Diane Roy
Vice President, Regulatory Affairs

Gas Regulatory Affairs Correspondence
Email: gas.regulatory.affairs@fortisbc.com

Electric Regulatory Affairs Correspondence
Email: electricity.regulatory.affairs@fortisbc.com

FortisBC
16705 Fraser Highway
Surrey, B.C. V4N 0E8
Tel: (604)576-7349
Cell: (604) 908-2790
Fax: (604) 576-7074
www.fortisbc.com

April 21, 2021

British Columbia Utilities Commission
Suite 410, 900 Howe Street
Vancouver, B.C.
V6Z 2N3

Attention: Mr. Patrick Wruck, Commission Secretary

Dear Mr. Wruck:

Re: FortisBC Energy Inc. (FEI)

Application for Updated Demand Side Management (DSM) Expenditures for the period covering from 2021 to 2022

Response to the British Columbia Utilities Commission (BCUC) Information Request (IR) No. 1

On March 19, 2021, FEI filed the Application referenced above. In accordance with BCUC Order G-100-21 setting out the Regulatory Timetable for the review of the Application, FEI respectfully submits the attached response to BCUC IR No. 1.

If further information is required, please contact the undersigned.

Sincerely,

FORTISBC ENERGY INC.

Original signed:

Diane Roy

Attachments

1.0 Reference: Exhibit B-1, p. 4

Ratepayer Impact

On page 4 of the FortisBC Energy Inc. (FEI) Application for Updated Demand Side Management (DSM) Expenditures for the period covering from 2021 to 2022 (Application), with respect to the Innovative Technologies Program Area, FEI states:

> There was also concern expressed that, while more study is needed, increased program expenditures for deep retrofits and heat pumps could impact lower income customers and renters through rates, and that efforts need to be maintained to ensure fair access to benefits of DSM for these groups.

1.1 Please provide an estimated rate impact of the incremental expenditure request for 1) the Innovative Technology Program Area, and 2) the overall DSM portfolio in 2022.

Response:

The delivery rate impact due to the incremental DSM expenditures in 2021 and 2022 will begin in the year following the expenditure and continue for a further ten years thereafter. This is because the current accounting treatment of DSM expenditures, as approved by BCUC Order G-10-19[1], is to record the incremental expenditures above $30 million into the non-rate base DSM deferral account. The incremental expenditures are then transferred from the non-rate base DSM deferral account to the rate base DSM deferral account in the following year, with amortization of the rate base DSM deferral account expenditures beginning in the year after the transfer for a 10-year period. For example, the incremental expenditures in 2021 will be transferred to the rate base deferral account in 2022, with amortization beginning in 2023 over a 10-year period. As such, there will be incremental delivery rate impacts in both 2022 and 2023 due to the incremental expenditures in 2021. Similarly, the incremental expenditures in 2022 will be transferred to the rate base deferral account in 2023 with amortization beginning in 2024 over a 10-year period, thus resulting in an incremental delivery rate impact in both 2023 and 2024.

1) Innovative Technology Program Area

Any delivery rate impact due to the proposed increases in expenditures in the Innovative Technology Program Area will be mostly offset by the proposed decrease in expenditures in the Commercial Program Area. However, FEI provides below an estimated delivery rate impact due to the incremental increase in the Innovative Technology Program Area only, assuming no offsetting decrease from other program areas.

The cumulative delivery rate impact in 2024 due to the incremental expenditure requests of $2.433 million and $8.809 million in the Innovative Technology Program Area for 2021 and

[1] The current accounting treatment is consistent with the treatment originally approved by Order G-44-12.

2022, respectively, is estimated to be 0.2 percent (or equivalent to $0.008 per GJ) when compared to the 2021 approved delivery rates. For residential customers with an average annual consumption of 90 GJs, the cumulative delivery rate impact by 2024 will be equivalent to $0.76 per year.

2) Overall DSM Portfolio

With regard to the overall DSM portfolio, there is no delivery rate impact due to the incremental expenditure requests in 2021 as there is no change to the overall DSM portfolio expenditure in 2021. For the incremental expenditure request of $2.290 million in 2022, the cumulative delivery rate impact in 2024 is estimated to be 0.04 percent (or equivalent to $0.002 per GJ) when compared to the 2021 approved delivery rates. For residential customers with an average annual consumption of 90 GJs, the cumulative delivery rate impact by 2024 will be equivalent to $0.16 per year.

1.1.1 Please clarify whether FEI considers deep retrofits and/or heat pumps may be available to low income customers and/or renters in future, should these programs prove to be viable.

