not capped or targeted to a specific budget level. Incentive rates per kWh, fixed administrative costs, and per-kWh variable administrative costs escalated at the inflation rate, meaning they stayed constant in real dollars over the analysis horizon. Depending on the forecast's annual mix of adopted measures, the utility spending per kWh of realized market savings varied over time.

2.5.3.5 Re-Participation

Sometimes cumulative market potential is adjusted to reflect that some percentage of high-efficiency measure adopters revert to lower-efficiency equipment at burnout. This study assumed that, once customers had converted to high-efficiency measures, they continued to replace that equipment with high-efficiency equipment. When high-efficiency equipment failed at the end of its useful lifetime, the analysis did not credit the replacement with new savings or incur additional utility spending.

2.5.3.6 Market Potential Calibration

Forecast adoption rates can vary significantly depending on the study's incentive levels and Bass diffusion model parameters like marketing effectiveness and word-of-mouth strength. To ground the market potential analysis on actual and near-term expected program performance, Lumidyne calibrated the first several years of market potential to multiple benchmark values. The following commentary describes each of these benchmarks and the team's calibration approach.

Actual and Planned Program Savings

FortisBC provided Lumidyne with a list of measures recently offered through DSM programs, along with their actual and planned near-term savings. Lumidyne used the list to identify the subset of CPR measures corresponding to FortisBC's recent offerings. The actual and planned savings provided a benchmark to which the team calibrated near-term modelled savings from the subset of CPR measures. Calibration relied on adjusting incentive rates and Bass diffusion parameters until there was reasonable alignment in savings trajectories. Since the full collection of CPR measures included many measures that FortisBC DSM programs had not offered historically, the CPR's resulting total 2020 market potential from non-traditional measures generated 36 percent more savings compared with 2019 actual program savings.

Utility DSM Acquisition Costs

In addition to program savings, FortisBC provided actual and planned program spending broken out by incentives and fixed and variable administrative costs. The team normalized these spending summaries by the associated program savings to identify sector-level dollar-per-kWh acquisition costs. While calibrating the subset of recently offered CPR measures, Lumidyne ensured alignment between modelled acquisition costs and FortisBC's recent and expected values.

Incentive Percentage of Program Spending

Lumidyne took the spending calibration one step further by ensuring that the percentage of spending from incentives was similar to actual and planned values. By calibrating both the dollars-per-kWh acquisition costs and the incentive percentages, the team had assurance that the market potential applied reasonable incentive rates.

All three of the benchmarking tasks were interdependently related, which required an iterative approach to calibration. The outcome was a near-term market potential forecast grounded in observed and planned program metrics. Beyond the first several calibrated years, the market potential—and thus acquisition costs and incentive percentages of spending—dynamically evolved based on modelled assumptions regarding building stocks, equipment turnover, measure economics, and Bass diffusion dynamics.

3 Savings Potential Results

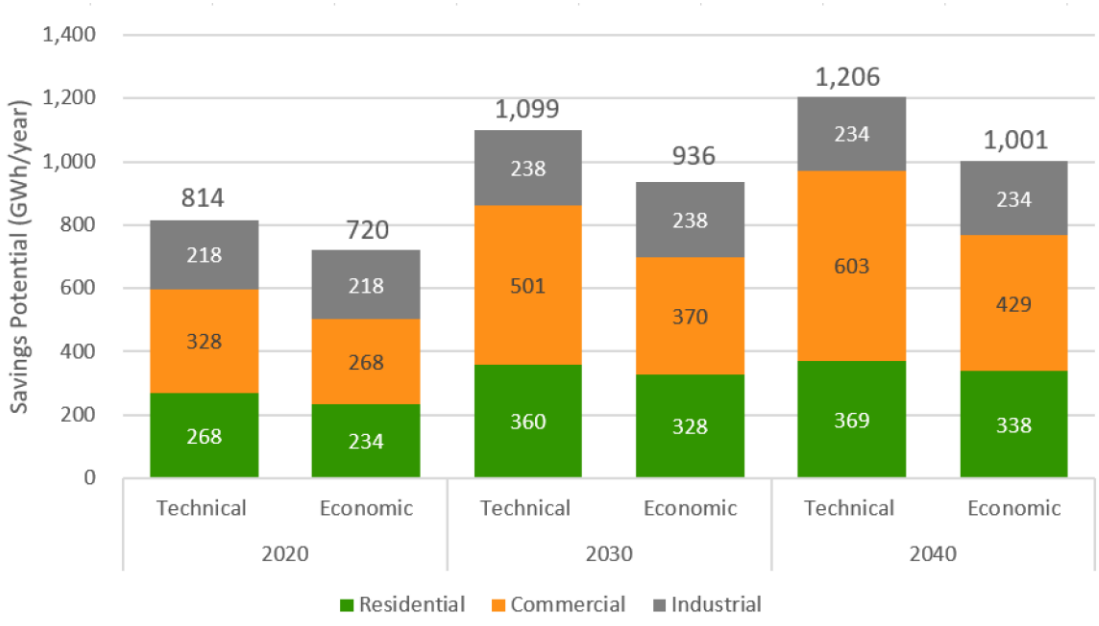
The remainder of the report highlights key study findings. All charts and figures included in this section have corresponding tabular data in Appendix A – Tabular Data for Charts. To complement these findings, Lumidyne provided attachments with detailed model assumptions and measure-level results, as listed in Appendix B – Attachments.

This section begins with a brief review of technical and economic potential. Then it presents market potential totals and aggregations by sector, customer segment, end use, and measures, along with a high-level comparison of market potential before and after natural change. The section concludes with a summary of cost effectiveness metrics.

3.1 Technical and Economic Potential

The study's focus was market potential results, though technical and economic potential are provided at a high level to give some context to market potential results. Figure 11 shows that technical potential grew from 814 GWh/year in 2020 to 1,206 GWh/year by 2040. The commercial sector drove 70 percent of the growth in technical potential, which coincided with the commercial sector having the highest forecast consumption growth in the *Reference Case*.

Figure 11. Technical & Economic Cumulative Electric Energy Savings Potential by Sector (GWh/year)



Source: Lumidyne

Economic potential captured 83 percent of the technical potential by 2040, and it grew 39 percent over the forecast period. Though the commercial sector still played a large role in economic potential, the residential and industrial sectors' percentage contributions grew relative to technical potential.

For both technical and economic potential, the end uses contributing the most savings were whole facility, lighting and space heating. Single-family detached homes, offices and non-food retail customer segments gained the most economic potential. The highest-saving measures in economic potential were commercial new construction

45% above code, new home Step Code 5, industrial pump equipment upgrades and commercial LEDs. The measures with the greatest reduction in potential between technical and economic potential were commercial new construction 45% above code, residential ductless mini-split heat pumps and commercial new construction Step Code 4.

3.2 Market Potential

From this section onward, all results pertain to cumulative market savings. The review of gross market potential examines different levels of aggregation, from total market potential to measure-level potential. After discussing gross market potential, the report provides a comparison with net market potential.

3.2.1 Total Potential

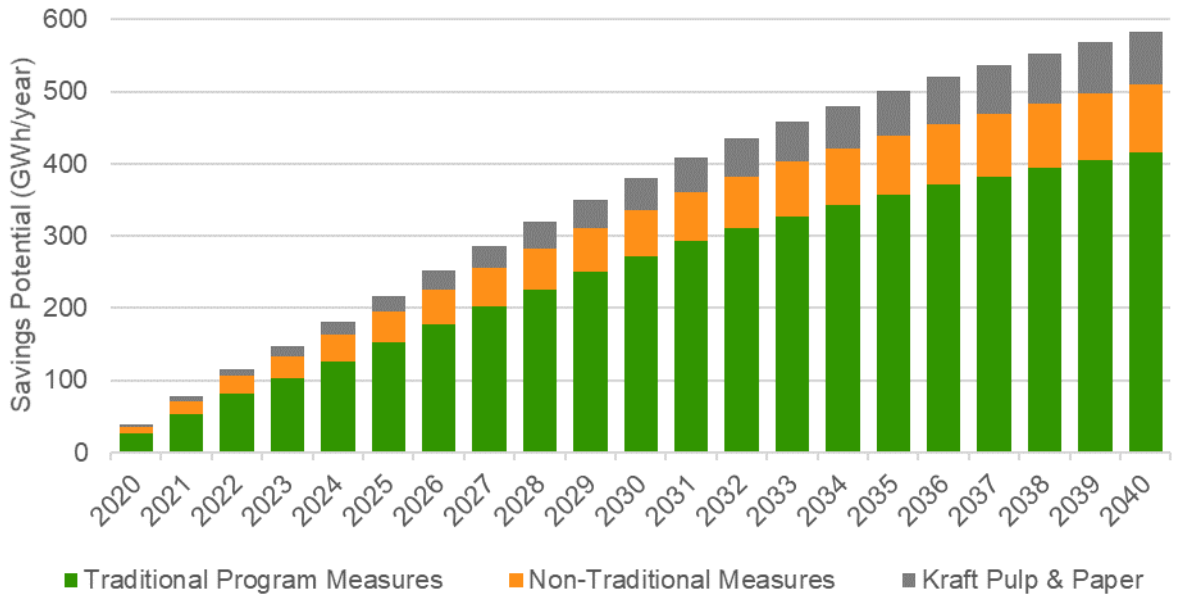
The analysis found cumulative electric energy market potential to begin at 38 GWh/year in 2020 and grow to 583 GWh/year by 2040, as shown in Figure 12Figure 1. The average incremental annual savings over the horizon was slightly less than 28 GWh/year. Incremental annual savings slowly declined over time due to efficient measures saturating the replace-on-burnout and retrofit markets and due to Step Codes' raising of the minimum-code baseline in the new construction markets, which led to a corresponding reduction in incremental savings from efficient measures. Energy savings in 2020 equated to 1 percent of FortisBC's direct plus indirect sales. By 2040, the cumulative potential was 12.5 percent of sales.

