New Brunswick Demand Side Management Potential Study

Volume 1 – Results (Final)

Prepared for:

Énergie NB Power

New Brunswick Power Corporation

dunsky Energy + Climate

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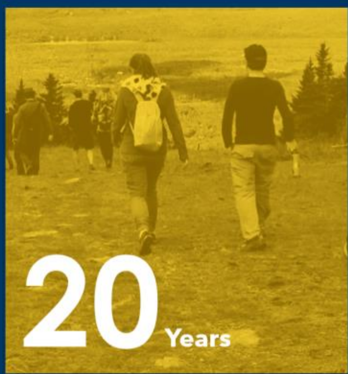
About Dunsky



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With deep expertise across the Buildings, Mobility, Industry and Energy sectors, we support our clients in two ways: through rigorous **Analysis** (of technical, economic and market opportunities) and by designing or assessing **Strategies** (plans, programs and policies) to achieve success.

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Executive Summary

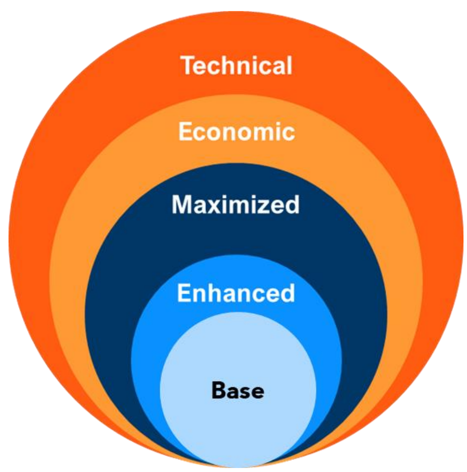
The following executive summary provides high-level results and key takeaways of the 2026-2050 New Brunswick Multi-Fuel Demand Side Management (DSM) potential study conducted by Dunsky Energy + Climate Advisors and its subcontractors. A detailed discussion of the results is provided in the main body of the report. Volume II of this report contains appendices that outline the methodological approach and data inputs utilized in this study.

Study Overview

The DSM potential study quantifies the savings potential for energy (electricity and combustible fuels, including natural gas, oil, biomass, propane, gasoline, diesel and marine fuel oil), peak demand and greenhouse gas (GHG) emissions over a 25-year horizon and includes five study components, covering:

- Energy efficiency (EE),
- Fuel switching in space heating and industry (FS),
- Renewable distributed generation (DG),
- Clean transportation (CT), and
- Demand Response (DR)

The study assesses potential at the technical, economic, and program achievable levels for each study component. For achievable potential, the study explores three scenarios to determine how incentive levels and enabling activities can impact achievable program savings:



- A **Base** scenario emulating existing incentive levels and program configurations,
- An **Enhanced** scenario that emulates increased DSM efforts, primarily through increased incentive levels above and beyond current program levels (EE, FS, DG), or through expanded program offerings (DR) and emulates increased DSM efforts above Base scenario levels, primarily in terms of enabling activities, expanded program configurations or incentives, and
- A **Maximized** scenario that emulates maximum reasonable DSM efforts. This scenario maintains the increased incentives from the enhanced scenario, and increases program enabling activities (EE, FS). For select study streams, the maximum scenario considers increased incentives above the enhanced scenario in addition to enabling activities (DR, DG).

The specific incentive parameters for each study component and the description and methodological approaches are described in Volume II.

System Impacts

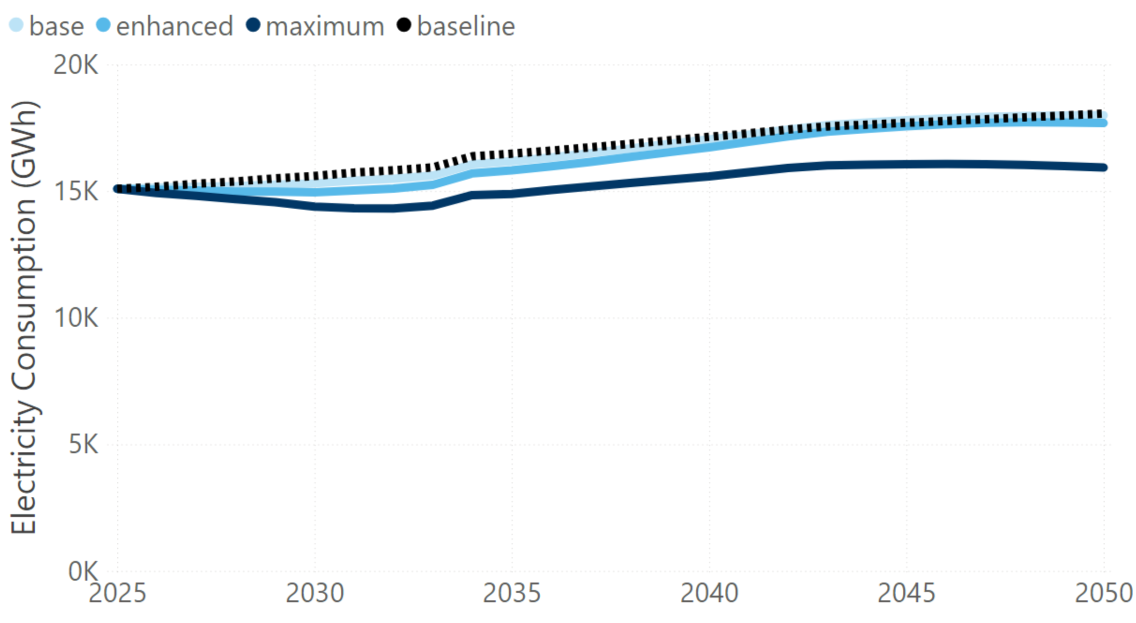
Over the course of the study period, the adoption of measures under the three achievable potential scenarios will have a notable impact on electricity consumption, peak demand, fuel consumption and greenhouse gas (GHG) emissions in the province.

Takeaway 1: Electricity system impacts will be determined by the combined influence of key drivers that decrease (EE, DG, DR) or increase (FS, CT) electricity consumption and peak demand. There is an **opportunity to leverage EE, DG and DR to mitigate the increase in consumption and peak demand from CT and FS.**

Electricity Consumption is projected to decrease in the short-term across all three scenarios, as the impacts of EE and DG outweigh the impacts of electrification (FS and CT), leading to a decrease in electricity consumption of 2-8% in 2030 relative to the baseline (Figure ES - 1).

In the longer term, in the base and enhanced scenarios, electricity consumption is comparable to the baseline (with the impacts of EE and DG approximately balancing FS and CT). In the maximum scenario, however, the combined increase of incentives and enabling activities significantly increases uptake of EE and DG, and their combined impact more than offsets the impacts of CT and FS, leading to a 12% decrease in electricity consumption in 2050 relative to the baseline.

Figure ES - 1. Forecasted electricity consumption (GWh) per scenario

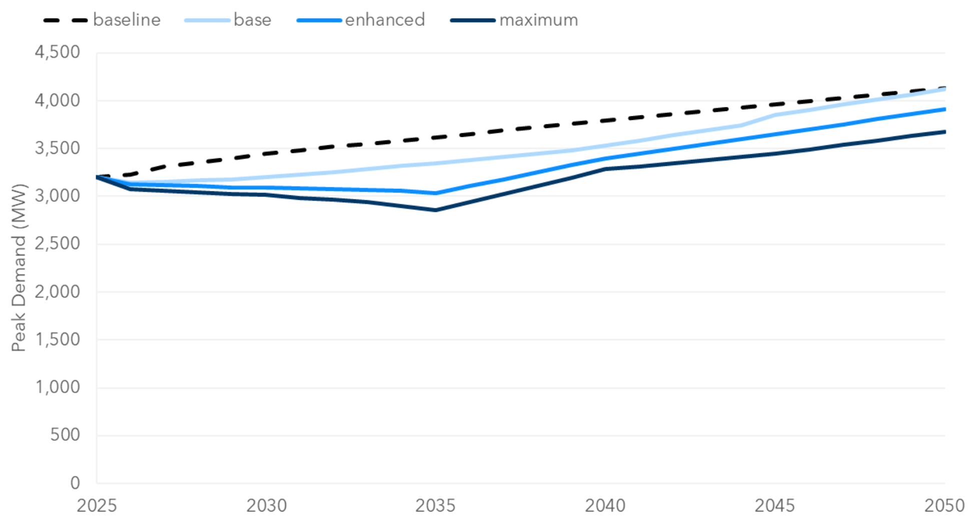


Peak demand follows a similar trend, with demand decreasing in the short term relative to the base scenario as the impacts of EE, DR and DG outweigh the impacts of electrification (FS and CT), leading to a decrease in peak demand relative to the baseline of 7-13% in 2030 relative to the baseline (In the longer term, in the base scenario, peak demand is comparable to the baseline forecast in 2050. In the enhanced and maximum scenarios, the impacts of EE, DR and DG continue to outweigh the impacts of CT and FS, and forecasted peak demand remains below the baseline forecast. Overall, this leads to a 5-11% decrease in peak demand in 2050 relative to the baseline forecast.

Figure ES - 2).

In the longer term, in the base scenario, peak demand is comparable to the baseline forecast in 2050. In the enhanced and maximum scenarios, the impacts of EE, DR and DG continue to outweigh the impacts of CT and FS, and forecasted peak demand remains below the baseline forecast. Overall, this leads to a 5-11% decrease in peak demand in 2050 relative to the baseline forecast.

Figure ES - 2. Forecasted peak demand (MW) per scenario

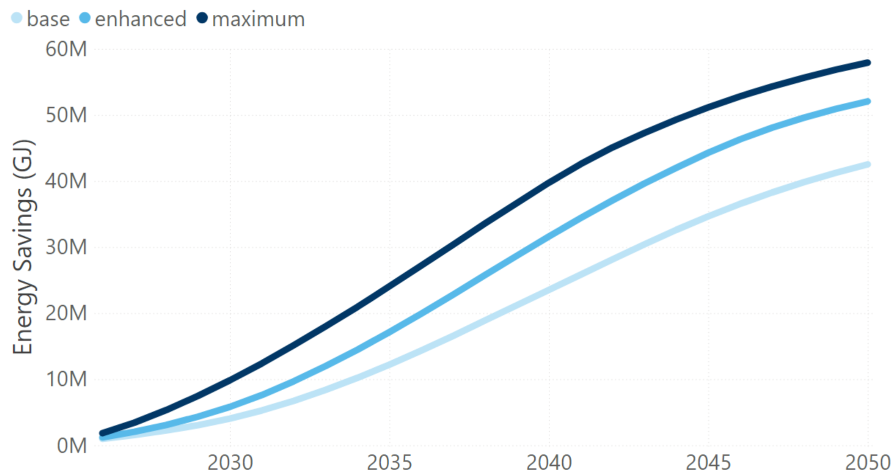


Takeaway 2: Combined, opportunities in energy efficiency, fuel switching, distributed generation and clean transportation are projected to **significantly reduce fuel consumption and GHG emissions in the province.**

Combustible fuel savings are expected to reach 40-55 PJ in 2050 (Figure ES - 3), which is approximately 20% of province-wide energy consumption.[1] The vast majority (~90%) of fuel savings are driven by electrification of on-road transportation considered in the clean transportation (CT) study component, and include diesel and gasoline savings. The remaining approximately 10% of combustible fuel savings are driven by EE and FS, and include primarily oil and natural gas.

[1] New Brunswick's total energy consumption was approximately 209 PJ in 2020.