Response:

FEI anticipates that if a future program were to be developed for deep retrofits and/or heat pumps, it would be available to low income customers and to buildings with rental units.

2.0 Reference: Exhibit B-1, p. 6

Portfolio Expenditures

In Table 4-1 of the Application, FEI outlines the 2021 and 2022 Program Area expenditures (plan vs revised forecast).

2.1 Please clarify whether Table 4-1 includes any unspent amounts from previous years which have been rolled over to 2021 for any of the Program Areas. If so, please provide the amounts in this table.

Response:

Table 4-1 does not include any unspent amounts rolled over to 2021 from prior years. In the 2020 FEI Annual DSM Report, FEI reported that all approved expenditure amounts, including amounts rolled over from 2019 into 2020, were spent in 2020 leaving no unspent funding available to roll-over into 2021[2] in any of the Program Areas.

2.2 Please confirm, or explain otherwise, that based on the revised forecast for 2021 and 2022, FEI does not anticipate any funding transfers greater than 25 percent of the Program Area budgets for Program Areas other than Commercial, Industrial and Innovative Technologies.

Response:

FEI does not anticipate any funding transfers greater than 25 percent of the Program Area budgets for Program Areas other than Commercial, Industrial and Innovative Technologies. If FEI anticipates the need for a significant budget increase in any other Program Area, FEI will submit an application to the BCUC separately for that amount.

[2] 2020 FEI DSM Annual Report, Section 3.0, page 10. https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/210331-fei-2020-dsm-annual-report.pdf?sfvrsn=8824a81d_2. In the 2020 Annual Report, Rollover Amounts are called "Carryover" for consistency with the FortisBC Inc. (FBC) Annual DSM Report. For the purpose of this IR response, the terms are considered interchangeable.

3.0 Reference: Exhibit B-1, pp. 9–10

Commercial Program Area

On page 9 of the Application, FEI states:

> The main factors driving the lower than originally forecast commercial expenditures and savings in 2021 and 2022 are as follows:
>
> - FEI has experienced lower than expected participation in the Prescriptive Program furnace replacement and kitchen incentive offers due to lower market demand. This trend is expected to continue in 2021 and 2022;
>
> …
>
> - FEI has experienced lower than expected participation in the Rental Apartment Efficiency Program due to restricted on-site activities at some buildings due to COVID-19 and lower than anticipated demand from small property management companies. This trend is expected to continue in 2021 and 2022.

Table 5-1 shows the 2021-2022 Commercial Program Area expenditures by program. For the Prescriptive Program, non-incentive expenditures in the revised forecast are $800,000 in 2021 and $700,000 in 2022, compared to $3,046,000 and $3,653,000 respectively in the DSM Plan.

3.1 Please explain FEI's understanding of the reasons for the lower market demand in the Prescriptive Program.

Response:

FEI launched the commercial furnace incentive offer in the Prescriptive program in late 2019 and has seen lower than anticipated market demand. FEI has not conducted a study to formally evaluate the reasons for lower participation; however, anecdotal reasons for lower demand are as follows:

1. **Tenant / Landlord Split Incentive Dilemma** – Commercial furnaces are often found in small businesses. Many of those small businesses have space leased from property management companies. As such, property management companies are required to invest in capital for upgrades like furnaces while the tenants are those that receive the benefit from energy efficiency. This split incentive dilemma appears to result in lower demand for property management companies to invest in energy efficiency than anticipated in the DSM Plan.

2. **Marketing Challenges** – Small businesses that have furnaces may include restaurants, retail stores, small offices and many other end-uses. When developing the offer it was

difficult to find common marketing channels visible to the broad range of potential customers, including small and large property management companies.

3. **Lower than Anticipated Potential** – The commercial furnace incentive offer under the Prescriptive Program was a new offer launched in 2019 based on the findings of the 2015 Conservation Potential Review that suggested that commercial furnaces had significant market potential for savings. The Conservation Potential Review uses a series of assumptions to derive the potential of various energy efficiency measures. It is possible that the actual market potential for high-efficiency furnaces is lower than stated in the 2015 Conservation Potential Review.

3.2 Please provide further explanation of why FEI considers the trends observed in the Prescriptive Program and Rental Apartment Efficiency Program are expected to continue in 2021 and 2022.