Figure 12. Total Cumulative Electric Energy Savings Potential (GWh/year, % of sales)

Source: Lumidyne

Figure 13 breaks out total market potential by the kraft pulp and paper segment and traditional and non-traditional measures. One goal of this breakdown is to show the opportunity of non-traditional measures that haven't been included in FortisBC's recent program offerings. The ratio of 2040 non-traditional potential to traditional potential was about 1:4. The figure also highlights the kraft pulp and paper segment's potential because much of its potential is not eligible for incentives—because a significant amount of kraft pulp and paper consumption is offset by self-generated electricity.

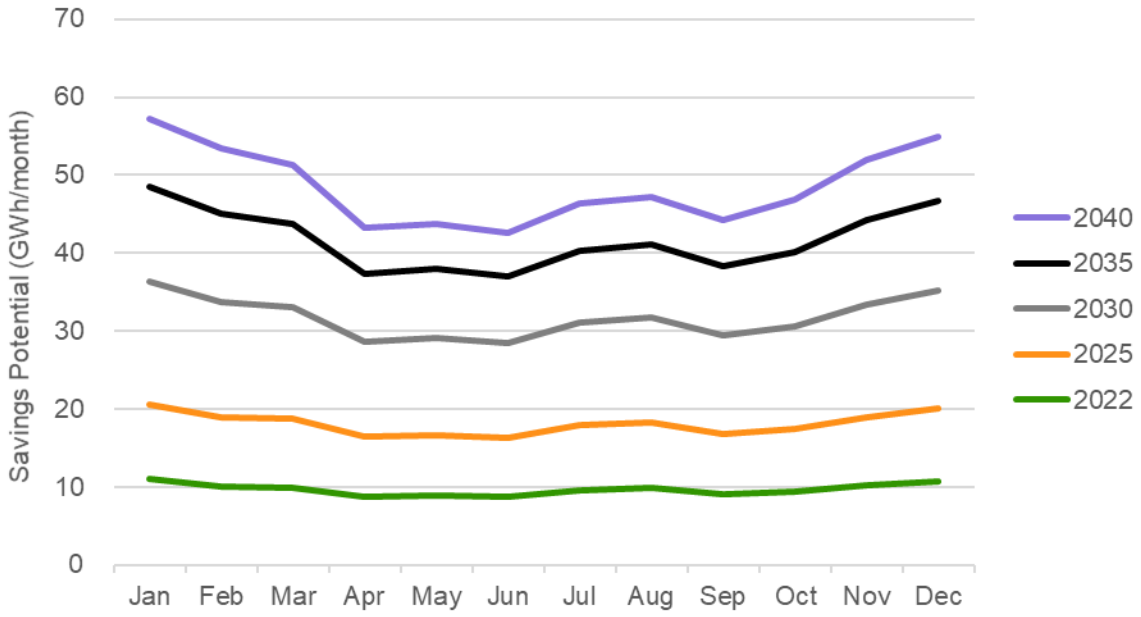
Figure 13. Cumulative Energy Savings Potential by Source (GWh/year)



Source: Lumidyne

Regarding the timing of market savings, the analysis found highest savings during winter months, as illustrated in Figure 14. Though the shape of the monthly savings was able to shift over time depending on the mix of measures included in market potential, the monthly distribution changed very little over the forecast horizon.

Figure 14. Total Cumulative Energy Savings Potential by Month (GWh/month)

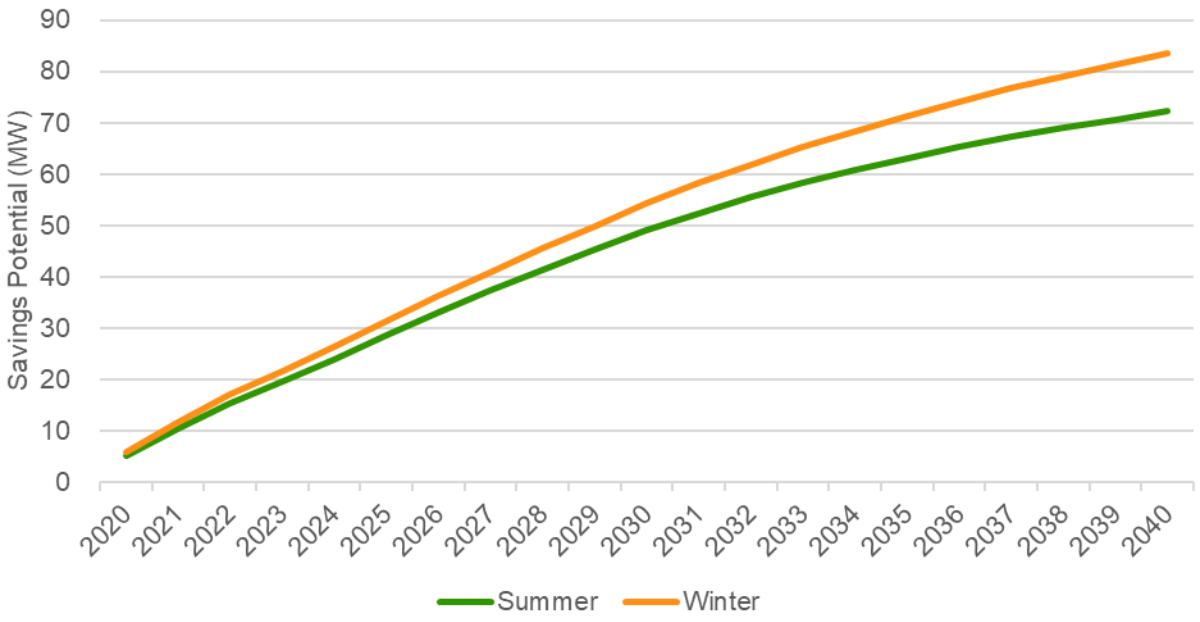


Source: Lumidyne

Savings in the lighting end use category boosted the winter and summer energy savings more than any other end use. The whole building end use came in second for winter and summer energy savings. The third most influential end uses were space heating for winter savings and industrial pumping for summer savings.

The forecast of cumulative electric winter demand market potential, shown in Figure 15, begins at 6 MW and reaches 84 MW by 2040. The market potential for summer demand is slightly lower, starting at 5 MW and reaching 72 MW. Winter potential corresponds to demand savings averaged between 5:00pm and 7:00pm in January and February. Summer potential averages demand savings between 5:00pm and 7:00pm in July and August. Though the analysis estimated demand savings across the two peakiest months in the summer and winter seasons, Lumidyne's load shape analysis suggests that the demand savings would be similar for adjacent months (e.g., December, March, June and September).

Figure 15. Total Cumulative Electric Demand Savings Potential (MW)



Source: Lumidyne

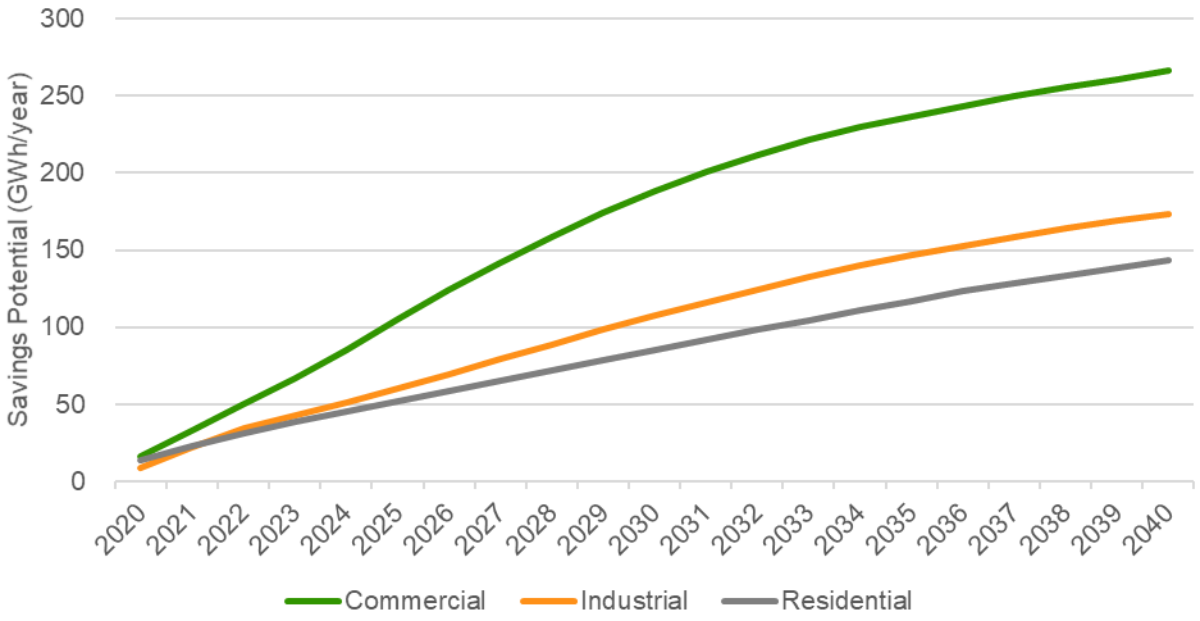
Winter demand savings tracked winter energy savings, where lighting, whole building and space heating end uses contributed the most. Lighting and whole building end uses drove much of the summer demand savings, with residential and commercial electronics being the next highest end use.

3.2.2 Potential by Sector

Next, the report looks at cumulative market potential by sector. Per FortisBC's guidance, the results categorized MURBs with the commercial sector. Thus, the residential sector only included single-family detached, single-family attached and other residential dwelling types.