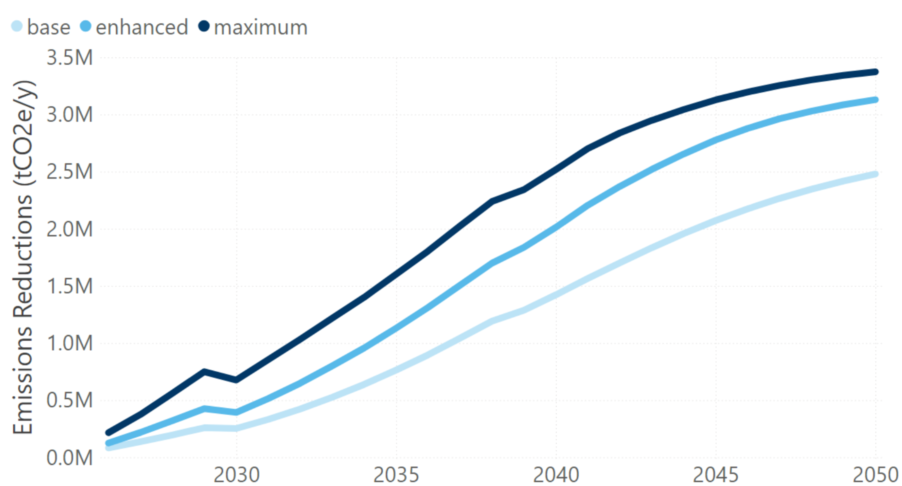
Figure ES - 3. Combustible fuel savings (GJ) 2025-2050 per scenario



Greenhouse gas emissions reductions are also projected to be significant under the three achievable scenarios (Figure ES - 4). By 2030, Emissions are reduced by 0.3 to 0.7 MtCO2e/y (3-6% compared to 2022 GHG emissions)[2]. By 2050, Emissions are reduced by 2.5 to 3.4 MtCO2e/y (21-28% compared to 2022 GHG emissions).

In the short term, energy efficiency accounts for the majority of emission reductions. However, from 2030 onwards as uptake of electric vehicles increases, the electrification of on-road transportation represents the majority of emissions reductions.

Figure ES - 4. Annual GHG emissions reductions (tCO2e/y) 2025-2050 per scenario



Overall Program Savings Potential

The following section presents a summary of the **combined achievable potential results and program costs and benefits** for study streams core to NB Power's DSM programs and

[2] Environment and Climate Change Canada (2024). National inventory report 1999-2022.

plans – energy efficiency (EE), fuel switching (FS), distributed generation (DG), and demand response (DR).

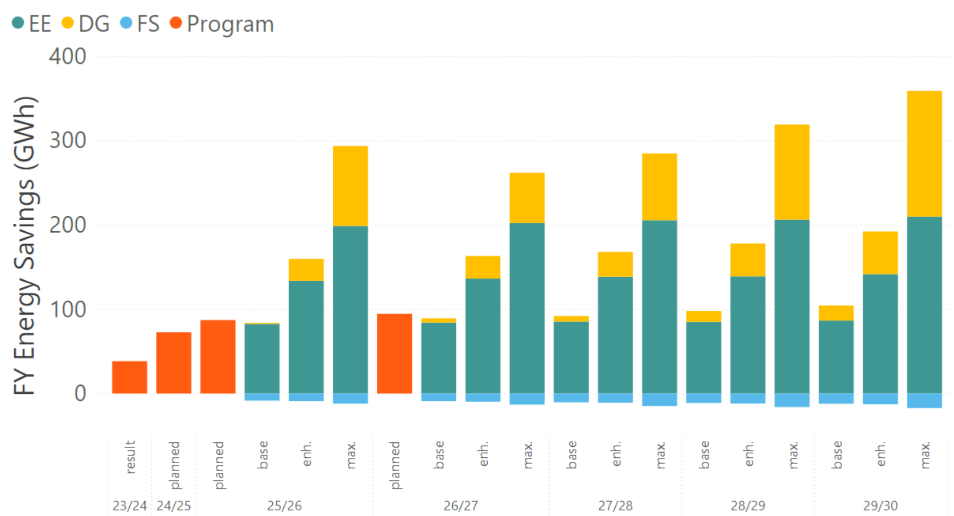
Takeaway 3: Projected electricity energy savings fall slightly below planned savings in the base scenario. This indicates that program enhancements may be required to achieve planned savings over the coming years.

Base scenario savings exceed recent program results and are comparable with 24/25 planned savings but fall below planned savings in 26/27 and 27/28, with marginal year-over-year increase in savings, indicating that program enhancements may be required to meet future planned savings (Figure ES - 5).

There is **significant potential to increase savings through increased incentives (enhanced scenario) and enabling activities (maximum scenario).**

- **Savings from EE dominate savings**, particularly in the base scenario
- As **adoption of rooftop solar PV increases overtime** (and in the enhanced and maximum scenarios), DG savings potential is also significant.
- **FS measures lead to some increase in electricity consumption, but net energy savings overall**, as the electrified equipment is typically more efficient than a fuel-fired counterpart (e.g. air-source heat pumps are approximately 3 times more efficient than gas or oil heating equipment).

Figure ES - 5. Achievable electric EE, FS and DG potential (first-year GWh)

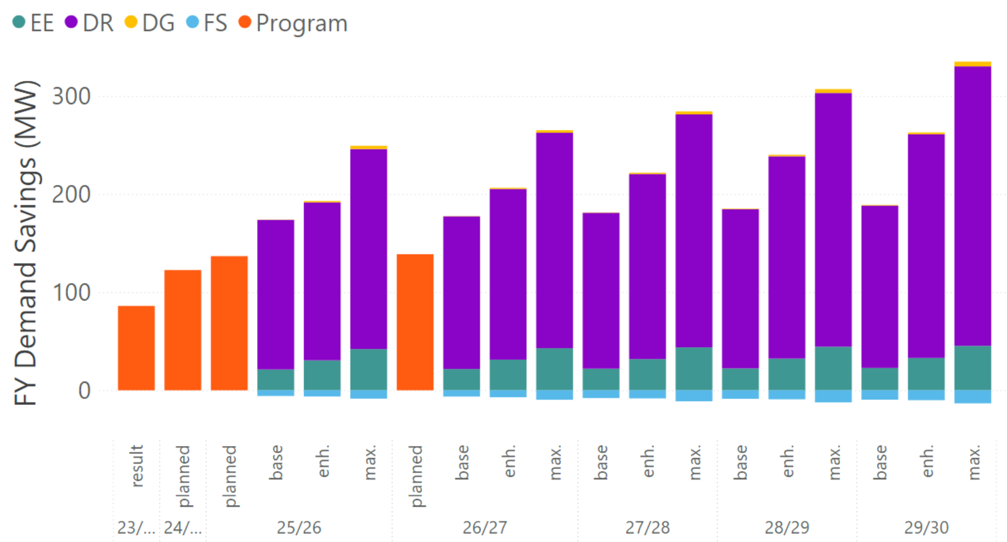


Takeaway 4: Projected demand savings exceed planned savings in the base scenario (Figure ES - 6) This indicates a potential source of increased savings with existing programs, should NB Power seek to adjust its portfolio investments.

Peak demand savings represent approximately **5-8% of forecasted baseline peak demand.**

While **demand response potential is notable** and accounts for the majority of first-year savings, **passive savings from energy efficiency are also significant and** contribute to nearly half of cumulative demand savings by FY 39/40.

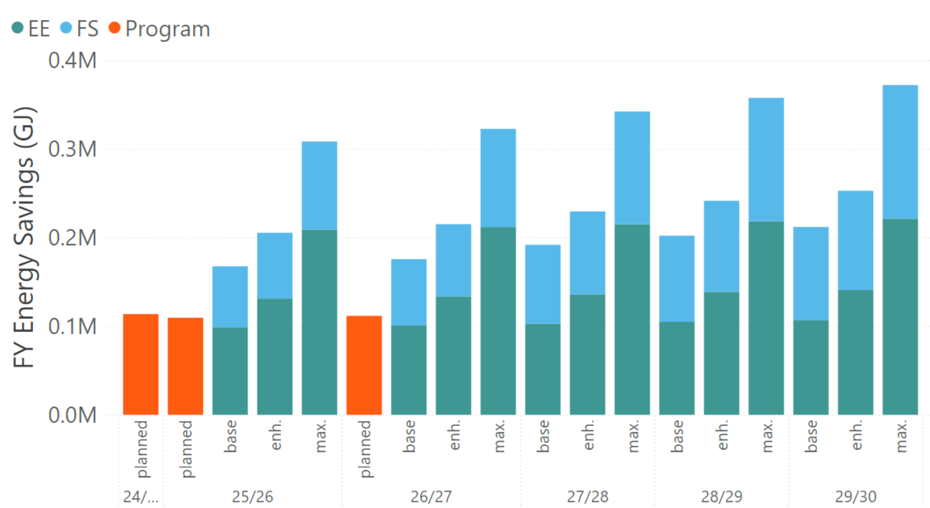
Figure ES - 6. Achievable demand EE, FS, DG and DR potential (first-year MW)



Takeaway 5: Projected combustible fuel savings exceed planned savings in the base scenario (Figure ES - 7) This indicates a potential source of increased savings with existing programs, should NB Power seek to adjust its portfolio investments.

Oil savings account for over half of overall combustible fuel savings, followed by natural gas and biomass. Oil savings are largely driven by electrification of oil space heating (particularly in the residential sector), and electrification of oil-heated industrial processes.

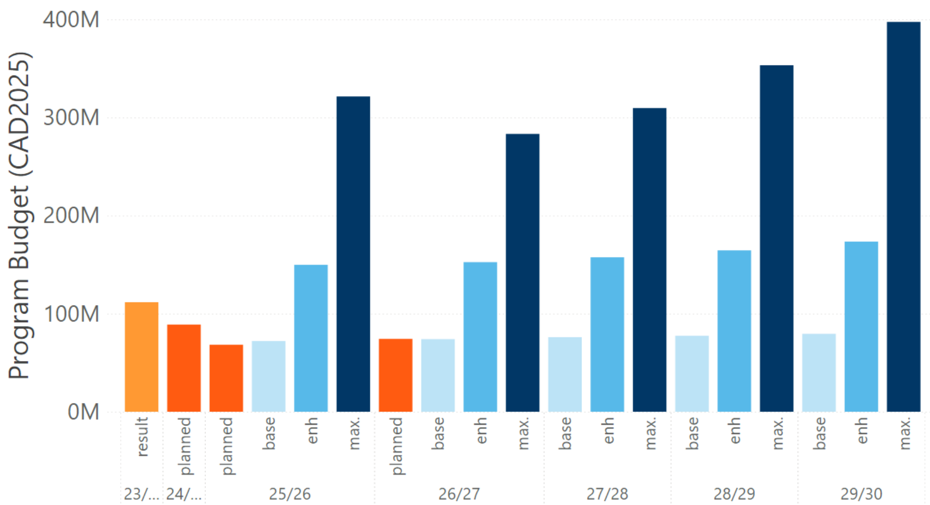
Figure ES - 7. Achievable combustible fuel EE and FS potential (first-year GJ)



Takeaway 6: Increased incentives and enabling activities increase savings significantly but also come at a higher cost, driven by both increased incentives paid as well as an increase in program administration costs required to support increased enabling activities.

In the base scenario, annual program budgets are approximately $72M (CAD2025), which is comparable to planned budgets in 25/26 and 26/27 (Figure ES - 8).

Figure ES - 8. Program Cost Estimates



Average acquisition costs in the base scenario are also comparable to plans.[3] In the enhanced and maximum scenarios, costs increase at a faster rate than first-year savings, resulting in higher average acquisition costs per **first-year** GJ of energy savings as each additional unit of savings comes at a higher marginal cost. This being said, increases in average acquisition cost per **lifetime** GJ of energy savings, taking into account the total savings over a measures' lifetime, increase only marginally between scenarios (Table ES - 1). These results indicate a potential opportunity for programs to deliver more sustained, long-term savings with increased investments and enabling activities.