Response:

The response to BCUC IR 1.3.1 discusses why FEI expects the trends observed in the Prescriptive Program to continue in 2021 and 2022. The actual expenditures of Rental Apartment Efficiency Program in 2020 were approximately 50 percent lower than anticipated in the DSM Plan. FEI has not formally evaluated the reasons for lower participation; however, anecdotally the primary reasons for lower demand are as follows:

1. **COVID-19: Restrictions** – Unlike most of FEI's other commercial energy efficiency programs, the Rental Apartment Efficiency Program has a significant in-person component that requires a third party contractor to enter tenant premises to both evaluate energy efficiency opportunities and complete the direct installation of efficient measures. In March of 2020, FEI put restrictions on contractors conducting in-person site visits consistent with the province's Provincial Health Orders. Those restrictions have changed over time as the Provincial Health Orders have changed. As of spring 2021, the restrictions in place reduce the number of site visits that the contractor can conduct. Given the continued uncertainty regarding the COVID-19 pandemic, it is anticipated that this could continue well into 2022.

2. **COVID-19: Demand Impact –** Similarly, there is lower demand from property management companies that operate rental apartments to participate in the Rental Apartment Efficiency Program due to the in-person activities that affect their tenants. While FEI and the contractor have implemented a plan to conduct site visits safely, feedback from property management companies is that there is reduced appetite for non-essential work in their buildings while COVID-19 remains active. It is anticipated that this could continue well into 2022 and that it will take time to re-engage demand from property management companies after the pandemic ends.

3.3 Please explain the significant decrease in non-incentive spending in the Prescriptive Program in the revised forecast.

Response:

The Commercial Program Area is anticipating lower than anticipated non-incentive spending in 2021 and 2022 compared to DSM Plan for the following primary reasons:

1. **Less Than Anticipated Third Party Program Implementation –** In preparing the DSM Plan, it was assumed that several of the program offers would be administered externally through third party implementation consultants. Following program development, significantly fewer program offers were required to be administered externally as they were able to be administered through existing program structures. This reduced FEI's non-incentive administration expenditures significantly.

2. **Lower Than Anticipated Commercial Program Headcount –** In preparing the DSM Plan, it was assumed that FEI would require a significantly larger program team and engineering team to achieve program goals. FEI was able to launch the planned Prescriptive Program offers with fewer labour resources, reducing non-incentive expenditures through program design efficiencies.

3.4 Please discuss if FEI considers there are any actions that could address the lower than expected demand for the Prescriptive Program and Rental Apartment Efficiency Program, and whether such actions would involve an increase in non-incentive expenditures.

Response:

FEI continually looks for additional opportunities to increase program performance. The following are actions that are currently being implemented and/or considered to increase program performance:

Prescriptive Program:

- FEI launched the revised Commercial Energy Assessment offer in mid-2020 that provides walkthrough energy assessments and implementation support for small and medium business. It is anticipated that this program will open up an additional marketing channel to encourage customers to engage in FEI's Prescriptive Program offer. This expenditure was already included in the DSM Plan.

- FEI is launching a marketing campaign for its program offers in summer and fall of 2021 specifically targeting small businesses. While the details are not yet finalized, it is anticipated that this campaign will increase customer awareness and participation in the Prescriptive Program. This expenditure was already included in the DSM Plan.

- FEI is currently evaluating the potential to improve offers as part of its Trade Ally Network to encourage contractors and distributors to market the Prescriptive Program offers to commercial customers. This action would increase non-incentive expenditures.

- FEI is currently evaluating the potential to expand offering contractor incentives for Prescriptive Program offers. In the DSM Plan, it was anticipated that FEI would offer contractor incentives along with customer incentives. However, in practice it was found to be very difficult to offer contractor incentives for all Prescriptive Program offers, particular with FEI's legacy rebate processing software. FEI launched contractor incentives for some of the prescriptive rebate offers. With the launch of the Prescriptive Program on FEI's new rebate processing software, FEI will re-evaluate the potential to offer contractor incentives more broadly. The action would be considered an incentive and would increase incentive expenditures.

- FEI is currently working on better aligning food service equipment incentives with the sales cycle for this particular industry. FEI will look at expanding point-of-sales incentives with additional vendors and to provide incentives for equipment leases. This action would increase both incentive and non-incentive expenditures.

Rental Apartment Efficiency Program

- It is anticipated that there are limited actions that can be taken to improve program participation for the Rental Apartment Efficiency Program while provincial COVID-19 restrictions are in place. Once lifted, FEI will evaluate different strategies to re-build relationships and trust with past and potential building owner participants. These activities are typically direct outreach performed by the Program's Implementation Contractor and they are expected to have a minimal impact on the non-incentive expenditures.