Though the commercial and residential sectors started with similar 2020 potential, Figure 16 shows that the commercial sector quickly outpaced the residential sector. This reflected the *Reference Case's* projection that the rate of growth in commercial consumption would be more than double that of the residential and industrial sectors. For comparison, the study found 2040 cumulative savings from the new construction market to be 16 GWh/year in the residential sector and 69 GWh/year in the commercial sector. More than 80% of the growth in the industrial sector came from retrofit measures.

Figure 16. Cumulative Energy Savings Potential by Sector (GWh/year)

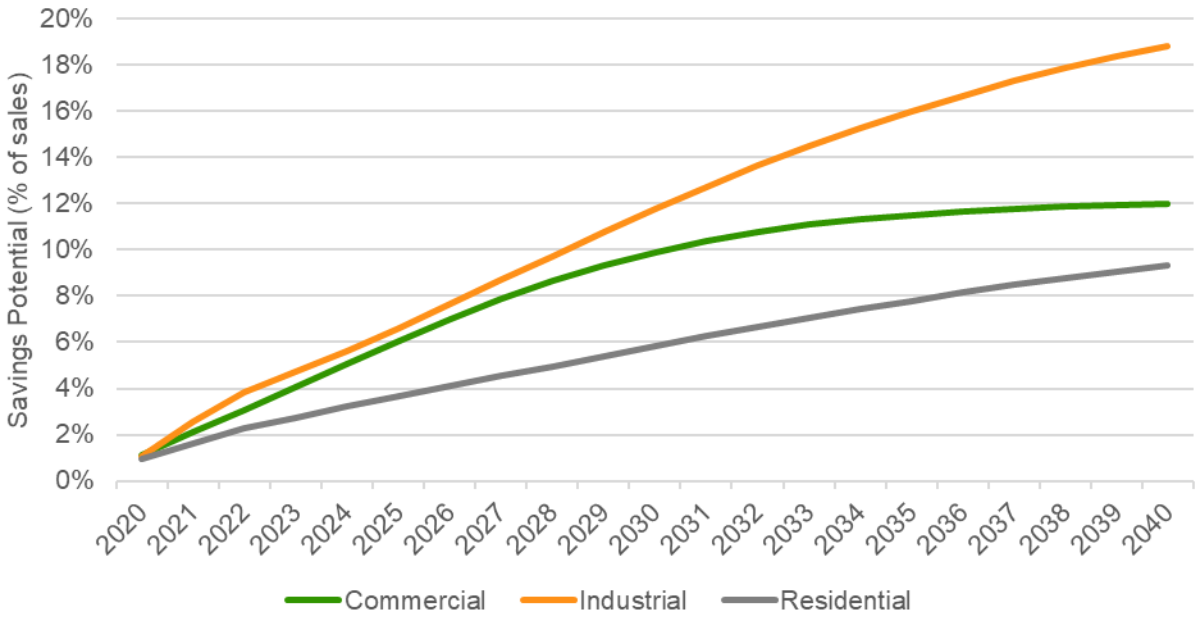


Source: Lumidyne

The rate of change in the commercial sector's potential slowed in the 2030s as the retrofit market saturated, particularly for LED lighting, building automation systems and variable-speed drives on pumps. Similarly, incremental potential for residential LED lighting dropped off quickly in the replace-on-burnout market, and half of the lighting potential in that market was achieved within the first four simulation years.

When viewed as a percentage of sector-level sales, the industrial sector achieved the highest savings percentages, reaching just above 18 percent by 2040. Saturation of the commercial sector is more apparent in Figure 17, where commercial savings percentages nearly flattened out by the end of the forecast. Despite having the lowest market potential as a percentage of sales, the residential sector showed a consistent upward trend.

Figure 17. Cumulative Energy Savings Potential as a Percentage of Sales by Sector (%)

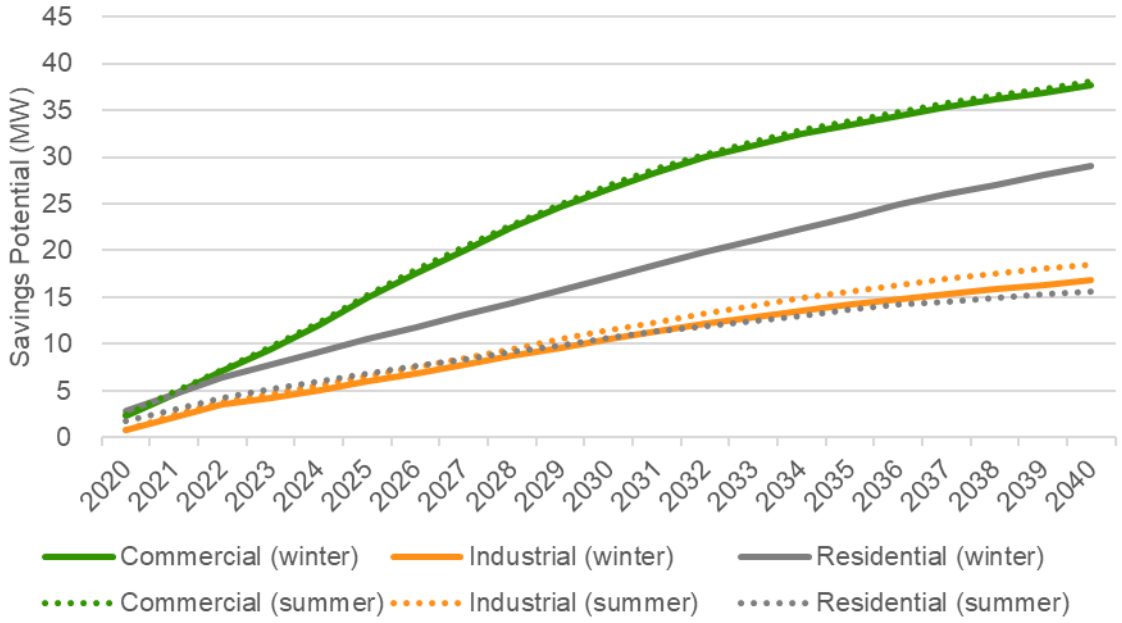


Source: Lumidyne

The *Base Year* analysis indicated that the residential sector's largest loads were space heating, appliances and hot water, so an inspection of those end uses' market potential provided insight into why residential savings were a lower percentage of sales. The team found that the space heating end use was achieving appreciable savings from smart thermostats and building shell measures. On the other hand, the market potential showed little contribution from the appliance end use. The highest-saving appliance measures were efficient electric clothes dryers by a large margin, followed by ENERGY STAR freezers. Notably, ENERGY STAR refrigerators did not pass the economic screen. The minimal difference in efficiency levels between high-efficiency and baseline appliances was likely a factor in the lack of significant market potential from appliances. A review of the hot water end use uncovered that heat pump water heaters and electric storage water heaters had the largest economic potential. However, the participant economics were not attractive enough to spur much adoption. In fact, much of the hot water heater adoption went to the electric storage water heater, and heat pump water heaters only reached 12 percent of their economic potential.

Despite differences in summer and winter demand savings potential within each commercial end use, the aggregate commercial demand savings were nearly identical between seasons, as shown in Figure 18. Industrial demand savings were highest in the summer, owing largely to pumping and fans and blowers end uses. The residential sector's 2040 summer demand savings were 46 percent lower than winter savings even though summer-month energy consumption was only 30 percent lower than winter-month energy consumption. One driver for this outcome is that efficient space cooling equipment showed very little technical potential and no market potential. However, if summer temperatures increase appreciably and residential space cooling equipment has higher operating hours and becomes more prevalent in homes, then space cooling will likely become a larger contributor to residential energy consumption and peak summer demand. Consequently, this scenario would likely lead to more favourable economics for high-efficiency space cooling measures.

Figure 18. Cumulative Demand Savings Potential by Sector (MW)

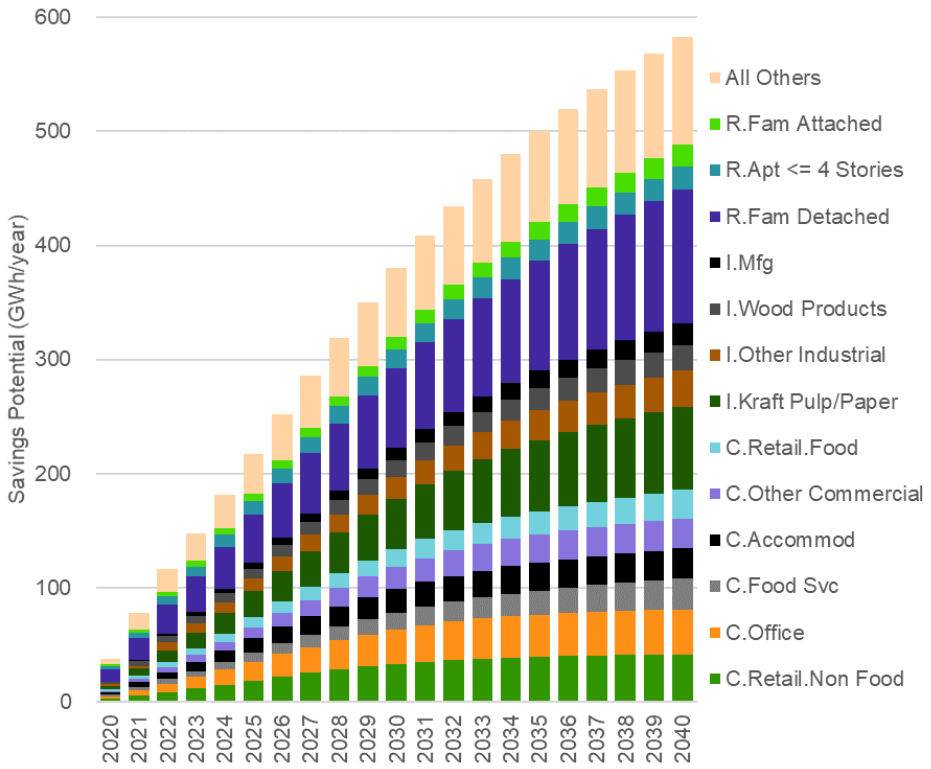


Source: Lumidyne

Potential by Customer Segment

An inspection of market potential by customer segment, given in Figure 19, showed that single-family detached homes accounted for 20 percent of 2040 energy savings. Kraft pulp and paper represented 13% of the 2040 potential, while non-food retail and offices were both at about 7%.