Table ES - 1. Program Costs per GJ target fuel savings (CAD2025 per GJ)[4]

Scenario	Base	Enhanced	Maximum
Average $ per GJ *(first-year savings)*	177	190	235
Average $ per GJ *(lifetime savings)*	10	10	12

[3] Implementation Plans indicate an average acquisition cost of 158 $/GJ (first-year savings), considering the average of 24/25, 25/26 and 26/27.
[4] Averaged over the first five study years (FY25/26 to FY29/30)

Takeaway 7: Existing programs are cost-effective across all scenarios, based on the program administrator cost test (PACT). New demand response programs are not cost-effective during the first years of the study period, due to the ramp-up period required for new programs, but the portfolio becomes cost-effective between 27/28 and 28/29.

Portfolio PACT ratios decline in the enhanced and maximum scenarios as incentives and enabling activities increase, due to the greater cost incurred to procure savings, however the portfolio remains cost-effective across all scenarios (Table ES - 2).

Table ES - 2. Program Portfolio PACT ratios

Program Type	Scenario	25/26	26/27	27/28	28/29	29/30
EE	base	2.8	2.8	2.8	2.8	2.8
	enhanced	2.3	2.3	2.4	2.4	2.5
	maximum	1.9	2.0	1.9	1.9	1.9
DR - Existing	base	2.1	2.1	2.1	2.2	2.2
	enhanced	2.1	2.0	2.1	2.2	2.2
	maximum	1.6	1.6	1.6	1.6	1.7
DR - New	base	-	-	-	-	-
	enhanced	0.5	0.8	1.1	1.3	1.6
	maximum	0.5	0.7	0.9	1.1	1.2

Electricity Energy Efficiency

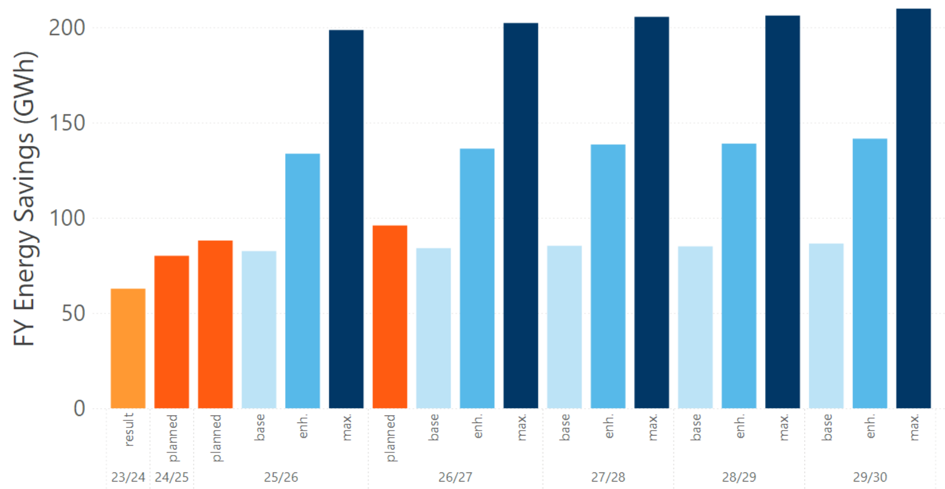
The following section presents a summary of the assessment of the electricity savings potential from energy efficiency (EE) measures.

Takeaway 8: Under the base scenario, projected savings fall slightly below plans in 25/26-26/27 (Figure ES - 9). This indicates that program enhancements may be required to meet forward-looking plans and minimum targets.

Savings represent approximately 0.55% of baseline energy consumption in the base scenario, 0.9% in enhanced, and 1.3% in maximum.

- **Residential savings exceed planned savings in the base scenario,** largely due to higher than planned savings from the enhanced energy savings program. While the potential study does not account for program participation or budget caps that may constrain actual savings, this could be a source of increased savings should NB Power seek to adjust their investments.
- **Industrial savings are comparable with planned savings in the base scenario.**
- **Commercial savings fall notably below planned savings under the base scenario.** As the base scenario reflects current programs, this could indicate that program enhancements and further investments are needed to achieve the plan goals in the coming years.

Figure ES - 9. Achievable electric EE savings (First-year GWh)



Takeaway 9: The enhanced and maximum scenario provide **insights into effective strategies for increasing achievable savings for different measure types, and where significant opportunities exist for growing achievable potential.**

- In the residential sector, **envelope measures show significant opportunity for growth** and can benefit from both increased incentives and enabling activities. HVAC measure savings are also significant, and respond well to increased incentives, whereas enabling strategies are likely required to grow hot water savings.
- In the commercial sector, **increased incentives can significantly increase savings across most measure types** – particularly lighting (controls), envelope, process and HVAC motors. **For other measure types, enabling strategies are likely be more effective to grow savings** – particularly refrigeration, hot water and behavioural measures. Savings from HVAC and lighting controls can benefit from both increased incentives and enabling activities.
- In the **industrial sector, there is an important role for behaviour-driven savings through strategic energy management, as well as process-related measures.** Enabling strategies are likely required to grow industrial savings.

Combustible Fuels Energy Efficiency and Fuel Switching

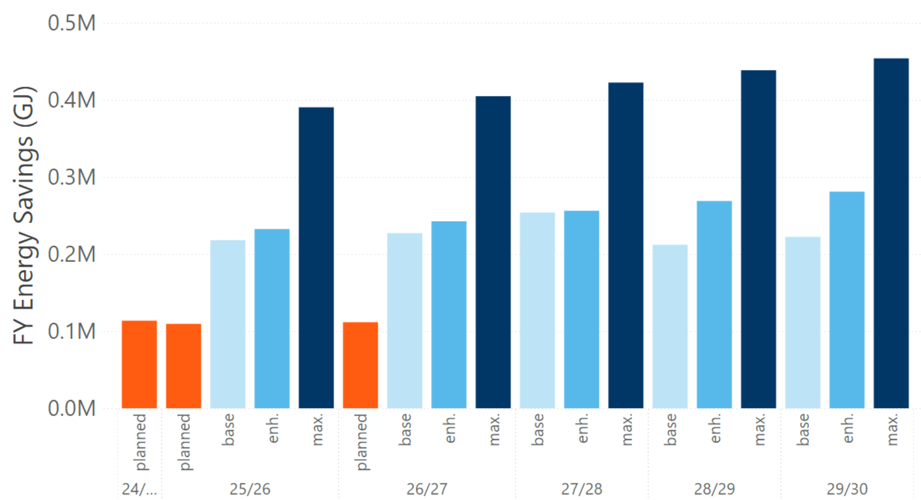
The following section presents a summary of the combustible fuel savings potential for energy efficiency (EE) and fuel switching (FS) measures. Combustible fuels considered in this section include oil, natural gas, biomass and propane.

Takeaway 10: Combustible fuel savings are forecasted to exceed planned savings (Figure ES - 10). This indicates a potential source of increased savings with existing programs, should NB Power seek to adjust its portfolio investments.

- **Residential savings exceed planned savings in the base scenario,** largely due to higher than planned savings from the enhanced energy savings program. While the potential study does not account for program participation or budget caps that may constrain actual savings, this could be a source of increased savings.

- **Industrial savings exceed planned savings under the base scenario.** While natural gas savings are approximately aligned with planned savings, the results project higher than planned oil savings due to electrification of oil-heated industrial processes.
- **Commercial savings are comparable to planned savings under the base scenario.**

Figure ES - 10. Achievable combustible fuel EE and FS savings (First-year GJ)



Takeaway 11: Oil savings – both from residential and industrial fuel switching – account for a significant portion of combustible fuel savings.

This is reflective of the high price of oil, making electrification a cost-effective alternative for customers, as well as the NB Power and governmental programs supporting the transition away from oil heating, particularly for residential customers.

Takeaway 12: The enhanced and maximum scenario provide **insights into effective strategies for increasing achievable savings for different measure types, and where significant opportunities exist for growing achievable potential.**

- In the residential sector, **HVAC and envelope measures show significant opportunity for growth**, particularly through enabling strategies.
- In the commercial sector, **HVAC measures show significant opportunity for growth,** particularly through enabling strategies.
- In the **industrial sector, there is an important role for behaviour-driven savings through strategic energy management, as well as process-related measures.** Enabling strategies are likely required to grow industrial savings.

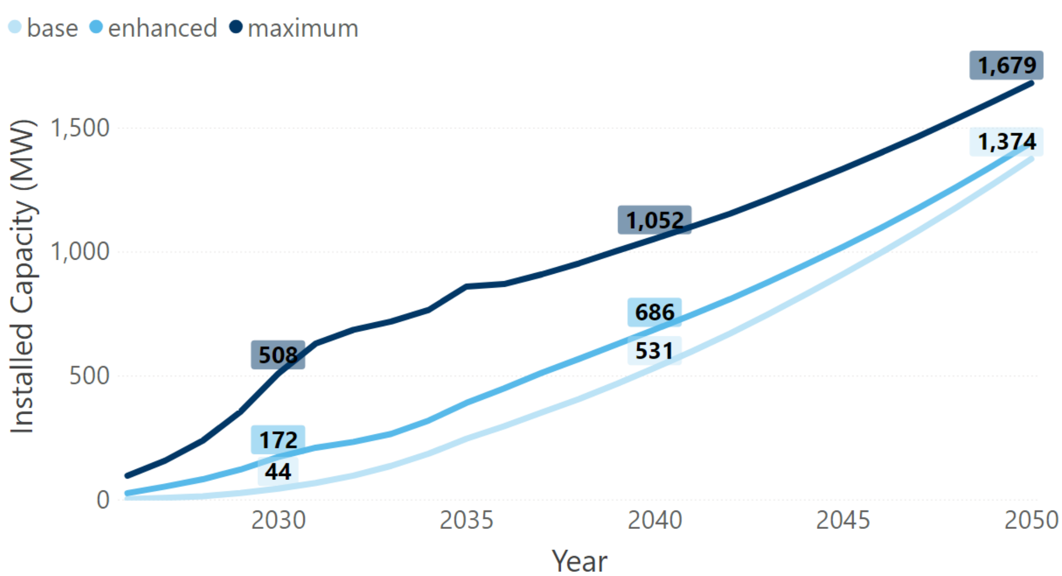
Distributed Generation

The following section presents a summary of the potential uptake of renewable distributed generation (DG) systems. The analysis focuses on customer-sited solar PV, including both standalone and storage-paired solar PV systems.

Takeaway 13: Uptake of behind-the-meter rooftop solar PV is projected to continue increasing across all scenarios and reach 1.4 to 1.7 GW of installed capacity in 2050 (Figure ES - 11). In the base scenario, uptake is projected to drop in the short term, as a result of removing equipment incentives,[5] coupled with lower annual compensation under NB Power's proposed new NEM scheme. However, as system costs are projected to continue to decrease, adoption is expected to return to previous levels and continue to grow from FY26/27 onwards.

In the enhanced scenario, the inclusion of incentives over and above past program offerings leads to a notable increase in adoption. In the maximum scenario, further increased incentives combined with enabling activities drives a rapid increase in uptake. This being said, constraints outside the scope of the potential study – such as industry and workforce capacity to respond to customer demand – could potentially hinder the industry's ability to fulfill such a rapid increase in projected demand.

Figure ES - 11. Cumulative installed solar PV capacity by scenario (MW)



[5] The study assumes no incentives for solar PV in the base scenario, due to the recent EUB decision to remove renewables from NB Power's current programs. The Canadian federal government's Greener Homes Grant incentives were also phased out as of March 2024.