- FEI is currently evaluating the potential to expand eligible building types under the Rental Apartment Efficiency Program from rental apartments to include similar building types like motels and hotels. Broadening the target market will result in supporting natural gas customers with similar needs as the rental apartment building owners. This action would increase both incentive and non-incentive expenditures.

4.0 Reference: Exhibit B-1, p. 16

Gas Fired Heat Pumps

On page 16 of the Application, FEI states:

> According to research conducted by Posterity Group (an energy efficiency engineering consultant organization), the energy savings potential of gas heat pumps across FEI's service territory is approximately 500,000 GJ per year attributed to equipment with efficiencies ranging from a 1.07 to 1.4 coefficient of performance (COP). FEI pilot trial data has also shown that gas heat pumps can maintain efficiencies greater than 100 percent throughout the year, even in cold temperatures. These efficiencies are particularly promising given the aspirational goals of the Pan-Canadian Framework on Clean Growth and Climate Change that require that all space and water heating technologies perform with efficiencies greater than 100 percent by 2035. Although electric resistance heating is 100 percent energy efficient, natural gas fired appliances with this performance level are either not commercially available today or have a low adoption rate.

4.1 Please clarify the difference in scope between the pilot trial data FEI has already obtained, and the proposed pilot project in 2021-2022 for which FEI is seeking additional funding. Please further explain what additional outcomes or learnings FEI anticipates from the 2021-2022 pilot.

Response:

In 2020, FEI completed the Gas Absorption Heat Pump Pilot evaluating commercial gas absorption heat pump technology for domestic hot water applications. While results were promising, they were only representative of the commercial market. FEI's proposed projects in 2021-2022 will focus on investigating residential pre-commercial gas heat pump technologies. Evaluation data will help identify system reliability and performance, installation requirements and customer acceptance to inform future program opportunities for the residential sector.

4.2 Please clarify whether the statement "gas heat pumps can maintain efficiencies greater than 100 percent throughout the year" means the average efficiency over the year is greater than 100 percent, or the heat pumps maintain an efficiency greater than 100 percent at all times in the year.

Response:

The efficiency of gas heat pumps varies throughout the year as it depends on load and temperature. Typically, the efficiency is reduced when there is less demand on the system or

the ambient temperature decreases. On the other hand, if there is greater demand and higher ambient temperatures, the efficiency increases. Gas heat pumps can perform above 100 percent efficiency depending on the outlet hot water temperature set point, the exterior ambient temperature and the temperature differential between the supply and return lines. For instance, Robur's (a commercial gas heat pump manufacturer) performance specification sheet shows ranges from low ambient temperatures of (-30C) to perform at 0.88-1.02 Coefficient of Performance (COP) and at 25C to perform at 1.34-1.46 COPs. Based on how these temperatures compare to temperatures in FEI's service territory, FEI anticipates that the heat pumps will maintain an average efficiency of greater than 100 percent throughout the year for the majority of customers.

4.2.1 Please discuss whether the cold temperatures tested are comparable to the winter conditions observed in FEI's service area.

Response:

Yes, pilot data and evidence from manufacturer performance specification sheets indicate that gas heat pumps will perform under the average winter conditions observed in FEI's service area that range from -15.7C to 4.7C according to Environment Canada[3]. In 2019, FEI conducted a gas heat pump pilot monitoring seven commercial sites across the Lower Mainland between October 2019 to September 2020. Throughout this period, sensors logged outdoor temperatures between -10C to 25C. Another pilot facilitated through The Atmospheric Fund (TAF) measured gas heat pumps in Toronto, Ontario operating with temperatures ranging between -23C to 31C.[4] Both pilots showed average annual COPs (coefficient of performance) of 1.14. Furthermore, the performance specification sheet for the commercial gas heat pump manufacturer (Robur) shows ranges from low ambient temperatures of -30C to perform at 0.88-1.02 COP and at 25C to perform at 1.34-1.46 COP.

4.2.2 Please discuss whether there are any operational limitations of gas heat pumps in extreme cold weather.

Response:

FEI recognizes that given the low adoption of gas heat pumps there is insufficient information with respect to the performance in cold weather lower than -10C and this will require further field

[3] Based on the Environmental Canada's average daily temperatures from 2011 to 2020 from November to February

[4] https://taf.ca/wp-content/uploads/2018/10/TAF_GAHP-White-Paper_2018.pdf

pilots to assess. Please refer to the response to BCUC IR1 4.2.1 regarding FEI's observations on gas heat pump performance across different temperatures. Anecdotally, based on discussions with manufacturers, if the ambient temperature drops below -30C, gas heat pumps will still perform but may act similar to standard and/or condensing gas furnaces and have similar efficiencies.