Figure 19. Cumulative Energy Savings Potential by Customer Segment (GWh/year)[32]



Source: Lumidyne

Note: Customer segments comprising the "All Others" category have individual savings ranging from 0.3% to 2.6%—for a combined sum of 16.3%—of the 2040 total, and they include: I.Agriculture, C.College/Univ, C.Long Term Care, C.Hospital, I.Cannibis, C.Logistic/Warehouse, R.Other Residential, C.Schools, C.Streetlights/Signals, I.Food/Beverage, and R.Apartments > 4 Storeys.

When looking at market potential as a percentage of sales, the highest customer segments were kraft pulp and paper, agriculture, colleges/universities and food retail. Apartments and residential segments fell on the low end

[32] Segment abbreviations have the following descriptions:
"Fam Attached" -- single-family attached homes;
"Apt <= 4 Stories" -- apartments less than or equal to four storeys in height;
"Fam Detached" -- single-family detached homes;
"Mfg" -- manufacturing;
"Accomod" -- accommodations;
"Food Svc" -- food services;

of savings as a percentage of sales. Apartments' economic potential was appreciably lower than technical potential, and this played a role in the low market potential as a percentage of sales.

Table 18, Table 19 and Table 20 provide a 2030 mid-forecast breakdown of savings for customer segments within each sector. In this 10-year view, non-food retail, offices and accommodation provide close to half the commercial savings, whereas kraft pulp & paper and "other industrial" garner about 60% of industrial potential. Lastly, over 80% of 2030 residential potential savings come from detached homes.

Table 18. Commercial Cumulative Energy Savings Potential in 2030 by Customer Segment

Customer Segment	GWh/year	% of Sector
C.Retail.Non Food	33	17.6%
C.Office	30	16.1%
C.Accommod	21	11.0%
C.Other Commercial	19	10.3%
R.Apt <= 4 Storeys	17	8.8%
C.Retail.Food	15	8.2%
C.Food Svc	15	7.9%
C.College/Univ	8	4.3%
C.Hospital	7	4.0%
C.Long Term Care	7	3.9%
C.Logistic/WHouse	7	3.6%
C.Schools	5	2.4%
C.Streetlights/Signals	2	1.2%
R.Apt > 4 Storeys	1	0.8%
Total	**188**	**100.0%**

Table 19. Industrial Cumulative Energy Savings Potential in 2030 by Customer Segment

Customer Segment	GWh/year	% of Sector
I.Kraft Pulp/Paper	44	41.3%
I.Other Industrial	19	17.8%
I.Wood Products	15	13.7%
I.Mfg	11	9.8%
I.Cannabis	9	8.2%
I.Agriculture	8	7.8%
I.Food & Bev	1	1.3%
Total	**107**	**100.0%**

Table 20. Residential Cumulative Energy Savings Potential in 2030 by Customer Segment

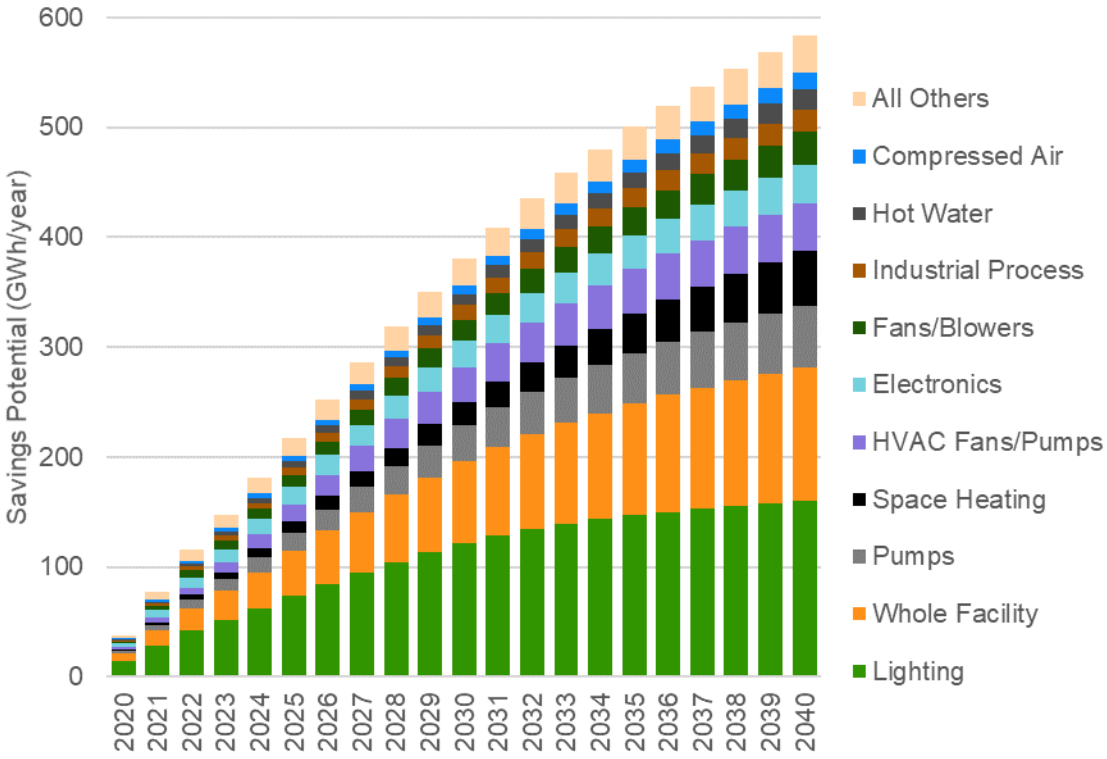
Customer Segment	GWh/year	% of Sector
R.SingleFam Detached	70	82.3%
R.SingleFam Attached	11	12.7%
R.Other Residential	4	5.0%
Total	**85**	**100.0%**

Source: Lumidyne

3.2.3 Potential by End Use

Figure 20 shows the market potential by end use and highlights the large impact from lighting, which was concentrated in the single-family detached, non-food retail, and office segments. However, incremental lighting potential slowed in the 2030s due to saturation of the retrofit and replace-on-burnout markets. Despite the slowing growth rate in lighting, it accounted for 27 percent of 2040's market potential. In contrast, whole facility measures like commercial efficient new construction and building automation systems continued an upward trajectory throughout the forecast horizon and landed at 21 percent of the final year's market potential. The customer segments with the highest whole facility savings were food service, single-family detached and food retail. Notably, industry-specific end uses like pumps, fans/blowers and industrial process were some of the highest-saving end uses.

Figure 20. Cumulative Energy Savings Potential by End Use (GWh/year)



Source: Lumidyne

Note: End uses comprising the "All Others" category have individual savings ranging from 0% to 1.8%—for a combined sum of 5.8%—of the 2040 total, and they include: Refrigeration, Appliances, Office Equipment, Material Transport, Space Cooking, Other, Product Drying, and Ventilation.

Mid-forecast savings breakdowns by end use and sector appear in Table 21, Table 22 and Table 23. The commercial sector's market potential was dominated by lighting, whole facility and HVAC fans/pumps. The residential sector's savings were distributed more evenly across its end uses. Interestingly, 21 percent of residential potential came from electronics, one of the few end uses that the *Reference Case* found to be increasing in energy intensity. The absence of space cooling potential in the residential sector flags an opportunity for future exploration of lower-cost space cooling measures. Lastly, the industrial sector was the only sector not to have lighting as the highest-saving end use. In fact, savings from industrial pumping was 33 percent larger than lighting savings.

Table 21. Commercial Cumulative Energy Savings Potential in 2030 by End Use

End Use	GWh/year	% of Sector
Lighting	75	39.7%
Whole Facility	59	31.4%
HVAC Fans/Pumps	32	17.0%
Electronics	6	3.2%
Refrigeration	5	2.6%
Office Equip	4	2.2%
Space Cooling	3	1.5%
Hot Water	2	1.0%
Other	1	0.6%
Space Heating	1	0.4%
Cooking	0	0.3%
Appliances	0	0.1%
Total	**188**	**100.0%**

Table 22. Industrial Cumulative Energy Savings Potential in 2030 by End Use

End Use	GWh/year	% of Sector
Pumps	32	30.2%
Lighting	24	22.7%
Fans/Blowers	19	17.7%
Industrial Proc	13	12.1%
Compressed Air	8	7.5%
Whole Facility	3	3.2%
Mat Transport	3	2.6%
Refrigeration	3	2.6%
Space Heating	1	1.2%
Product Drying	0	0.2%
Total	**107**	**100.0%**

Table 23. Residential Cumulative Energy Savings Potential in 2030 by End Use

End Use	GWh/year	% of Sector
Lighting	23	26.5%
Space Heating	19	22.5%
Electronics	18	21.4%
Whole Facility	12	14.0%
Hot Water	8	9.4%
Appliances	5	6.2%
Total	**85**	**100.0%**