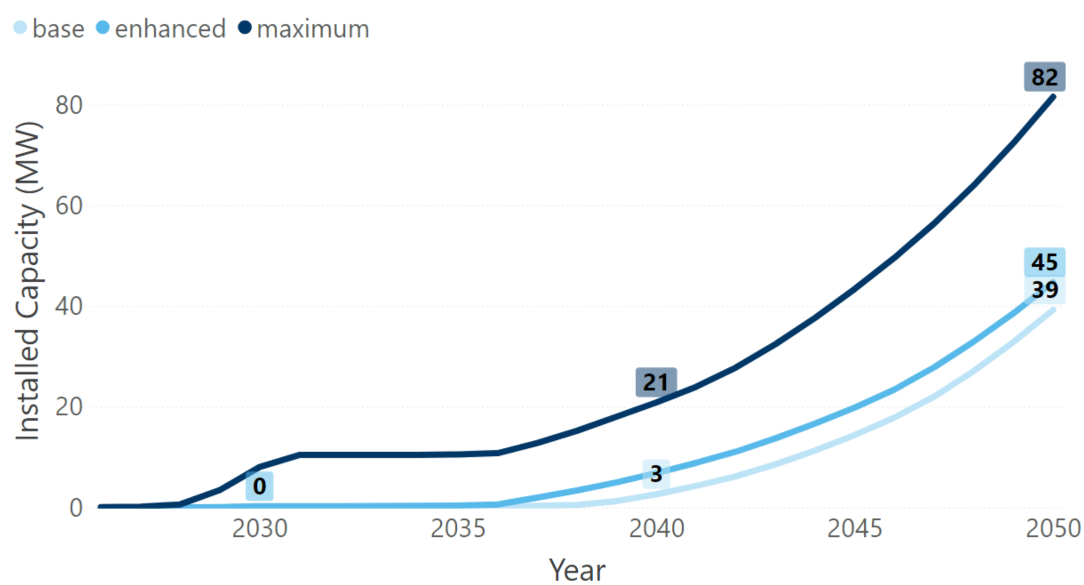
Takeaway 14: Under current rates and proposed NEM scheme, customer benefits from storage are limited relative to costs, and storage-paired systems are projected to account for a relatively small share of the total installed solar PV systems (7-12% in 2050). These results indicate that new strategies and additional support are likely required to encourage greater uptake of storage-paired systems.

As standalone rooftop solar PV systems benefit from much better customer economics compared to storage-paired systems, storage-paired systems remain a relatively small share of the overall market. Overall, storage-paired solar PV systems lead to 39 to 82 MW of installed storage capacity by 2050 (Figure ES - 12).

Storage-paired systems offer some benefits to customers, through (1) increasing self-consumption of solar generation[6] and (2) offering the opportunity to manage their demand and demand charges. However, **customer benefits from storage remain limited relative to costs** under current rates and proposed NEM scheme.

This being said, customer sited storage, when paired with solar PV, could offer substantial system benefits when managed to meet NB Power's needs. If NB Power should seek to encourage greater uptake of storage-paired systems, further exploration of other strategies and support would be required. For example, NB Power could develop a strategy to derive grid benefits from customer-sited batteries, and a compensation mechanism that shares these benefits with host customers.

Figure ES - 12. Cumulative battery storage capacity from storage-paired solar PV systems (MW)



[6] Given that the compensation for exported solar generation is lower than customers' retail energy rates, increasing self consumption can increase customer benefits.

Clean Transportation

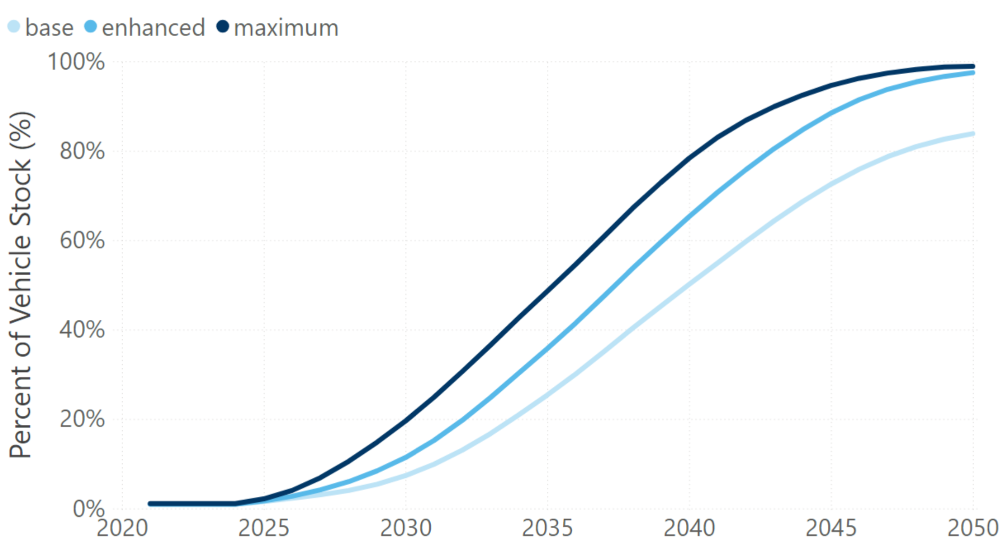
The following section presents a summary of the potential uptake of clean transportation technologies. The analysis includes electrification of on-road vehicles, alternative fuels and fuel saving devices for on-road vehicles, and shore power for marine vessels.

Takeaway 15: Uptake of electric vehicles is projected to increase across all scenarios, with EVs reaching 84-99% of the total vehicle stock in 2050 (Figure ES - 13). Vehicle electrification is projected to be the dominant pathway for vehicle decarbonization, with FCEVs and vehicle retrofits possibly playing a targeted and uncertain role primarily in the long-haul heavy-duty vehicle segment.

Although the pace of electric vehicle uptake varies between scenarios, the declining total cost of ownership of electric vehicles relative to their ICE counterparts, as well as increasing access to charging and vehicle availability, leads to significant uptake of EVs by the end of the study period.

- **Light-duty vehicles (LDVs)** benefit from a strong business case for electrification, and EVs account for a steadily increasing portion of annual vehicle sales. While EVs currently account for approximately 8% of LDV sales, this is forecasted to increase to 30-70% by 2030.
- **Buses and medium-duty vehicles (MDVs)** also benefit from a strong business case for electrification, due to consistent daily usage and high overall driving distances. By 2030, EVs account for 48-95% of bus vehicle sales, and 29-42% of MDV sales.
- **Heavy-duty vehicles (HDVs)** are also largely electrified. Electrification is lowest in this segment, particularly among long-haul vehicles, where there can be technical challenges and weaker economics for electrification. Nonetheless, EVs account for 11-22% of annual HDV sales by 2030.

Figure ES - 13. Electric vehicles percent of total vehicle stock (cumulative %)



Takeaway 16: If unmitigated, electric vehicles will have a significant impact on peak demand and will likely shift NB Power's system from a winter morning to a winter evening peak. This underscores the importance of implementing and scaling managed charging programs to leverage the flexibility of EV loads and mitigate peak impacts.

Considering NB Power's current winter morning peak window, EVs increase peak demand by 150 MW-360 MW (6%-11%) in 2040. However, **EV peak impacts are more than double that during the winter evening peak window (420 MW-800 MW in 2040).**

As the difference between NB Power's winter morning and evening peak is currently approximately 300 MW, this highlights the potential for NB Power's system peak to shift from its current pattern of winter morning peaks to winter evenings, when the majority of EV charging occurs. This is even more likely when taking into account the other factors considered in this study, such as energy efficiency, heating electrification and demand response, which decrease the winter morning peak.

Takeaway 17: Of New Brunswick's five ports, two (Saint John and Belledune) are viable candidates for shore power. Impacts on electricity consumption and peak demand are projected to be relatively minor compared to on-road vehicle electrification and baseline consumption.

Other ports assessed – including Caraquet, Dalhousie and Shediac – are generally characterized by low traffic volumes with primarily coast guard, fishing, special purpose and tug vessels. These vessels are generally not considered viable candidates for shore power, which is better suited to ships which spend long hours at berth and require significant power for "hotelling" (running on-board systems such as lighting, HVAC, refrigeration) – such as cruise ships, ferries and container ships.

Overall, shore power at Saint John and Belledune is projected to increase electricity consumption by 15-54 GWh and peak demand by 19-67 MW in 2050, therefore impacts are relatively minor compared to NB Power's total electricity sales (<1%) and peak demand (<1 to 1.5%).

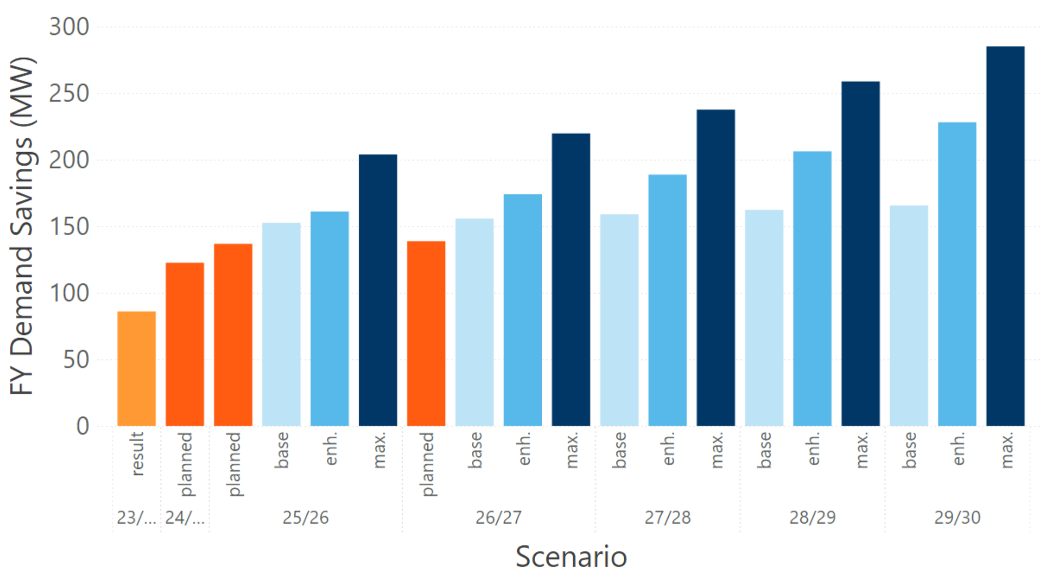
Demand Response

The following section presents a summary of the demand response (DR) potential for peak demand savings.

Takeaway 18: NB Power can increase achievable DR potential both through increased participation in current programs, as well as expanded program offerings. The results project that in the base scenario, participation in the Peak Rewards program will increase significantly compared to recent program results. In the longer term, however, expanding program offerings to cover residential and managed EV charging opportunities will be key to unlocking further potential.

- Savings slightly exceed planned savings under the base scenario, indicating an opportunity to increase potential through increased participation in existing programs, particularly in the short-term (Figure ES - 14).
- In the longer term, a combination of **expanded DR programs and measures** (covering residential and small/medium commercial direct load control (DLC) as well as EV managed charging) **as well as increased incentives and enabling activities, will be required to grow savings.** New programs will take time to ramp up, so significant increases in potential
- DR savings represent **5-6% of forecasted baseline peak demand** in FY25/26.

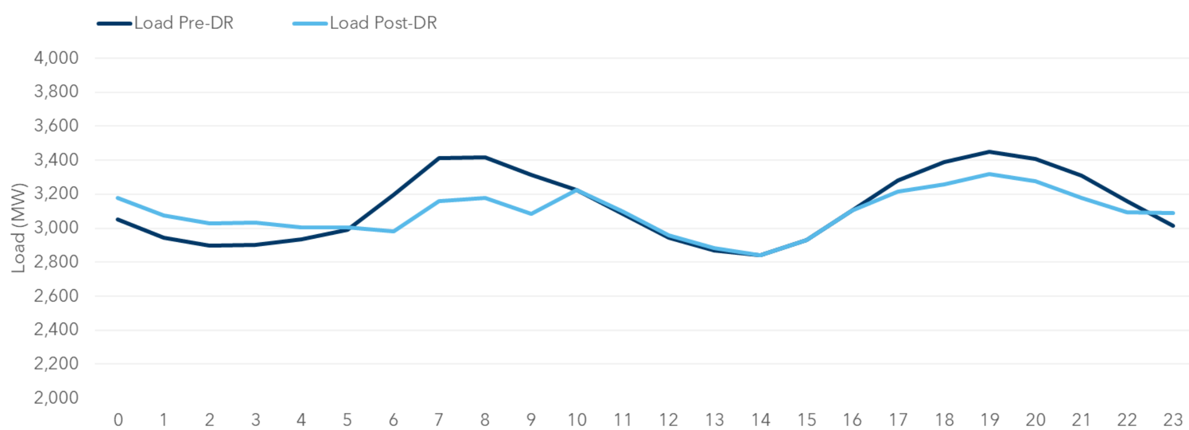
Figure ES - 14. Achievable DR potential (MW) per scenario



Takeaway 19: With increasing penetration of EVs, robust managed charging programs will be key to managing peak impacts. As uptake of EVs increase, there is a possibility that NB Power's system will shift to a winter evening peak, when the bulk of EV charging occurs. Therefore, as EV penetration increases, it will be necessary to target the winter evening hours when the majority of EVs are charging.