4.3 Please outline the typical efficiency range of existing natural gas fired appliances.

Response:

Other than gas heat pumps, all of the existing natural gas fired appliances have efficiencies less than 100 percent. The actual range of those efficiencies can vary across different sites due to age, condition, loads and temperatures. Anecdotally, FEI estimates that the typical efficiency range of natural gas appliances can be 10 percent for a decorative style fireplace and as high as 98 percent for a condensing furnace, while manufacturer claims for gas heat pumps can range up to 160 percent.

4.4 Please clarify whether the intent of the pilot program is to replace/ supplement existing natural gas fired appliances, and/or existing electric heating systems.

Response:

The intent of the program will be to evaluate natural gas heat pumps as a replacement to baseline natural gas measures such as a furnace, boiler and hot water tank. FEI will only be using the pilot program to assess how gas heat pumps can directly or indirectly result in significant reductions of energy use or significantly more efficient use of energy as per the technology innovation program definition in the Demand-Side Measures Regulation.

5.0 Reference: Exhibit B-1, pp. 16–17

Deep Energy Retrofits

On page 16 of the Application, FEI states:

> There has been an increased interest beyond what was originally anticipated from local governments and other stakeholders in pursuing deep retrofits that include a combination of window, envelope and mechanical upgrades to dramatically reduce GHG emissions within the existing building stock.

On page 17, FEI states:

> A deep energy retrofit or 'deep retrofit' of a home or building is a retrofit in which the envelope and mechanical systems are improved such that there is a reduction in overall energy and GHG performance by at least 30 percent or more…
>
> A deep retrofit approach encourages a comprehensive "home-as-a-system" or "building-as-a-system" approach, potentially leading to more comprehensive energy and GHG savings. From a program perspective, a Deep Energy Retrofit approach may allow FEI to achieve deeper engagement and higher levels of cost-effective savings…
>
> FEI is requesting increased funding to support pilot-scale deep retrofits across residential and commercial rate customers to identify whether it is feasible and cost-effective to move a broader initiative forward. The pilot program will determine the practicality of a deep retrofit approach in BC.

5.1 Please discuss the significance of a 30 percent reduction in energy, or the rationale for this threshold to be classed as a "deep" retrofit.

Response:

FEI considers a "deep" retrofit to encourage customers to upgrade their mechanical systems and building envelope as a comprehensive approach to achieve greater overall savings than that of individual energy efficiency improvements. Based on a review of available literature and case studies, energy reductions from deep retrofits can vary from approximately 30 to 80 percent depending on building type, vintage, end use, and the extent of energy efficiency upgrades implemented.

The 30 percent reduction in energy is on the low end of the estimates for deep energy retrofits, but reflects a reasonable minimum for a project that completes comprehensive mechanical system and building envelope improvements in tandem. For instance, in high-rise condos built between 1990 and 2000, where the Domestic Hot Water (DHW) and ventilation is provided by natural gas appliances but the heating is provided by electric baseboards, overall natural gas energy reductions are estimated at 22 percent. This assumes that the retrofit would replace

both the DHW and ventilation system with efficient mechanical natural gas upgrades, as well as cladding and window replacements while keeping the electric heating system as is. On the other hand, for high-rise rental apartments built between 1950 and 1970, where DHW, ventilation and heating is provided by mid efficiency natural gas appliances, overall natural gas energy can be reduced by approximately 84 percent. This assumes that the retrofit will incorporate gas heat pumps, in-suite Heat Recovery Ventilators (HRVs), cladding and window upgrades. FEI recognizes that a pilot will be required to better understand energy reduction levels and to optimize bundle solutions across different building archetypes. Information gained from the pilot will be incorporated into future program design considerations.

5.2 Please discuss whether FEI's current DSM portfolio includes programs containing any or all of the following offerings: window upgrades, envelope upgrades, and mechanical upgrades.

5.2.1 If yes, please discuss why FEI requires a pilot project to understand the viability of a program which packages such offerings together.

Response:

FEI's current residential and commercial programs include incentives for some of the offerings noted above, but not all, and none of them take the system-wide approach that a deep retrofit does. While individual prescriptive measures continue to serve their purpose for equipment upgrades and smaller renovations, deeper retrofits require a different approach.