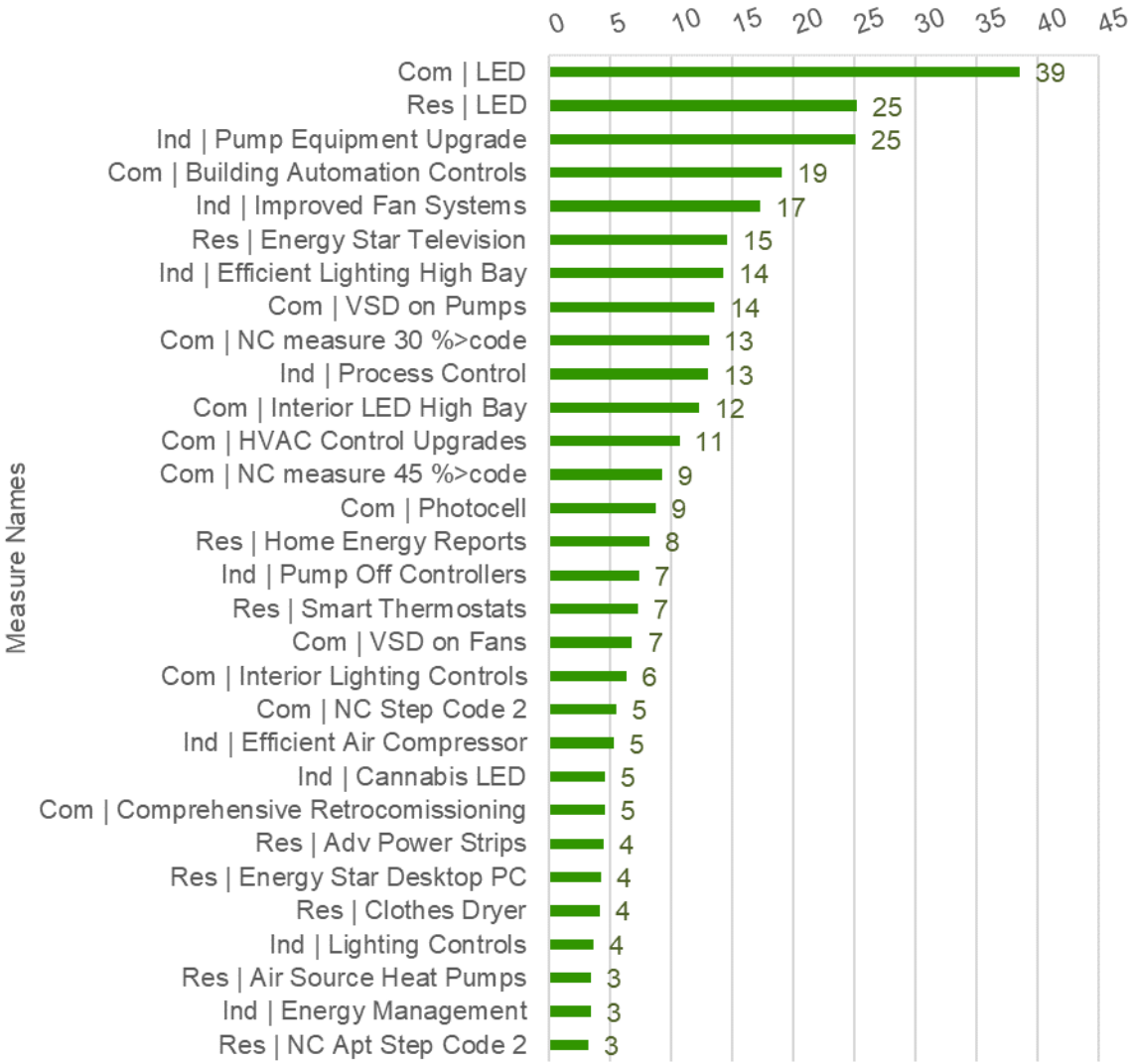
Source: Lumidyne

3.2.4 Potential by Measure

The following figures show energy and summer/winter demand savings by measure. In some instances, the measure names consist of groups of similar measures. For example, the “Com | LED” measure group includes interior LED, interior LED MR/PAR, LED luminaire and troffer LED.

Figure 21 shows the top 30 measures for cumulative energy savings midway through the forecast period. This view is insightful because it illustrates that, relative to the CPR’s full list of 167 unique measures, most savings come from a small subset of high-impact measures. For energy savings, the top 10 measures accounted for 50 percent of the 2030’s total potential, while the top 26 measures accounted for 80 percent. The remaining 141 measures contributed the other 20 percent of potential. Commercial LEDs accounted for 10 percent of total potential, and the sum of residential and commercial LED potential contributed 17 percent.

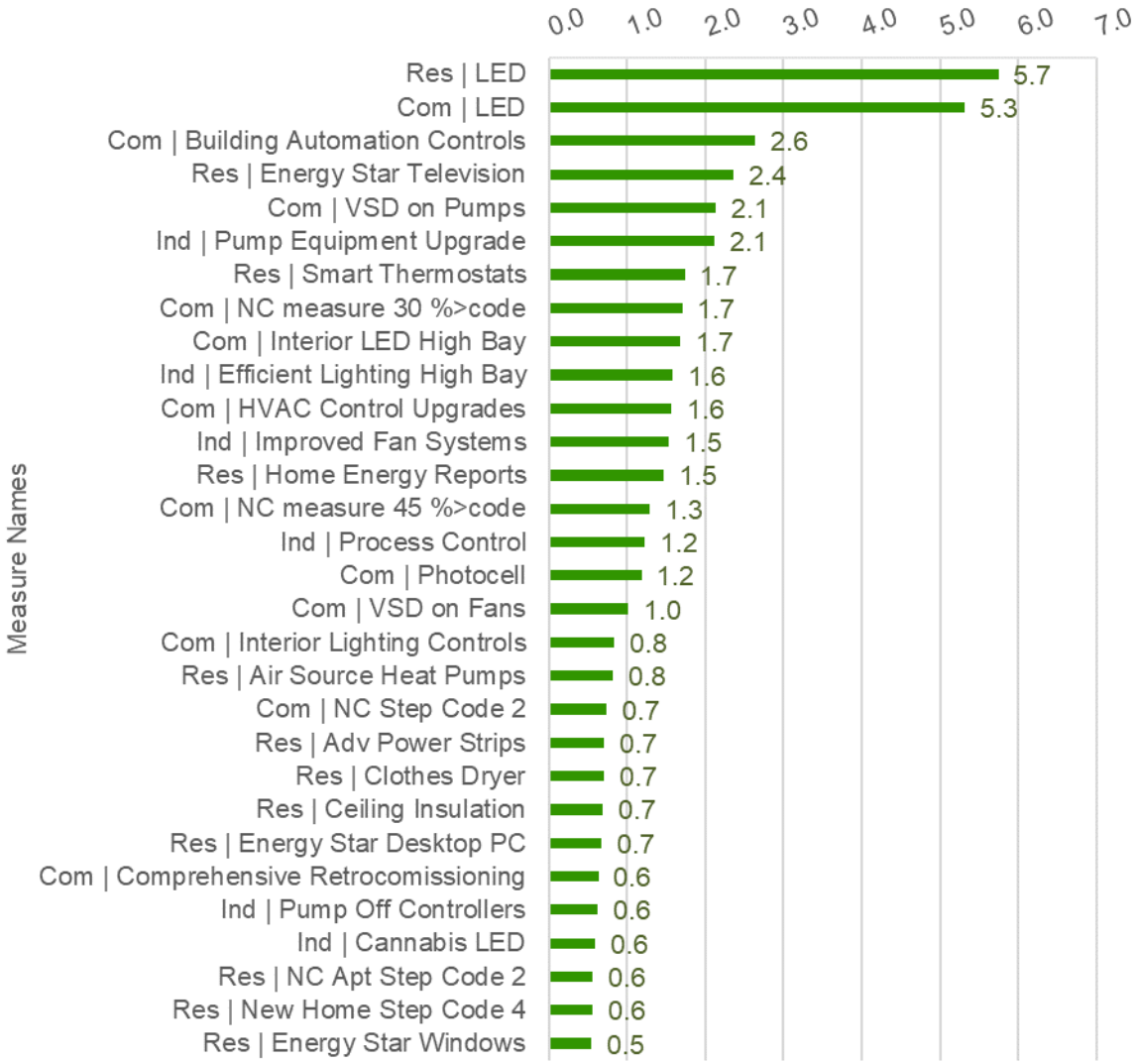
Figure 21. Top 30 Measures for Cumulative Energy Savings in 2030 (GWh/year)



Source: Lumidyne

Eight of the top ten energy-saving measures also appeared in the top 10 winter-demand-saving measures shown in Figure 22. Though commercial LED had higher energy savings than residential LED, those rankings reversed for winter demand savings. Additionally, the combined winter demand potential from these two LED measures increased to 20 percent of the total 2030 winter demand savings. Once again, the top ten measures accounted for 50 percent of the total demand potential, and 80 percent of 2030's potential came from the top 27 measures.