In the initial 5-10 years of the study period for all scenarios, NB Power's system remains predominantly winter morning peaking. However, by 2040, EV uptake is significant and the impact become more pronounced, and NB Power's system begins to exhibit a winter evening and/or dual peaking pattern (winter morning and winter evening (Figure ES - 15). It therefore becomes critical for DR measures to address both the morning and evening peak.

Figure ES - 15. Pre- and post-DR typical peak winter day 24h load curve (enhanced scenario, 2040)



Takeaway 20: NB Power will need to keep a close eye on the magnitude and single/dual peaking nature of demand on its representative peak day and tailor its DR program designs and strategies to the evolving system needs. Keeping to a rigid morning only or evening only approach for specific DR measures and programs may limit the actual peak reduction benefits available to the DR programs in future years.

Even with EV DR measures (smart charging, vehicle-to-grid) targeting the evening peak, the system remains evening peaking, and the apparent peak reduction is constrained, as other measures are assumed to target only the morning peak. **To further increase apparent peak reduction, it will be necessary to adjust DR programs and build a portfolio that accounts for the dual peaking nature of the system.**

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1. Introduction

1.1 Study Overview

The following report volume presents the results of the New Brunswick Multi-Fuel Demand Side Management (DSM) Potential Study, conducted by Dunsky Energy + Climate Advisors and its subcontractors.

The DSM potential study was commissioned by a partnership of New Brunswick utilities and government to provide an updated and comprehensive assessment of DSM opportunities across the province. Building upon the 2018 DSM Potential Study, this updated analysis provides a refreshed outlook that reflects the evolving program and market conditions.

The primary objective of the study is to quantify the potential for energy efficiency, demand response (load shifting) and electrification in the residential, commercial, industrial, and transportation sectors over a 25-year horizon, to support long-term system planning and inform the development of cost-effective DSM programs that align with New Brunswick's sustainability goals.

Within this context, the DSM potential study quantifies the savings potential for energy, peak demand and greenhouse gas (GHG) emissions and includes five study components, covering:

- Energy efficiency (EE),
- Fuel switching in space heating and industry (FS),
- Renewable distributed generation (DG),
- Clean transportation (CT), and
- Demand Response (DR)

The multi-fuel analysis assesses electricity as well as combustible fuels. Throughout the report, results for combustible fuels are typically grouped together, but the DSM potential study assesses natural gas, oil, biomass, propane, gasoline, diesel, and marine fuel oil.

The study's 25-year horizon spans fiscal years 2025/26 to 2049/50. When presenting system-wide impacts, results for the entire study period are included. When presenting program impacts, this report primarily focuses on the first five years of the study period (2025/26 to 2029/30).

1.1.1 Purpose and Applications of the Potential Study

The DSM potential study is a high-level assessment of electric and combustible fuel DSM savings opportunities in New Brunswick over the next 25 years. The main purposes of the study are to **(1) quantify the cost-effective savings opportunities for DSM programs** – specifically for energy efficiency, fuel switching, distributed generation, and demand response, and **(2) support resource planning and NB Power's integrated resource plan.**

In addition to these objectives, the DSM potential study can also support and inform program design (e.g., NB Power's future DSM plans), as well as provincial policy and strategies (e.g., informing more detailed design and/or implementation of near-term actions identified)

However, while the DSM potential study can support these initiatives, the following limitations should be noted.

- First, while the DSM potential study provides granular information such as savings for specific measures in specific building segments, the study is not a program design document meant to accurately forecast and optimize savings and spending through DSM programs in a given future year. The DSM potential study is meant to quantify the total potential opportunities that exist under specific parameters as defined under each scenario. Estimated costs, particularly under program scenarios that deviate significantly from current conditions, are not optimized from a program design perspective.
- Second, the DSM potential study takes a "stated policies" approach for future federal and provincial policies that may impact DSM opportunities and costs in the future. The savings and costs estimated in this study do not consider the implementation of new policies that may fundamentally alter – both negatively and positively – the opportunities for DSM savings. For this reason, the application or comparison of the study's results to scenarios contemplating significantly different policy frameworks is not appropriate.
- Third, while the DSM potential study estimates annual program costs associated with procuring achievable savings, it does not consider initial start-up costs (e.g., program design, administration planning, program delivery contracting, etc.) for developing new programs or offerings. It also assumes (in most cases) that programs can be instantaneously developed and begin operation once the DSM potential study identifies the measures within the range of achievable potential without explicitly considering the lead time that may be required to develop a new program or offering.
- Finally, the DSM potential study provides an evaluation of DSM potential over the next 25 years. Forecasting potential over this length of period inherently presents challenges due to uncertain future technological developments, social changes, and government policies. The study focuses on current and emerging commercially viable measures to provide NB Power with up-to-date insights needed to help plan future DSM programs and is most accurate in the initial years of the study for which program planning is most applicable. In later years of the study, results are more appropriately interpreted for directional trends than for granular potential assessment.

1.1.2 Report Structure

This report is structured into two volumes. This volume (Volume I) presents the potential study results, while Volume II presents the study's supporting data, inputs, models, and methodological approach.

In **Volume I**, study results are presented in various chapters. The first section presents the system-wide impact results in terms of overall impacts on energy consumption, peak demand and GHG emissions in New Brunswick, aggregating results for all study streams (EE, FS, DG, CT and DR). The second section then presents a results summary for savings streams at the core of NB Power's DSM programs (EE, FS, DG and DR). After this summary, results for each study stream are presented in more detail in individual chapters. For each stream, results are broken down by various parameters such as sector, segment, and end-use.

The bulk of Volume I focuses on program savings estimates for the first years of the study period. For brevity and where appropriate, multi-year average values may be highlighted (e.g., 2030/31 to 2034/35), although the study estimates potential on a year-by-year basis. Full study results are provided in detailed results data tables.

In **Volume II**, study inputs and methodological approaches are described in detail in various appendices. Appendices included are as follows:

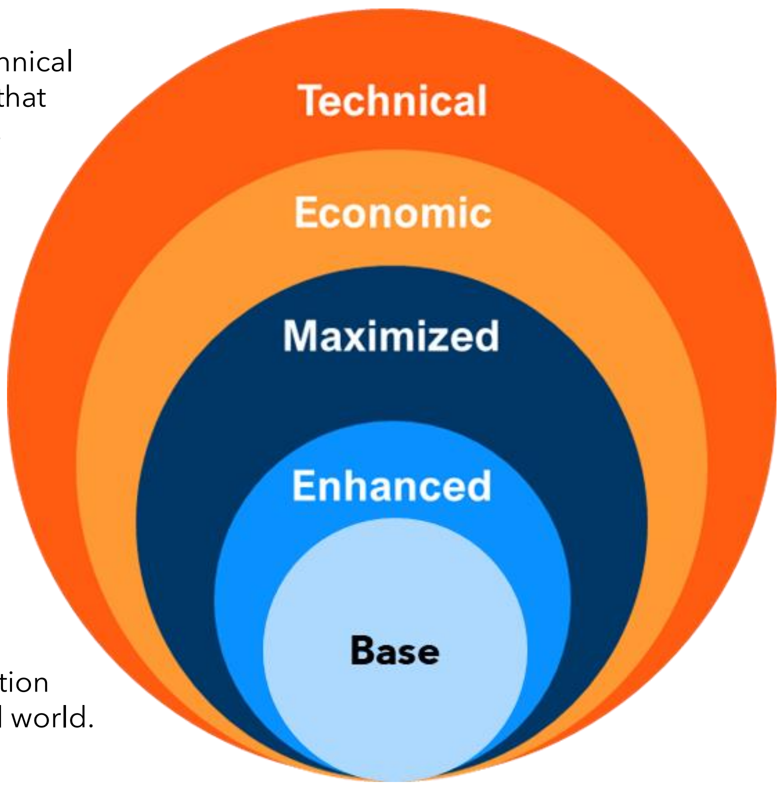
- **Appendix A**: Global Methods, Inputs, and Assumptions
- **Appendix B**: Energy Efficiency Methodology
- **Appendix C**: Fuel Switching Methodology
- **Appendix D**: Distributed Generation Methodology
- **Appendix E**: Clean Transportation Methodology
- **Appendix F**: Demand Response Methodology

1.2 Study Approach

As is standard practice in potential studies, the study assesses potential at the technical, economic, and program achievable levels for each study component.

Technical potential is all theoretically possible energy savings stemming from the applied measures.

Economic potential is a subset of technical potential that only includes measures that pass cost-effectiveness screening. This study screens measures based on the marginal resource cost (MRC) test and evaluates programs based on the Program Administrator Cost Test (PACT). More detailed descriptions of this process are included in Volume II.



Achievable potential is savings stemming from the customer adoption of savings measures. Each of the models employed in this study applies customer adoption curves based on a combination of customer cost-effectiveness and market barrier level parameters to the estimate adoption of measures to be expected in the real world.

1.2.1 Scenarios

For achievable potential, which is the focus of the analysis, the DSM potential study explores three scenarios to determine how incentive levels and enabling activities can impact achievable savings:

- A **Base** scenario emulating existing incentive levels and program configurations,
- An **Enhanced** scenario that emulates increased DSM efforts, primarily through increased incentive levels above and beyond current program levels (EE, FS, DG), or through expanded program offerings (DR) and emulates increased DSM efforts above Base scenario levels, primarily in terms of enabling activities, expanded program configurations or incentives, and
- A **Maximized** scenario that emulates maximum reasonable DSM efforts. This scenario maintains the increased incentives from the enhanced scenario, and increases program enabling activities (EE, FS). For select study streams, the maximum scenario considers increased incentives above the enhanced scenario in addition to enabling activities (DR, DG).

The specific incentive parameters employed for each study component and the description and methodological approaches for determining technical, economic, and achievable potential are described in Volume II. A qualitative description of the scenario for each study component can also be found in each respective section of this report.

Program Enabling Activities

To optimize achievable potential savings, DSM programs typically combine financial incentives (or rebates) to improve customer cost-effectiveness along with enabling activities such as contractor training, targeted marketing and education, upstream programs, financing programs, and other approaches that help reduce market barriers to widespread adoption of efficient technologies. Such barrier-reducing activities can help transform the wider market for savings technologies and reduce the overall cost of acquiring program savings by boosting participation without increasing incentive payouts.

1.2.2 Modelling Approach

The study assesses the technical, economic, and achievable potential for DSM measures using a hybrid bottom-up and top-down modelling approach.

For most study streams and customer segments, the study employs a bottom-up modelling approach that leverages a suite of Dunsky's in-house models to estimate thousands of "measure-market" combinations and apply program impacts (e.g., incentives and enabling activities that help address market barriers) to assess energy savings potentials across multiple achievable scenarios for prescriptive measures applicable to wide swaths of the residential and non-residential customer populations.

The bottom-up modelling methodology estimates customer demand for modelled measures based on customer economics and market barriers. The models do not explicitly consider supply-side constraints such as NB Power's ability to process a large influx of applications under a high adoption scenario, which could constrain measure adoption.

For the large industrial sector specifically, the scope of the study also included primary data collection from industrial facilities in order to support the measure-market characterization.