- Part 9 Programs - Residential
    - The Home Renovation rebate program offered through the Residential Program Area provides rebates for window upgrades through the CleanBC Better Homes Program, insulation offers for basic insulation upgrades, and mechanical upgrades for space and water heating appliances. However, in order to realize the full energy and cost savings potential in major renovation projects, gaps exist for addressing the comprehensive building envelope, air sealing, and the house-as-a-system approach. Optimizing the building envelope enables the right-sizing of equipment for operational efficiency. Improving air tightness and adding wall insulation are examples of measures not routinely upgraded during routine renovations. Not doing so results in lost opportunities for conservation, improved occupant comfort, and climate action potential. The need to accelerate home retrofits is in response to climate action policies and customer demand. Local governments, for example, are developing energy retrofit strategies with a goal for deep energy savings in the existing building stock beyond the level that the Home Renovation Rebate Program incentives are able to achieve. In addition, the BC Government is working on a Building Alterations Code to improve the

performance of existing buildings. As a result, FEI believes it would be beneficial to explore program design options for homeowners doing a deep renovation project. Examples of the types of projects this offer would be suitable for include homes where cladding is being removed, or where interiors are being taken down to the studs. In addition, a design offer that builds upon the existing EnerGuide for homes energy advisor process, and workforce training to support the end-to-end process is critical.

- Part 3 Programs - Commercial
    - The Commercial Program Area offers three programs that provide incentives for high efficiency mechanical systems and building envelope retrofits.
        - The Prescriptive Program provides incentives for replacement of existing natural gas mechanical equipment.
        - The Performance and Rental Apartment Efficiency Programs provide incentives to evaluate and implement both mechanical and building envelope upgrades, though only a few smaller-scale building envelope projects have been advanced through the programs. No project incented through either program has looked at a comprehensive mechanical and building envelope retrofit completed in tandem.

Although incentives are available for retrofits of individual equipment or end-uses, customers rarely undertake comprehensive mechanical and building envelope retrofits necessary to attain deep energy savings due to barriers that include, but are not limited to:

- Cost;
- Risk and liability;
- Permitting;
- Technical knowledge of building owners and trades;
- Project timing; and
- Impact on occupants.

FEI believes that a pilot is required to better understand those barriers and to fill gaps to better assess the viability of designing and offering a future deep energy retrofit program. Some of the gaps include:

- Better understanding of the overall process for conducting a deep retrofit such as points of intervention and integration of measures;
- Phasing of the assessments and detailed upfront design work;
- Identifying existing or innovative energy efficiency bundles across building archetypes, vintages and sector;
- Gauging project costs and energy savings for cost benefit calculations;

- Overseeing the construction phase;
- Assessing and mitigating risks associated with the construction such as asbestos removal and tenant safety;
- Gauging the customer acceptance of deep retrofits;
- Identifying the specific educational gaps across stakeholders involved in the retrofit; and
- Ensuring building owners understand the energy savings opportunities and the benefits of their project.

FEI expects deep retrofits to be key contributors to federal government climate action targets. According to the Department of Finance Canada's Budget 2021 A Healthy Environment for a Healthy Economy[5]:

> … deep home energy retrofits can have a big effect on emissions reduction … Budget 2021 proposes to provide $4.4 billion on a cash basis ($778.7 million on an accrual basis over five years, starting in 2021-22, with $414.1 million in future years), to the Canada Mortgage and Housing Corporation (CMHC) to help homeowners complete deep home retrofits through interest-free loans worth up to $40,000.". Further, in 2020, The Atmospheric Fund (a regional climate agency that invests in low-carbon solutions) published The Case for Deep Retrofits[6], a report supported by financial contributions from Natural Resources Canada and the Federation of Canadian Municipalities, stating that "Achieving Canada's goal of net-zero carbon emissions by 2050 will require deep energy efficiency retrofits that target more than 40 per cent savings across all building types.

5.3 Please explain FEI's current understanding of window upgrades, envelope upgrades, and mechanical upgrades on an individual basis, with respect to: 1) equipment performance/ energy savings 2) cost-effectiveness, and 3) customer acceptance.

Response:

Please refer to the response to BCUC IR 1.5.2 which outlines program offerings that provide rebates for window, envelope and mechanical upgrades. It is that program knowledge as further described in FEI's natural gas demand-side management annual reports that provides FEI with a strong understanding of those upgrades on an individual basis with respect to equipment performance/energy savings, cost-effectiveness and customer acceptance.