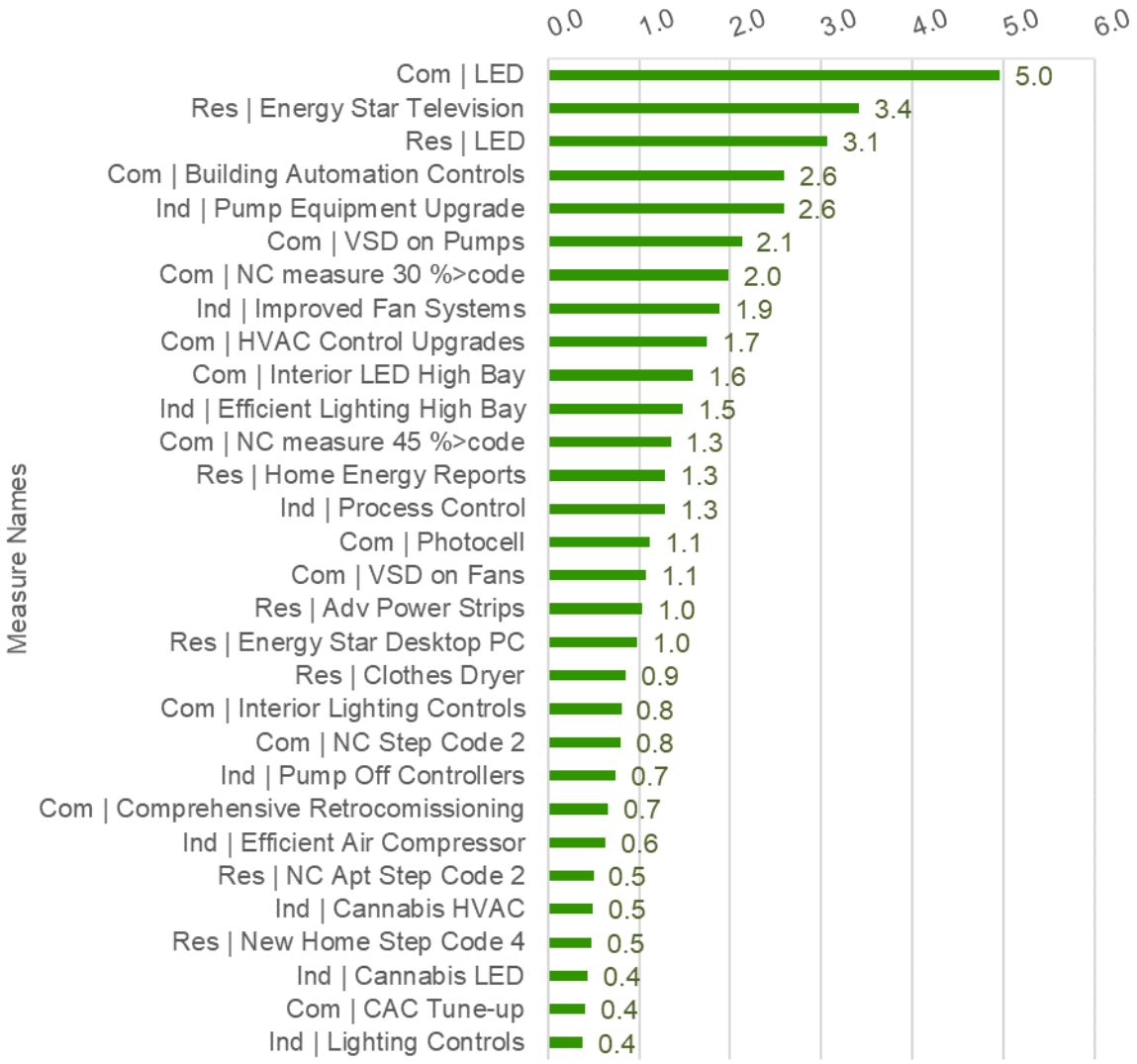
Figure 22. Top 30 Measures for Cumulative Winter Demand Savings in 2030 (MW)



Source: Lumidyne

Figure 23 shows the top 30 measures for summer demand savings in 2030. Most of the top ten energy-saving and winter-demand-saving measures landed in the top ten measures for summer demand saving. The implication is that most of the top energy-saving measures will also contribute appreciably to reducing both winter and summer peak demand. For summer demand potential, the top nine measures generated 50 percent of 2030's total savings, and the top 23 measures generated 80 percent. Commercial LEDs provided 10 percent of the savings, and the sum of commercial and residential LEDs accounted for 17 percent.

Figure 23. Top 30 Measures for Cumulative Summer Demand Savings in 2030 (MW)



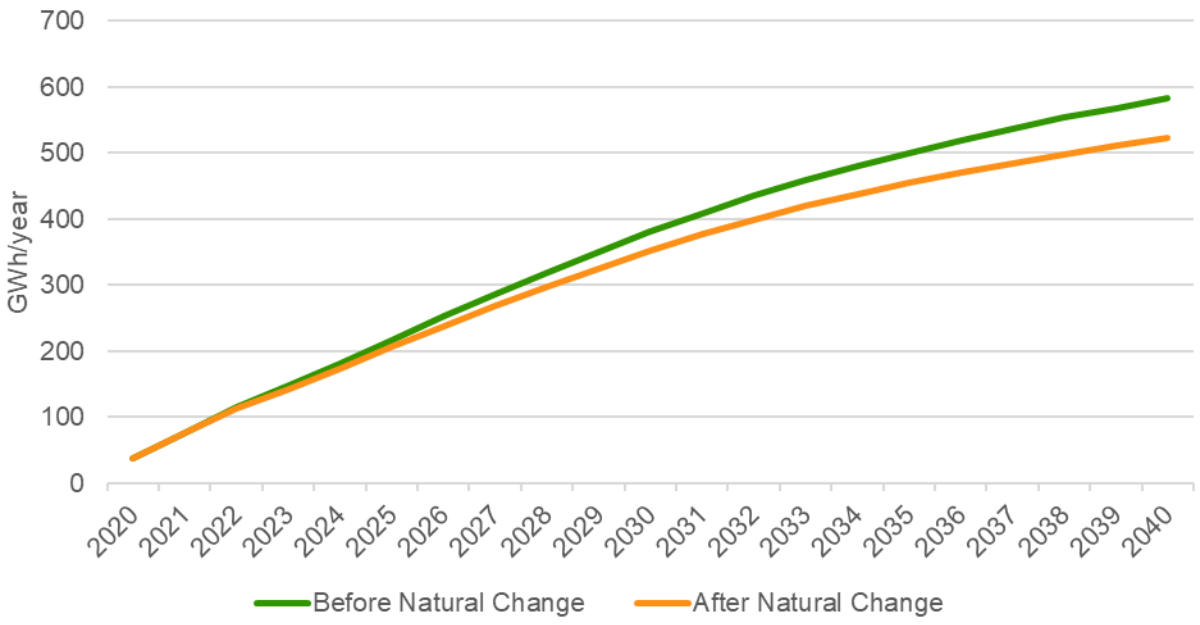
Source: Lumidyne

3.2.5 Potential Adjusted for Natural Change

Thus far in the report, all market potential results have implicitly attributed all increases in efficient measure adoption to DSM program activity, which is akin to representing gross savings potential. In real-world markets, there is some likelihood that utility customers, absent any utility incentives or recruitment, will still pursue energy conservation measures. The implication is that the *Reference Case's* end use intensity trends likely included some combination of program-driven change in efficiency and some "natural change" that was not program-driven. Using the rate of change in end use intensities and the modelled savings as a percentage of consumption, the team estimated by how much each customer segment and end use's potential could be attributed to DSM program activities versus natural change.

The results in Figure 24 show total market potential before and after addressing natural change. Potential before natural change is identical to the total market potential shown previously in this report. Potential after natural change is similar to net savings potential and corrects for efficiency changes that might occur in absence of utility-sponsored DSM programs. The difference between the two curves represents the net natural conservation that might be expected based on recent trends in end use intensities. Importantly, this aspect of gross versus net savings is separate from the free-rider and spillover effects applied to DSM reporting at the program level.

Figure 24. Total Cumulative Energy Savings Potential after Natural Change (GWh/year)



Source: Lumidyne

3.3 Market Potential Cost Effectiveness

The final section of this report summarizes the cost effectiveness of market potential at the sector and portfolio level. Differing from the approach used in measure-level economic screening, the benefit-to-cost ratios and net benefits shown in Table 24 and Table 25 included administrative costs where appropriate to the given cost test. Additionally, these metrics represent cost effectiveness across the entire 2020-2040 forecast horizon.

The benefit-cost ratios were favourable for all costs tests and sectors, except for the Rate Impact Measure Test (RIM). Relative to the previous CPR, avoided energy and demand costs decreased appreciably and electric rates increased slightly, as shown earlier in Table 1. Both factors negatively impacted the RIM test, which treats avoided costs as benefits and lost revenues as costs.

Table 24. Benefit-to-Cost Ratios across 2020-2040 Horizon (ratio)

Sector	Total Resource Cost Test	Utility Cost Test	Participant Cost Test	Rate Impact Measure Test
Commercial	2.45	3.95	3.37	0.80
Industrial	2.91	4.39	3.15	0.97
Residential*	2.26	2.33	4.68	0.63
Portfolio	2.05	2.62	3.65	0.73

Source: Lumidyne

**Note: the residential sector relied on a modified Total Resource Cost (mTRC) test.*

Though the analysis applied an mTRC test to residential measures, more than 96 percent of residential market potential passed the more restrictive TRC test.

Net benefits subtract total costs from total benefits, so all positive values represent an improvement in financial standing. Notably, the net present value of market potential over the 20-year horizon is more than $173 million in 2020 dollars from the TRC perspective. Net present values are also positive for the utility and participant perspectives, and negative only for the rate RIM test. Since the BC governing legislation forbids use of the RIM test for approval purposes, it is presented for informational purposes only.

Table 25. Net Present Value of Net Benefits across 2020-2040 Horizon (million 2020$)

Sector	Total Resource Cost Test	Utility Cost Test	Participant Cost Test	Rate Impact Measure Test
Commercial	$95.4	$118.3	$142.0	-$39.8
Industrial	$56.9	$67.0	$60.5	-$2.4
Residential*	$50.4	$53.8	$111.4	-$54.9
Portfolio	$173.1	$209.6	$314.0	-$126.7

Source: Lumidyne

**Note: the residential sector relied on a modified Total Resource Cost (mTRC) test.*

4 Appendix A – Tabular Data for Charts

This appendix provides tabular data for charts included in the body of the report.