For specific opportunities within clean transportation related to alternative fuels, vehicle retrofits and shore power, the study employs a top-down modelling that estimates achievable savings based on measure uptake trajectories informed by market research.

Table 1-1 lists the various models applied to estimate savings potential in the study. Additional details are provided in the appendices of Volume II as well as the respective study component chapters in Volume I.

Table 1-1. DSM Potential Study Component Modelling Approaches

Study Component	Model Applied	Additional Details
Energy Efficiency	Dunsky's Demand and Energy Efficiency (DEEP) Model Dunsky's Heating Electrification Adoption (HEAT) Model (heat pumps for space heating)	Appendix B
Fuel Switching	Dunsky's Demand and Energy Efficiency (DEEP) Model, combined with 8760 energy simulation to characterize temperature-dependent heat pump capacity and performance	Appendix B & C
Distributed Generation	Dunsky's Solar Adoption Model (SAM)	Appendix D
Clean Transportation	Dunsky's Electric Vehicle Adoption Model (EVA) (on-road vehicle electrification) Top-down market assessment (alternative fuels, vehicle retrofits, shore power)	Appendix E
Demand Response	Dunsky's Demand and Energy Efficiency (DEEP) Model, combined with additional load curve impacts analysis	Appendix F

1.2.3 Market Segmentation

The study considers the market sectors and segments summarized in Table 1-2.

Table 1-2. Study Segmentation

• Sector	Segment
Residential	Single Family
	Multifamily
	Low Income
Non-Residential	Office
	Retail
	Grocery/Restaurant
	Health Services
	Education
	Warehouse
	Lodging/Hospitality/MURB
	Other Commercial
	Government
	Small/Medium Industrial
	Large Industrial
	Agriculture

1.2.4 Key Data Sources

The study leverages a pool of New Brunswick-specific data to populate the models used to estimate DSM market potential. Where New Brunswick-specific data is not available or insufficient, data from other jurisdictions is leveraged to fill gaps and produce a more robust representation of market parameters.

Table 1-3 provides an overview of the key data sources used in the study. A more detailed description of the sources, inputs, and assumptions can be found in the appendices of Volume II.

Table 1-3. MPS Major Data Sources and Uses

Data Item	Application in study
NB Power Customer Data	Sector and segment populations, key market metrics (e.g., average consumption, average square footage, etc.)
NB Power 2022 Energy Planning Survey	Residential market metrics (e.g., equipment saturation and penetration estimates applied in models)
NB Power program data	Results benchmarking and calibration, program characterization (e.g., reference incentive levels, administrative costs, etc.), and measure characterization (e.g., custom measures characterized leveraging custom projects database)

NB Power net metering data	Distributed generation measure characterization and model calibration
Various Technical Resource Manuals (TRMs)	Measure characterization
NB Power avoided costs	Cost-effectiveness assessment and screening (PACT)
Dunsky's Market Archetype	Where New Brunswick specific baseline data is not available (or was based on a low number of observations), baseline data from neighboring jurisdictions is leveraged and adjusted for New Brunswick-specific attributes wherever possible.

1.2.5 Savings Terminology and Calculations

This study expresses savings in terms of **program savings** and **cumulative savings**.

Program savings are the primary focus of this report. These savings represent the savings from measures that are incentivized by DSM programs *in a given year*. Program savings are expressed in terms of first-year savings.[7] **First-year program savings** measure the savings achieved in the first year of the measures incentivized through efficiency programs. Unless otherwise noted, all program savings in this report are expressed in terms of **net program savings**, which account for free ridership and spillover effects attributable to DSM programs.

Cumulative savings are a rolling sum of all new savings from measures incentivized by programs. Cumulative savings provide the total expected impact of incentivized measures on energy consumption and peak demand in a given year. Cumulative savings assume that program participants will re-adopt energy efficient measures after the end of the efficient measure's expected useful lifetime.

1.3 Baseline Forecasts

The study established baseline energy and demand forecasts for the study period to discern the impact of the DSM measures analyzed in the DSM potential study on energy sales and peak electric demand; to compare modelled savings in terms of percentages of sales relative to legislated targets; and to provide inputs and benchmarks for QA/QC purposes. To create these baseline forecasts, electricity and peak demand forecasts provided by NB Power are adjusted to remove the projected impacts of post-2025 DSM programs. This avoided double-counting DSM impacts in the study. We also leverage data from Liberty Gas and Canada's Energy Futures to develop projections for natural gas, oil, biomass and propane. The derivations and projections of these baseline forecasts are provided in Appendix A of Volume II.

[7] The detailed results files also include lifetime program savings, which are a measure of the savings expected over the entire useful lives of measures incentivized through efficiency programs in a given year.

System Impacts

2. System Impacts

The following chapter presents a high-level overview of the combined achievable potential results of all study streams – **EE, FS, DG, CT and DR.**

This section assesses the impacts of all the measures considered in the study on New Brunswick's overall energy system, accounting for gross savings potential. A more detailed presentation and discussion of each of the study streams is presented in their respective chapters. The methodological approach for each study stream can be found in the Volume II report appendices.

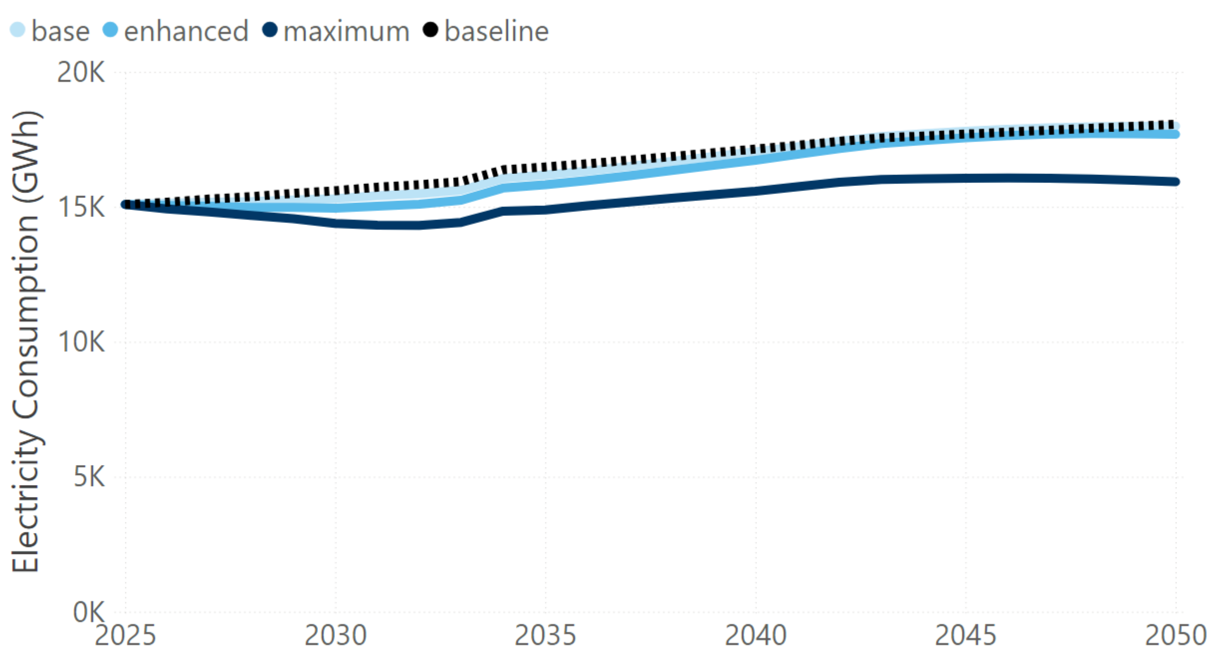
2.1 Electricity Consumption

Over the course of the study period, the adoption of measures under the three achievable potential scenarios will have a notable impact on the forecasted electricity consumption in the province.

Uptake of EE and DG measures will decrease electricity consumption, whereas the electrification of space heating, industry and transportation in the FS and CT study streams will drive increases in electricity consumption. Overall, the combined pace and magnitude of uptake of these measures will determine how electricity consumption evolves relative to the baseline forecast.

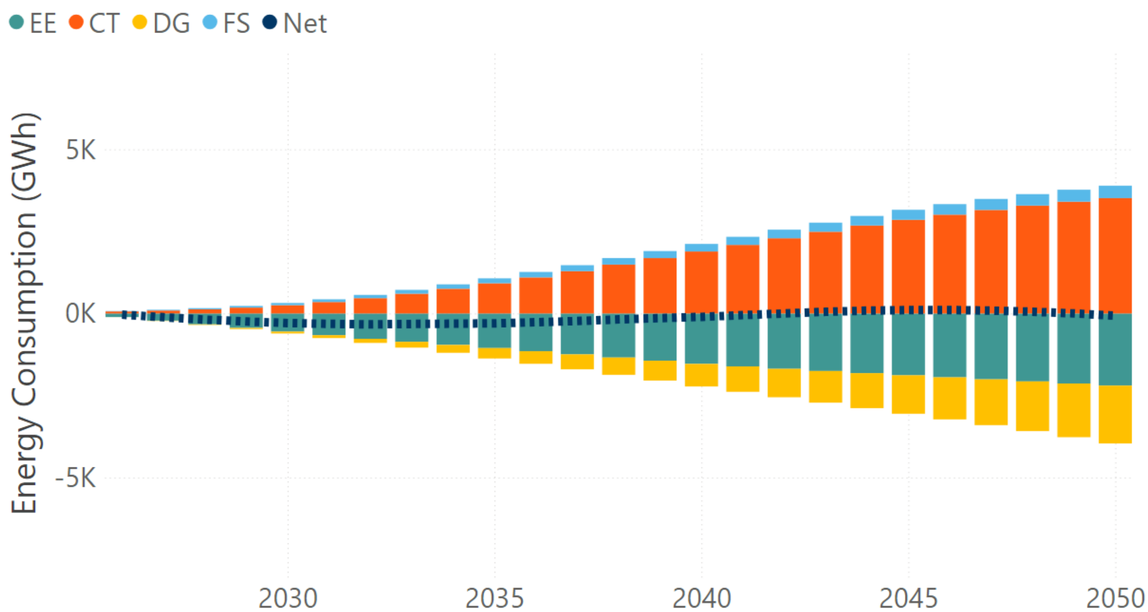
In the short term, the impacts of EE and DG outweigh the impacts of CT and FS, leading to a decrease in electricity consumption of **2-8% in 2030 relative to the baseline** (Figure 2-1, Figure 2-2).

Figure 2-1. Forecasted electricity consumption (GWh) 2025-2050 per scenario



In the longer term, in the base and enhanced scenarios, the impacts of EE and DG approximately match the impacts of CT and FS, and forecasted electricity consumption does not deviate significantly from the baseline forecast. In the maximum scenario, however, the combined increase of both enabling activities and incentives significantly increases uptake of EE and DG, and their combined impact more than offsets the impacts of CT and FS, leading to a 12% decrease in electricity consumption in 2050 relative to the baseline forecast.