[5] https://www.canada.ca/en/department-finance/news/2021/04/budget-2021-a-healthy-environment-for-a-healthy-economy.html

[6] https://taf.ca/wp-content/uploads/2020/09/TAF-Business-Case-Deep-retrofits_2020.pdf

FEI filed its most recent Natural Gas Demand Side Management Programs Annual Report with the BCUC on March 31, 2021. The Report notes that in 2020, FEI achieved its total approved DSM expenditures and surpassed its estimated annual energy savings for the year, based on its 2019-2022 DSM Plan. Incentive expenditures at year-end accounted for 73 percent of the overall portfolio expenditures. The Report details how FEI cost-effectively delivered these programs as set out in the 2019-2022 DSM Plan[7].

For residential buildings, FEI has a good understanding of the performance/energy savings and cost effectiveness of window upgrades that are incented through the CleanBC program but realizes that from a customer acceptance perspective, window installations are expensive and energy efficiency benefits may not routinely be part of the sales process. For envelope upgrades, FEI has a good understanding on the base insulation offers in the Home Renovation program for both performance/energy savings and cost effectiveness. For larger-scale renovation projects, FEI needs to continue to build its knowledge, and industry knowledge, of insulation and air sealing measures as well as costing models associated with deep energy retrofits. For mechanical upgrades, FEI has a very good understanding for equipment performance/ energy savings, cost-effectiveness and customer acceptance based on existing program knowledge but recognizes that additional experience and costing knowledge is needed to better understand heat recovery ventilators (HRVs), ventilation and interactive effects of multiple upgrades with increasing air tightness.

For commercial buildings, FEI has an excellent understanding of the performance/energy savings and cost effectiveness for a variety of mechanical upgrades through its Prescriptive and Performance Programs, including boilers, water heaters, roof top units, HRVs, energy recovery ventilators (ERVs), heat recovery chillers, and other hybrid system. FEI has some project-specific understanding of the performance/energy savings and effectiveness of building envelope and window upgrades through the Performance Program, though projects have been limited. FEI has not supported a comprehensive commercial retrofit project that included mechanical, building envelope, and window upgrades together. Thus FEI would benefit from additional experience and knowledge to better understand the interactive effects of multiple upgrades with increasing air tightness.

Although FEI has a strong knowledge of individual measures where programs exist, field pilot expertise for both Part 3 and Part 9 buildings is required to expand that knowledge to find ways to drive deeper savings, improve cost-effectiveness and customer acceptance.

5.3.1 With respect to 1) to 3) above, please describe how FEI anticipates a deep energy retrofit program may compare to a series of individual DSM offerings.

[7] FortisBC Energy Inc. Natural Gas Demand Side Management Programs 2020 Annual Report, March 31, 2021 p. 69

Response:

Based on a review of available literature and discussions with subject matter experts there is evidence that a "building-as-a-system" or a "house-as-a-system" approach may provide cost and performance efficiencies and increased customer acceptance when compared to the uptake of individual measures. Examples are as follows:

Greater performance / energy savings

- The intent of the design of the deep energy retrofit is to optimize the envelope upgrade through looking at a high performance envelope system when bundled together that will maximize performance and energy savings. This bundled solution may include high performance windows, walls, roof assemblies and air barriers collectively to reduce air leakage by 50 percent.
- The design of a deep energy retrofit will optimize a heating and domestic hot water system which may include high efficiency equipment, updated controls and energy distribution such as revised piping arrangement and updated terminal units.
- Collectively, both the envelope and mechanical upgrades are designed and optimized as a system to allow for better centralized building controls, operator experience and right sizing.
- Identifying additional energy saving opportunities that would not have been identified if not for the assessment or design of the deep energy retrofit.

Cost-effectiveness

Although there may be additional upfront costs to pay for design and assessments in comparison to individual upgrades, as well as the potential need for a general contractor to coordinate professionals and trades, there may be cost efficiencies gained, such as:

- Ability to consolidate and streamline retrofit design work rather than conducting multiple designs, each focusing on individual systems at different times.
- Ability to consolidate mechanical and envelope upgrades rather than hire multiple organizations at different times.
- The ability to capture additional energy savings may improve the cost effectiveness over the life of the project.
- The addition of low or no cost bundled upgrades that can be incorporated into the design that may result in additional savings.
- There may be cost efficiencies for the customer in upgrading other non-energy or safety improvements in the building such as space optimization, re-piping, seismic upgrades, hazardous material removal, resolving indoor air quality, pest and noise issues and accessibility improvements.

Improved customer acceptance

- Customers will have access to professional services to support them with the design and construction of their buildings that may improve their overall experience, acceptance of the upgrades, and improved outcome for health, safety and layout.
- Customers will have greater visibility and understanding of their building in relation to saving energy. As such, FEI anticipates the customer will become more involved throughout the process, increase their energy literacy and be more active in maintaining and optimizing energy use once the retrofit has been completed.