Table 26. Base Year 2019 Residential Monthly Consumption Shape by End Use (GWh/month)

End Use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Appliances	35.3	32.5	34.7	34.3	37.5	39.0	43.2	43.1	39.5	36.7	32.9	33.4
Electronics	11.0	9.9	11.2	10.1	11.2	11.6	15.4	15.6	12.6	10.6	9.4	11.4
Hot Water	18.0	16.7	18.2	16.9	15.5	14.4	13.8	12.9	13.3	14.6	15.4	16.1
Lighting	18.9	15.1	14.4	11.7	10.8	9.9	10.4	11.5	13.0	15.8	17.7	19.5
Other	17.3	14.8	10.5	10.2	9.9	10.0	10.2	10.3	9.7	9.7	14.5	16.4
Space Cooling	0.0	0.0	0.0	0.0	9.6	14.7	24.0	25.2	8.9	0.0	0.0	0.0
Space Heating	72.9	68.4	49.4	15.1	4.7	0.0	0.0	0.0	8.9	35.2	51.3	67.7
Ventilation	16.0	13.7	9.8	9.4	9.2	9.2	9.5	9.5	8.9	9.0	13.4	15.1

Table 27. Base Year 2019 Commercial Monthly Consumption Shape by End Use (GWh/month)

End Use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cooking	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Hot Water	2.3	2.1	2.3	2.2	2.3	2.2	2.3	2.3	2.2	2.3	2.2	2.3
Office Equipment	3.4	3.1	3.4	3.3	3.4	3.2	3.3	3.4	3.3	3.4	3.3	3.4
Other	13.2	11.9	13.2	12.8	13.2	12.6	12.9	13.2	12.7	13.3	12.8	13.1
Refrigeration	7.8	7.0	7.8	7.6	7.9	7.7	8.0	8.2	7.9	8.0	7.6	7.8
Lighting	43.4	39.0	42.9	41.3	42.5	40.7	41.8	42.6	41.3	43.5	41.9	43.1
HVAC Fans/Pumps	31.1	31.1	25.8	18.7	18.6	20.7	24.7	25.7	20.0	20.4	25.4	29.1
Space Cooling	4.7	4.9	5.0	5.0	5.5	7.1	9.2	9.4	6.8	5.4	5.2	4.8
Space Heating	6.3	6.3	4.1	1.8	1.3	0.5	0.0	0.0	0.5	1.9	3.6	5.2

Table 28. Base Year 2019 Industrial Monthly Consumption Shape by Segment (GWh/month)

Customer Segment	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Food & Beverage	0.9	1.0	0.9	1.0	1.1	1.3	1.0	1.0	1.1	0.9	1.0	0.9
Manufacturing	7.3	7.3	6.6	5.6	7.1	7.1	7.0	7.2	7.2	6.3	7.1	6.8
Other Industrial	9.8	10.7	11.9	10.9	11.5	10.7	11.1	11.6	11.1	11.3	11.4	9.8
Wood Products	12.2	12.7	12.7	12.4	10.9	11.5	10.9	11.6	11.3	14.1	14.1	12.8
Agriculture	2.2	2.1	2.0	2.8	6.3	7.4	8.2	8.5	4.9	3.3	2.4	2.2
Pulp & Paper - Kraft	32.8	29.4	31.5	31.0	32.1	28.3	31.8	31.0	30.4	22.9	33.6	30.7

Table 29. Technical & Economic Cumulative Electric Energy Savings Potential by Sector (GWh/year)

Year	Potential Type	Residential	Commercial	Industrial	Total
2020	Technical	268	328	218	814
2020	Economic	234	268	218	720
2030	Technical	360	501	238	1,099
2030	Economic	328	370	238	936
2040	Technical	369	603	234	1,206
2040	Economic	338	429	234	1,001

Table 30. Total Cumulative Electric Energy Savings Market Potential (GWh/year, % of Sales)

Year	GWh/year	% of Sales
2020	38	1.0%
2021	78	2.0%
2022	116	3.0%
2023	148	3.7%
2024	181	4.5%
2025	217	5.3%
2026	252	6.1%
2027	286	6.9%
2028	319	7.6%
2029	351	8.3%
2030	381	8.9%
2031	409	9.5%
2032	435	10.0%
2033	459	10.4%
2034	480	10.8%
2035	501	11.2%
2036	520	11.5%
2037	537	11.8%
2038	553	12.0%
2039	568	12.3%
2040	583	12.5%

Table 31. Cumulative Energy Savings Market Potential by Source (GWh/year)

Year	Traditional Program Measures	Non-Traditional Measures	Kraft Pulp & Paper
2020	26	9	3
2021	54	17	7
2022	81	25	10
2023	103	31	14
2024	126	37	18
2025	152	43	23
2026	177	48	27
2027	202	53	31
2028	226	57	36
2029	250	61	40
2030	272	65	44
2031	292	68	48
2032	311	72	52
2033	328	75	56
2034	343	78	59
2035	357	81	62
2036	371	84	65
2037	382	87	67
2038	394	90	69
2039	405	92	71
2040	415	95	73

Table 32. Total Cumulative Energy Savings Potential by Month (GWh/month)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	3.7	3.3	3.3	2.8	2.8	2.8	3.1	3.1	3.0	3.1	3.4	3.6
2025	20.6	18.9	18.7	16.4	16.7	16.4	17.9	18.3	16.9	17.5	19.0	20.0
2030	36.3	33.7	33.0	28.6	29.2	28.5	31.1	31.7	29.4	30.6	33.4	35.2
2035	48.4	45.1	43.8	37.4	38.0	37.0	40.3	41.1	38.3	40.2	44.2	46.7
2040	57.2	53.4	51.4	43.2	43.8	42.6	46.3	47.2	44.2	46.8	51.9	55.0

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Table 33. Total Cumulative Electric Demand Savings Potential (MW)

Year	Summer	Winter
2020	5	6
2021	10	12
2022	15	17
2023	20	22
2024	24	26
2025	29	31
2026	33	36
2027	37	41
2028	41	46
2029	45	50
2030	49	54
2031	52	58
2032	56	62
2033	58	65
2034	61	68
2035	63	71
2036	65	74
2037	67	77
2038	69	79
2039	71	81
2040	72	84

Table 34. Cumulative Energy Savings Potential by Sector (GWh/year)

Year	Commercial	Industrial	Residential
2020	16	8	13
2021	33	22	22
2022	50	35	31
2023	67	43	38
2024	85	51	45
2025	105	60	52
2026	124	70	58
2027	142	79	65
2028	159	89	71
2029	174	98	78
2030	188	107	85
2031	201	116	92
2032	212	125	98
2033	221	133	105
2034	230	140	111
2035	237	147	117
2036	244	153	123
2037	250	159	129
2038	255	164	134
2039	261	169	139
2040	266	173	143

Table 35. Cumulative Energy Savings Potential as a Percentage of Sales by Sector (%)

Year	All	Commercial	Industrial	Residential
2020	1.0%	1.1%	1.1%	1.0%
2021	2.0%	2.1%	2.6%	1.6%
2022	3.0%	3.1%	3.8%	2.3%
2023	3.7%	4.0%	4.7%	2.7%
2024	4.5%	5.0%	5.6%	3.2%
2025	5.3%	6.1%	6.6%	3.6%
2026	6.1%	7.0%	7.7%	4.1%
2027	6.9%	7.9%	8.7%	4.5%
2028	7.6%	8.6%	9.7%	5.0%
2029	8.3%	9.3%	10.8%	5.4%
2030	8.9%	9.9%	11.8%	5.8%
2031	9.5%	10.4%	12.7%	6.3%
2032	10.0%	10.8%	13.6%	6.7%
2033	10.4%	11.1%	14.5%	7.0%
2034	10.8%	11.3%	15.3%	7.4%
2035	11.2%	11.5%	16.0%	7.8%
2036	11.5%	11.6%	16.7%	8.2%
2037	11.8%	11.8%	17.3%	8.5%
2038	12.0%	11.9%	17.8%	8.8%
2039	12.3%	11.9%	18.4%	9.1%
2040	12.5%	12.0%	18.8%	9.3%

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Table 36. Cumulative Demand Savings Potential by Sector (MW)

Year	Commercial (winter)	Commercial (summer)	Industrial (winter)	Industrial (summer)	Residential (winter)	Residential (summer)
2020	2.3	2.4	0.8	0.9	2.8	1.8
2021	4.7	4.9	2.2	2.4	4.7	3.0
2022	7.1	7.3	3.5	3.9	6.5	4.2
2023	9.4	9.7	4.3	4.7	7.9	5.1
2024	12.0	12.4	5.1	5.5	9.2	6.0
2025	14.9	15.2	6.0	6.5	10.5	6.8
2026	17.6	17.9	6.9	7.5	11.8	7.6
2027	20.1	20.4	7.8	8.5	13.1	8.4
2028	22.4	22.8	8.7	9.5	14.4	9.1
2029	24.6	25.0	9.6	10.5	15.8	9.9
2030	26.6	27.0	10.5	11.5	17.2	10.6
2031	28.4	28.7	11.3	12.4	18.5	11.3
2032	29.9	30.3	12.1	13.3	19.8	12.0
2033	31.3	31.7	12.9	14.1	21.1	12.5
2034	32.5	32.8	13.6	14.9	22.3	13.1
2035	33.5	33.9	14.2	15.6	23.6	13.6
2036	34.4	34.8	14.8	16.3	24.9	14.2
2037	35.3	35.7	15.4	16.9	26.0	14.6
2038	36.1	36.5	15.9	17.5	27.0	15.0
2039	36.9	37.3	16.4	18.0	28.1	15.3
2040	37.7	38.1	16.8	18.5	29.1	15.7