Figure 2-2. Forecasted electricity consumption impacts (GWh) 2025-2050 in the base scenario, per study stream



2.2 Peak Demand

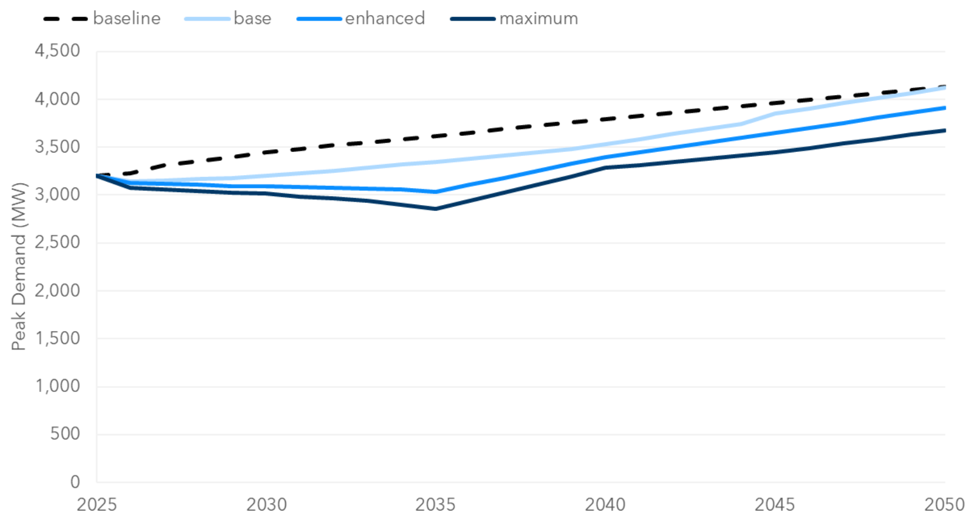
Over the course of the study period, the adoption of measures under the three achievable potential scenarios will have a notable impact on the forecasted peak demand in the province.

Uptake of EE, DG and DR measures will decrease peak demand, whereas the electrification of space heating, industry and transportation in the FS and CT study streams will drive increases in peak demand. Overall, the combined pace and magnitude of uptake of these measures, as well as their combined impact on NB Power's load curve, will determine how peak demand evolves relative to the baseline forecast.

In the short term, the impacts of EE, DR, and DG outweigh the impacts of CT and FS, leading to a decrease in peak demand relative to the baseline of 7-13% in 2030 relative to the baseline (Figure 2-3).

In the longer term, in the base scenario, the impacts of CT and FS are approximately balanced by the impacts of EE, DR and DG and peak demand is comparable to the baseline forecast in 2050. In the and enhanced and maximum scenarios, the impacts of EE, DR, and DG continue to outweigh the impacts of CT and FS, and forecasted peak demand remains below the baseline forecast. Overall, this leads to a 5-11% decrease in peak demand in 2050 relative to the baseline forecast.

Figure 2-3. Forecasted peak demand (MW) 2025-2050 per scenario

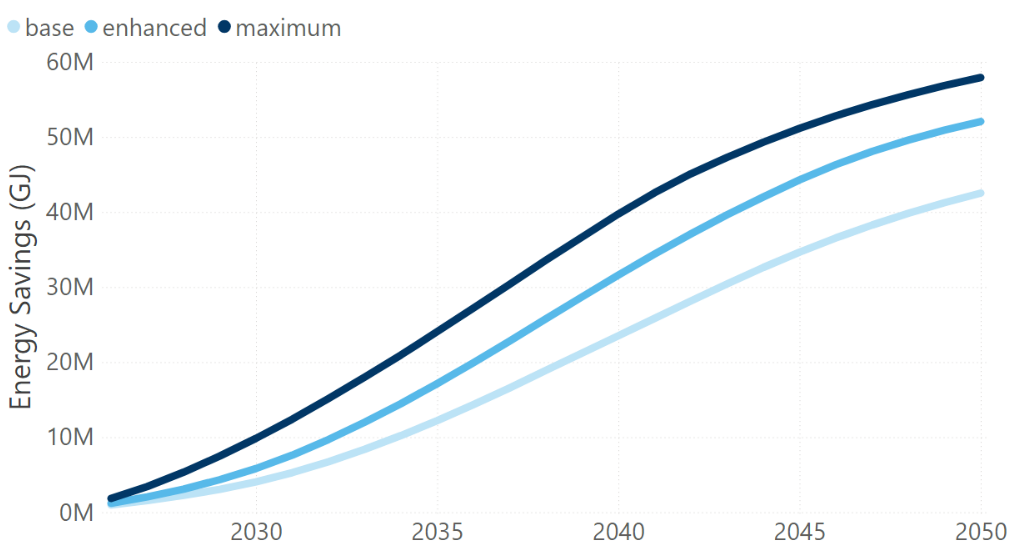


2.3 Combustible Fuels

Over the course of the study period, the adoption of measures under the three achievable potential scenarios will have a notable impact on the consumption of combustible fuels.

Uptake of EE, FS, and CT measures is projected to lead to fuel savings of 40-55 PJ in 2050 (Figure 2-4), which is approximately 20% of province-wide energy consumption.[8]

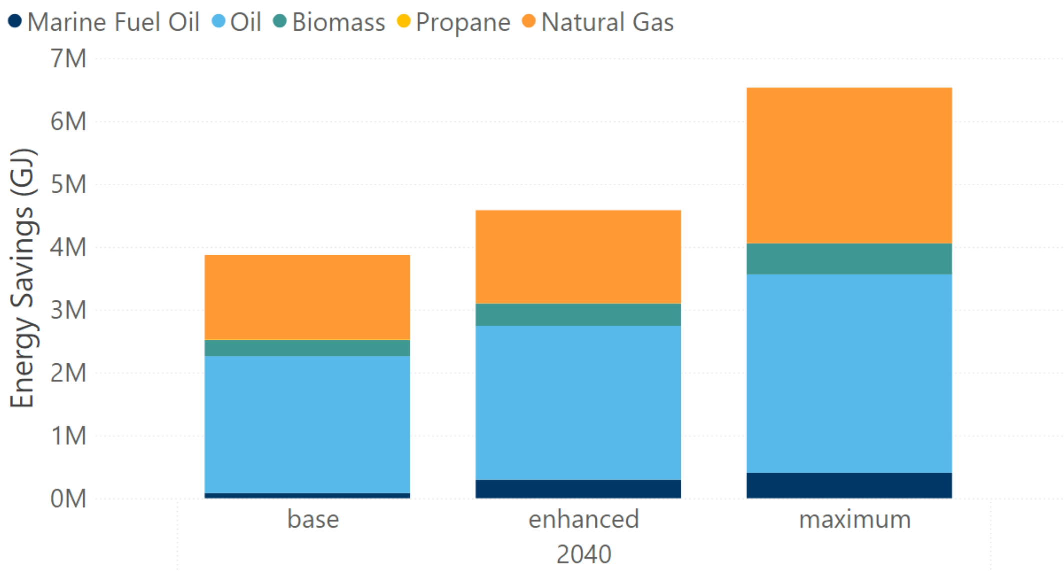
Figure 2-4. Combustible fuel savings (GJ) 2025-2050 per scenario



[8] New Brunswick's total energy consumption was approximately 209 PJ in 2020.

The vast majority (~90%) of fuel savings are driven by electrification of on-road transportation considered in the CT study stream, which includes primarily gasoline and diesel fuel savings. The remaining approximately 10% of combustible fuel savings are due to EE and FS, and include primarily oil and natural gas (Figure 2-5).

Figure 2-5. Combustible fuel savings (excluding gasoline and diesel) in 2040 per fuel and scenario



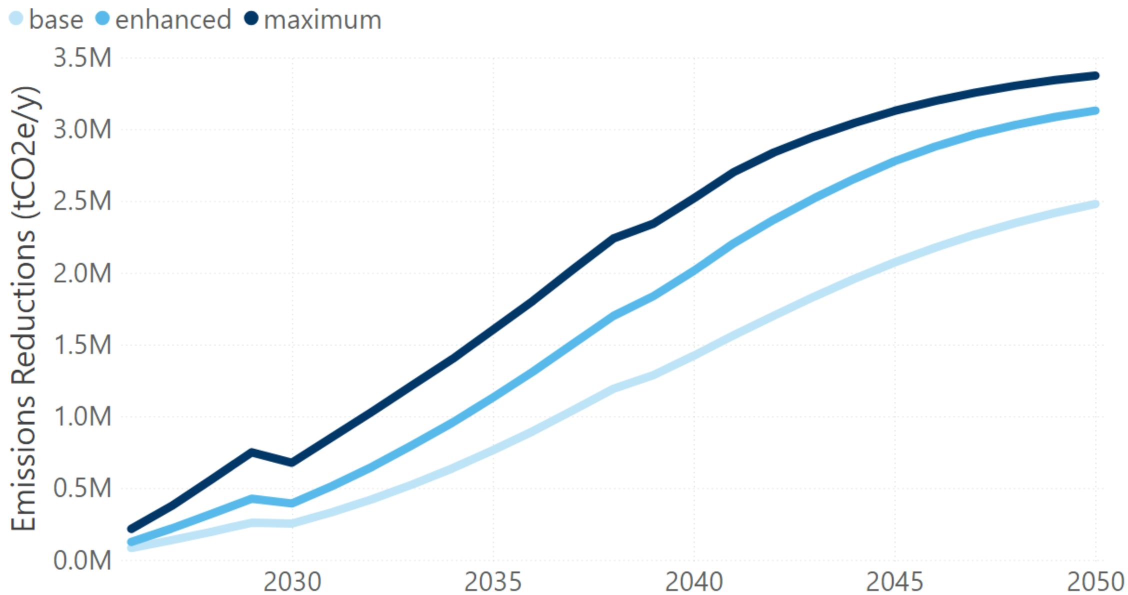
2.4 Greenhouse Gas Emissions

The combined impacts of EE, FS, DG, and CT are projected to lead to significant reductions in greenhouse gas (GHG) emissions in New Brunswick (Figure 2-6).

- **By 2030:** Emissions are reduced by 0.3 to 0.7 MtCO2e/y (3-6% compared to 2022 GHG emissions)[9]
- **By 2050:** Emissions are reduced by 2.5 to 3.4 MtCO2e/y (21-28% compared to 2022 GHG emissions)

[9] Environment and Climate Change Canada (2024). National inventory report 1999-2022.

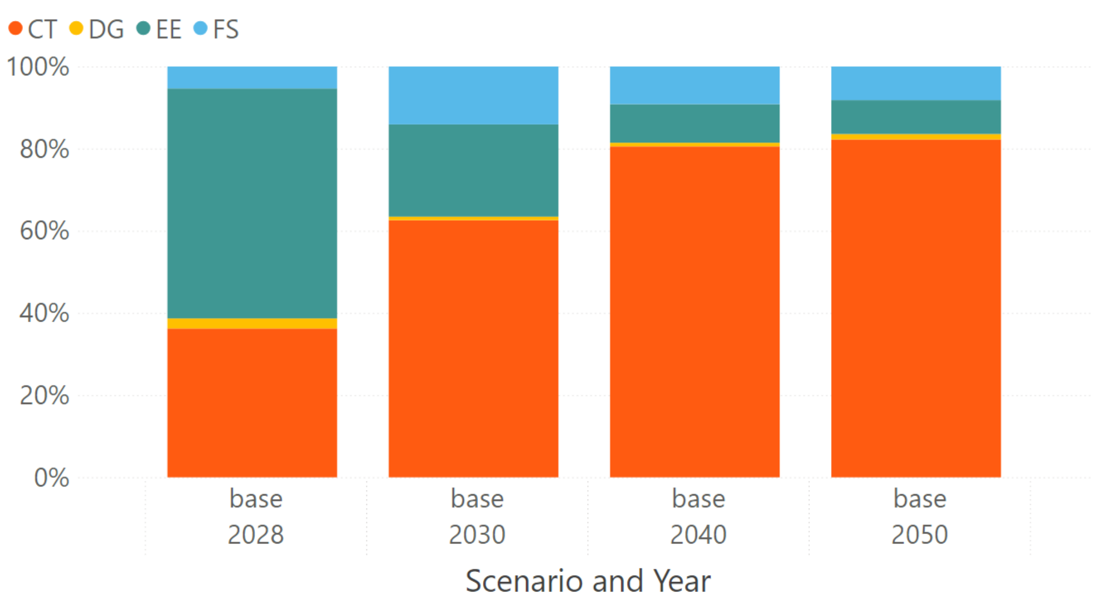
Figure 2-6. Annual GHG emissions reductions (tCO2e/y)



In the short term (FY25/26), EE accounts for the majority of emission reductions (Figure 2-7). However, **as uptake of electric vehicles (EVs) increases, CT accounts for a greater share, and the majority of emissions reductions, from 2030 onwards.**

While alternative fuels, vehicle retrofits and shore power are also included under CT, **on-road vehicle electrification accounts for >99% of the emissions reductions attributed to clean transportation.**

Figure 2-7. Share of annual emissions reductions per study stream (% of annual emissions reductions)



2.5 Key Takeaways

Based on the results presented in this section, the following key takeaways emerge:

- Electricity system impacts will be determined by the combined influence of key drivers that decrease (EE, DG, DR) or increase (FS, CT) electricity consumption and peak demand. **There is an opportunity to leverage EE, DG and DR to mitigate increases in consumption and peak demand from CT and FS.**
- Combined, opportunities in EE, FS, DG, and CT are projected to **significantly reduce fuel consumption and GHG emissions in the province.**

Overall Program Savings Potential

3. Overall Program Savings Potential

The following chapter presents a high-level overview of the combined achievable potential results of study streams core to NB Power's DSM programs and plans – **EE, FS, DG, and DR.** It assesses program impacts, with a focus on the first five years of the study period and accounting for net savings potential. A more detailed presentation and discussion of each of the study streams is presented in their respective chapters. The methodological approach for each study stream can be found in the Volume II report appendices.