The pilot will provide further data on whether designing a comprehensive deep retrofit program can achieve greater savings, cost-effectiveness and customer acceptance for the specific purposes of larger, more complex projects. Current program offers are expected to remain in market for individual upgrades as both streams of activities are necessary to support the improvement of British Columbia's building stock in Part 9 and Part 3 buildings for climate action objectives.

5.3.1.1 Please discuss any uncertainties in this regard, and how FEI anticipates the pilot program will address such uncertainties.

Response:

Please refer to the response to BCUC IR1 5.2.

5.4 Please explain further why the deep retrofit program is considered "innovative."

Response:

A deep energy retrofit is considered "innovative" as it meets the definition of a technology innovation program as defined in the Demand-Side Measures Regulation[8]. The table below provides a comparison of the Demand-Side Measures Regulation definition with an explanation of how deep retrofits meet the requirements.

Technology Innovation Program Definition	Supporting Factors to Meet Definition
(a) to develop, use or support	Deep energy retrofits incorporate a system of technologies and

[8] https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/326_2008

Technology Innovation Program Definition	Supporting Factors to Meet Definition
the increased use of a technology, a system of technologies, a building design or an industrial facility design that is	building design to optimize energy savings from a "building-as-a-system" or a "house-as-a-system" perspective. A "building-as-a-system" or a "house-as-a-system" approach integrates both the envelope and mechanical upgrades holistically rather than in isolation. This building science and design approach is not commonly applied but can result in significant incremental energy savings compared to independent and non-coordinated measure implementation.
(i) not commonly used in British Columbia, and	Based on available literature and case studies, deep energy retrofits are not commonly undertaken in British Columbia. For example, for Part 3 buildings, a recent study conducted by RDH Building Science (a building science and engineering consultancy agency) identified that deep energy retrofits involving a combination of mechanical and envelope upgrades are uncommon, especially those including innovative technologies such as gas heat pumps and enhanced building controls. In fact, the same study identified only a handful of deep energy retrofit projects across British Columbia, especially those that incorporate natural gas energy efficiency improvements. For Part 9 retrofit projects, they usually lack the support of any professional services and so rarely attain deep energy retrofit performance. There is a small, underutilized pool of energy advisors who can conduct a home energy audit and speak to the house-as-a-system and benefits of deep energy retrofit projects. Some deep energy retrofit systems (e.g., Larsen trusses) that permit significant additions of outboard insulation, require an engineer's design and so present both an affordability and availability barrier. General contractors often do not present detailed cost-benefit analyses or multiple subcontractor quotes to homeowners, and instead retain their preferred subcontractor trades and rely on these subcontractors to make technical decisions on the homeowner's behalf. FEI suspects that the low adoption and awareness of deep energy retrofits is attributable to several barriers and obstacles as greater detailed in response to BCUC IR 1.5.2.
(ii) the use of which could directly or indirectly result in significant reductions of energy use or significantly more efficient use of energy,	Based on industry reports and case studies, deep energy retrofits can result in building energy reductions of 30 – 80 percent depending on building type, vintage, end use, and the extent of energy efficiency upgrades implemented.
(b) to do what is described in paragraph (a) and to give demonstrations to the public of any results of doing what is described in paragraph (a), or	FEI will implement pilot programs in both the residential and commercial sector to demonstrate a "system approach" as well as to validate the overall energy savings and emission reductions opportunities. Furthermore, FEI will work with tenants and building maintenance staff to identify customer barriers and acceptance challenges as well as installation requirements. The Information gained from those demonstration projects will be important to support the development of a future deep energy retrofit program.
(c) to gather information about	As buildings pursue deeper energy, emissions, and cost

Technology Innovation Program Definition	Supporting Factors to Meet Definition
a technology, a system of technologies, a building design or an industrial design referred to in paragraph (a).	reductions; designs may require atypical approaches to envelope assemblies (e.g. thermally-broken balconies) or mechanical system design (e.g. gas heat pump integration). This may present a risk to both design and construction teams who may not be familiar with these technical approaches, and who may struggle with reliably addressing challenging envelope details. Local code requirements, heritage considerations, or permitting issues may inhibit the implementation of some deep energy retrofit design approaches. In addition, introduction of new technologies (e.g. smart thermostats) may not be well-received by occupants or operators, who may override controls and prevent the building from performing as expected. FEI will gather information on proposed deep energy retrofit designs and technologies to identify strategies to overcome barriers with awareness, affordability, availability, accessibility and acceptance to inform future DSM programming.

1