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Table 37. Cumulative Energy Savings Potential by Customer Segment (GWh/year)

Customer Segment	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
C.Accommod	2	4	6	8	10	13	15	17	18	20	21	22	23	23	24	25	25	25	26	26	26
C.College/Univ	1	1	2	2	3	4	5	6	7	7	8	9	9	10	11	11	12	12	13	13	14
C.Food Svc	1	3	4	5	6	8	9	11	12	13	15	16	17	19	20	21	22	24	25	26	28
C.Hospital	1	1	2	2	3	4	5	5	6	7	7	8	9	9	10	10	11	11	12	12	13
C.Logistic/WHouse	0	1	1	2	3	3	4	5	6	6	7	7	8	8	8	9	9	9	9	9	9
C.Long Term Care	0	1	2	2	3	4	4	5	6	7	7	8	9	9	10	10	11	11	12	12	13
C.Office	2	5	7	10	13	16	20	23	25	28	30	32	34	35	36	37	38	38	39	39	39
C.Other Commercial	1	3	4	6	8	10	12	14	16	18	19	21	22	23	24	25	25	25	26	26	26
C.Retail.Food	2	3	5	6	7	9	10	12	13	14	15	17	18	19	20	21	21	22	23	24	25
C.Retail.Non Food	3	5	8	11	15	18	22	25	28	31	33	35	36	38	39	39	40	40	41	41	41
C.Schools	0	1	1	1	2	2	3	3	4	4	5	5	5	6	6	6	6	6	6	6	6
C.Streetlights/Signals	0	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3
I.Agriculture	1	1	2	3	3	4	5	6	7	8	8	9	10	11	11	12	13	13	14	14	15
I.Food & Bev	0	0	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3
I.Cannabis	1	6	8	8	8	8	8	8	9	9	9	9	9	9	9	9	9	10	10	10	10
I.Mfg	1	1	2	3	4	5	6	7	8	9	11	12	13	14	15	15	16	17	18	18	19
I.Other Industrial	1	2	7	8	9	11	13	14	16	18	19	21	22	24	25	26	27	29	30	31	32
I.Kraft Pulp/Paper	3	7	10	14	18	23	27	31	36	40	44	48	52	56	59	62	65	67	69	71	73
I.Wood Products	2	4	5	7	8	9	10	11	12	14	15	16	17	18	19	19	20	21	21	22	22
R.Apt <= 4 Storeys	3	5	7	9	10	12	13	14	15	16	17	17	18	18	19	19	19	19	20	20	20
R.Apt > 4 Storeys	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
R.Other Residential	1	1	2	2	2	3	3	3	4	4	4	5	5	5	5	6	6	6	6	7	7
R.Fam Attached	2	3	4	5	6	6	7	8	9	10	11	12	13	13	14	15	16	17	17	18	19
R.Fam Detached	11	18	26	32	37	43	48	53	59	64	70	76	81	86	91	96	101	106	110	114	118

Table 38. Cumulative Energy Savings Potential by End Use (GWh/year)

End Use	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Appliances	1	1	2	3	3	4	4	4	5	5	5	6	6	6	7	7	7	7	7	8	8
Compressed Air	1	2	3	4	4	5	5	6	7	7	8	9	9	10	11	11	12	13	13	14	14
Cooking	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
Electronics	4	7	9	12	14	16	18	20	21	23	24	26	27	28	29	30	31	32	33	34	35
Fans/Blowers	1	4	6	7	9	11	12	14	16	17	19	21	22	23	25	26	27	28	28	29	30
Hot Water	1	2	3	4	5	5	6	7	8	9	10	11	12	13	14	14	15	16	17	18	19
HVAC Fans/Pumps	2	4	7	10	13	16	20	23	26	29	32	34	37	38	40	41	41	42	43	43	43
Industrial Process	1	2	3	5	6	7	8	9	11	12	13	14	15	16	17	18	18	19	20	20	20
Lighting	15	28	42	52	63	74	84	95	105	114	122	129	135	140	144	147	150	153	155	158	160
Mat Transport	0	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5
Office Equip	0	1	1	2	2	2	3	3	4	4	4	4	4	5	5	5	5	5	5	5	5
Other	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2
Product Drying	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumps	2	5	8	10	13	16	20	23	26	29	32	36	39	41	44	47	49	51	53	54	56
Refrigeration	1	3	4	5	5	6	6	6	7	7	8	8	8	9	9	9	9	10	10	10	10
Space Cooling	1	1	1	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	4	4
Space Heating	1	3	5	6	8	10	12	14	16	19	21	24	27	30	32	35	38	41	44	47	50
Whole Facility	7	14	20	26	33	41	49	55	61	68	74	81	86	91	96	101	106	110	114	118	122

Table 39. Top 30 Measures for Cumulative Energy Savings Potential in 2030 (GWh/year)

Measure	Market Potential
Com | LED	39
Res | LED	25
Ind | Pump Equipment Upgrade	25
Com | Building Automation Controls	19
Ind | Improved Fan Systems	17
Res | Energy Star Television	15
Ind | Efficient Lighting High Bay	14
Com | VSD on Pumps	14
Com | NC measure 30 %>code	13
Ind | Process Control	13
Com | Interior LED High Bay	12
Com | HVAC Control Upgrades	11
Com | NC measure 45 %>code	9
Com | Photocell	9
Res | Home Energy Reports	8
Ind | Pump Off Controllers	7
Res | Smart Thermostats	7
Com | VSD on Fans	7
Com | Interior Lighting Controls	6
Com | NC Step Code 2	5
Ind | Efficient Air Compressor	5
Ind | Cannabis LED	5
Com | Comprehensive Retrocommissioning	5
Res | Adv Power Strips	4
Res | Energy Star Desktop PC	4
Res | Clothes Dryer	4
Ind | Lighting Controls	4
Res | Air Source Heat Pumps	3
Ind | Energy Management	3
Res | NC Apt Step Code 2	3

Table 40. Top 30 Measures for Cumulative Winter Demand Savings in 2030 (MW)

Measure	Market Potential
Res | LED	5.7
Com | LED	5.3
Com | Building Automation Controls	2.6
Res | Energy Star Television	2.4
Com | VSD on Pumps	2.1
Ind | Pump Equipment Upgrade	2.1
Res | Smart Thermostats	1.7
Com | NC measure 30 %>code	1.7
Com | Interior LED High Bay	1.7
Ind | Efficient Lighting High Bay	1.6
Com | HVAC Control Upgrades	1.6
Ind | Improved Fan Systems	1.5
Res | Home Energy Reports	1.5
Com | NC measure 45 %>code	1.3
Ind | Process Control	1.2
Com | Photocell	1.2
Com | VSD on Fans	1.0
Com | Interior Lighting Controls	0.8
Res | Air Source Heat Pumps	0.8
Com | NC Step Code 2	0.7
Res | Adv Power Strips	0.7
Res | Clothes Dryer	0.7
Res | Ceiling Insulation	0.7
Res | Energy Star Desktop PC	0.7
Com | Comprehensive Retrocommissioning	0.6
Ind | Pump Off Controllers	0.6
Ind | Cannabis LED	0.6
Res | NC Apt Step Code 2	0.6
Res | New Home Step Code 4	0.6
Res | Energy Star Windows	0.5

Table 41. Top 30 Measures for Cumulative Summer Demand Savings in 2030 (MW)

Measure	Market Potential
Com | LED	5.0
Res | Energy Star Television	3.4
Res | LED	3.1
Com | Building Automation Controls	2.6
Ind | Pump Equipment Upgrade	2.6
Com | VSD on Pumps	2.1
Com | NC measure 30 %>code	2.0
Ind | Improved Fan Systems	1.9
Com | HVAC Control Upgrades	1.7
Com | Interior LED High Bay	1.6
Ind | Efficient Lighting High Bay	1.5
Com | NC measure 45 %>code	1.3
Res | Home Energy Reports	1.3
Ind | Process Control	1.3
Com | Photocell	1.1
Com | VSD on Fans	1.1
Res | Adv Power Strips	1.0
Res | Energy Star Desktop PC	1.0
Res | Clothes Dryer	0.9
Com | Interior Lighting Controls	0.8
Com | NC Step Code 2	0.8
Ind | Pump Off Controllers	0.7
Com | Comprehensive Retrocommissioning	0.7
Ind | Efficient Air Compressor	0.6
Res | NC Apt Step Code 2	0.5
Ind | Cannabis HVAC	0.5
Res | New Home Step Code 4	0.5
Ind | Cannabis LED	0.4
Com | CAC Tune-up	0.4
Ind | Lighting Controls	0.4

Table 42. Total Cumulative Energy Savings Potential After Natural Change (GWh/year)

Year	Before Natural Change	After Natural Change
2020	38	38
2021	78	76
2022	116	113
2023	148	143
2024	181	173
2025	217	206
2026	252	238
2027	286	268
2028	319	297
2029	351	325
2030	381	352
2031	409	377
2032	435	399
2033	459	419
2034	480	438
2035	501	455
2036	520	471
2037	537	485
2038	553	498
2039	568	511
2040	583	522

5 Appendix B – Attachments

Lumidyne delivered to FortisBC the following attachments:

Appendix B1

- See “Appendix_B1_2021-07-08.xlsx” with measure-level results.

Appendix B2

- See “Appendix_B2_2021-07-08.xlsx” with measure characterization data.

Appendix B3

- See “Appendix_B3_2021-07-08.xlsx” with key assumptions about building stocks, end use intensities, avoided costs, discount rates, retail rates, etc.

Appendix E
EM&V FRAMEWORK

Evaluation, Measurement & Verification Framework

Revised, May 2018

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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