3.1 Program Savings

Figure 3-1 presents the cumulative technical, economic and achievable energy savings potential (inclusive of all fuels considered in the study, including electricity, natural gas, oil, propane and biomass) over the first fifteen years of the study period for all EE, FS, and DG measures. Figure 3-2 shows the achievable potential per study stream.

Figure 3-1. Technical, economic and achievable all-fuels (including electricity) energy savings potential in FY 39/40 (Cumulative GJ)

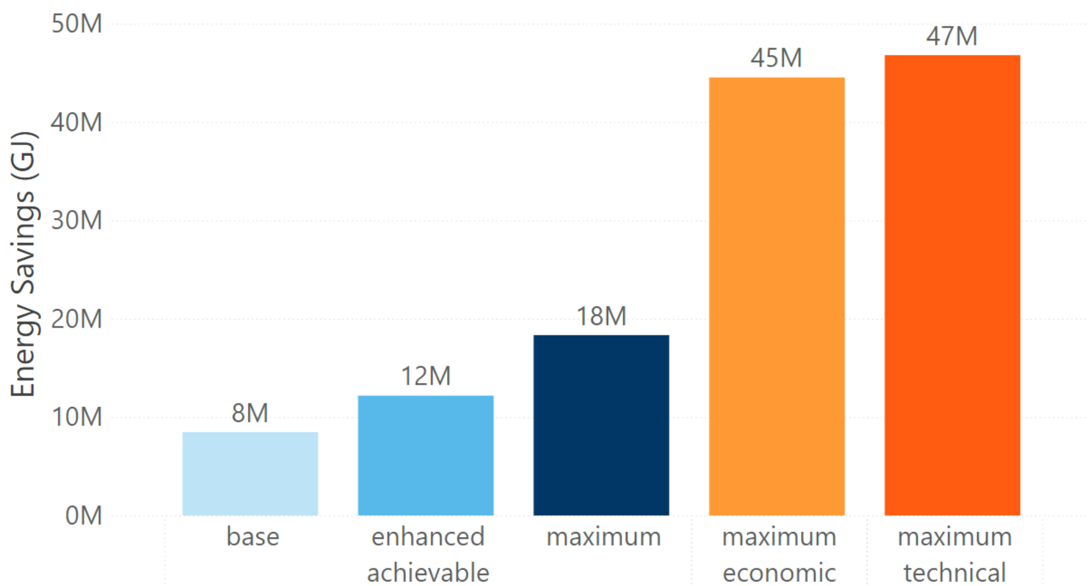
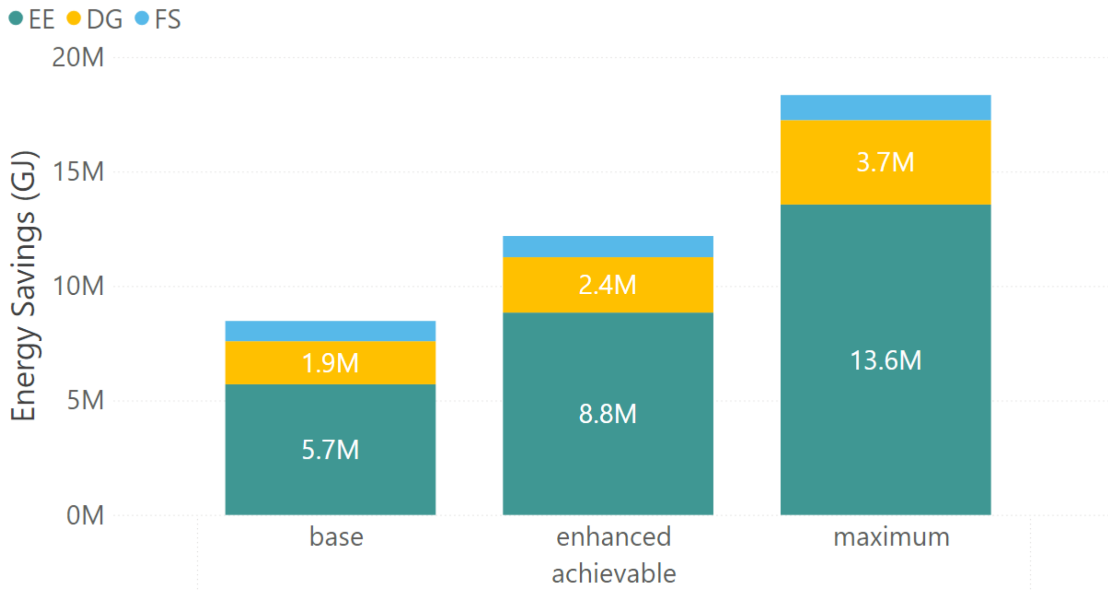


Figure 3-2. Achievable all-fuels (including electricity) energy savings potential in FY 39/40 (Cumulative GJ) by study stream



Based on these results, the following observations can be made:

- **Overall, technical potential for energy savings, including electricity and combustible fuels, is 47 PJ in FY39/40.** This is almost one quarter of province-wide energy consumption.[10]
- **Most savings pass the economic screening threshold.** Net economic potential is 96% of technical potential. This observation is partly explained by the fact that the study focuses on commercially available and viable technologies – measures that may theoretically offer technical potential but are not expected to be cost-effective were largely omitted from the study.
- **Increasing incentives and enabling activities can more than double savings.** Relative to the base scenario, savings increase by 50% in the enhanced scenario and 125% in the maximum scenario.
- **Energy efficiency accounts for the majority of overall energy savings,** followed by DG and FS. While FS does save energy overall, as electric upgrades are typically more efficient than the baseline equipment (for example, the efficiency of an air-source heat pump is approximately three times that of a gas-fired furnace), it also shifts energy from combustible fuels to electricity.

[10] New Brunswick's total energy consumption was approximately 209 PJ in 2020.

3.1.1 Electric Savings

The following section highlights the overall electric savings potential, taking into account both energy and peak demand savings potential of EE, FS, DG, and DR measures.

3.1.1.1 Energy

Figure 3-3 shows the achievable first-year electric EE, FS, and DG potential with savings per study stream, and Figure 3-4 shows achievable first-year savings as a percentage of forecasted baseline electricity consumption.

Figure 3-3. Achievable electric EE, FS and DG potential (first-year GWh)

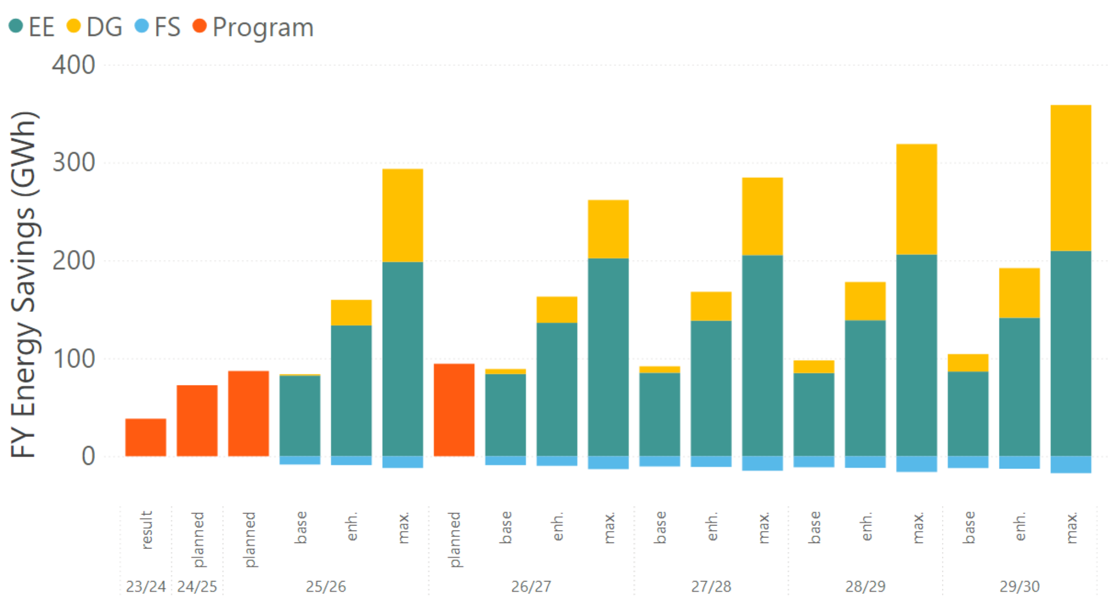
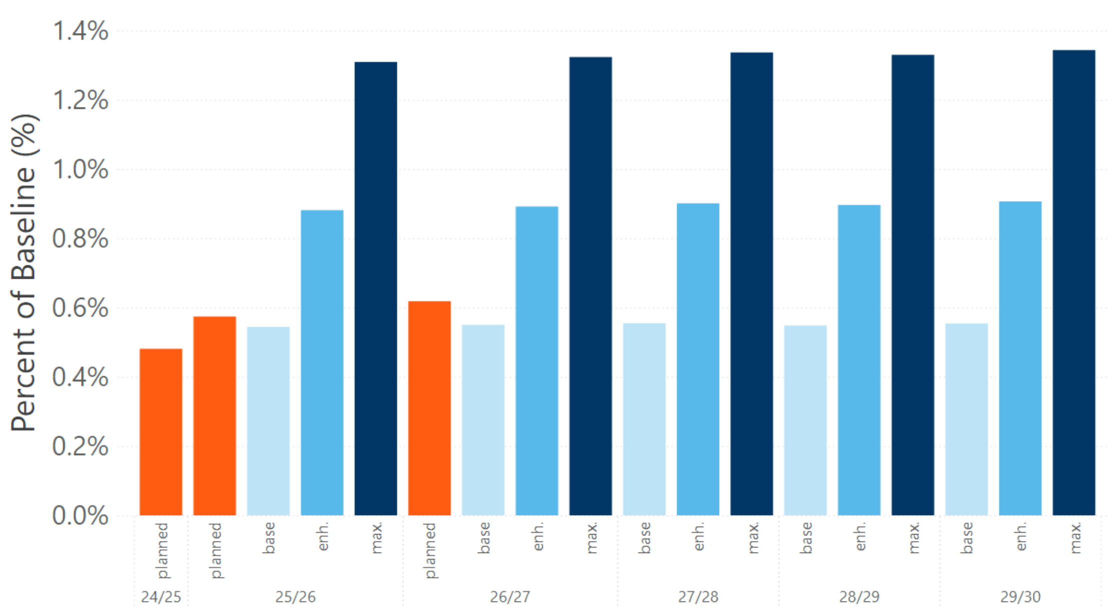


Figure 3-4. Achievable electric EE, FS and DG potential (first-year savings % of baseline forecast)



Based on these results, the following observations can be made:

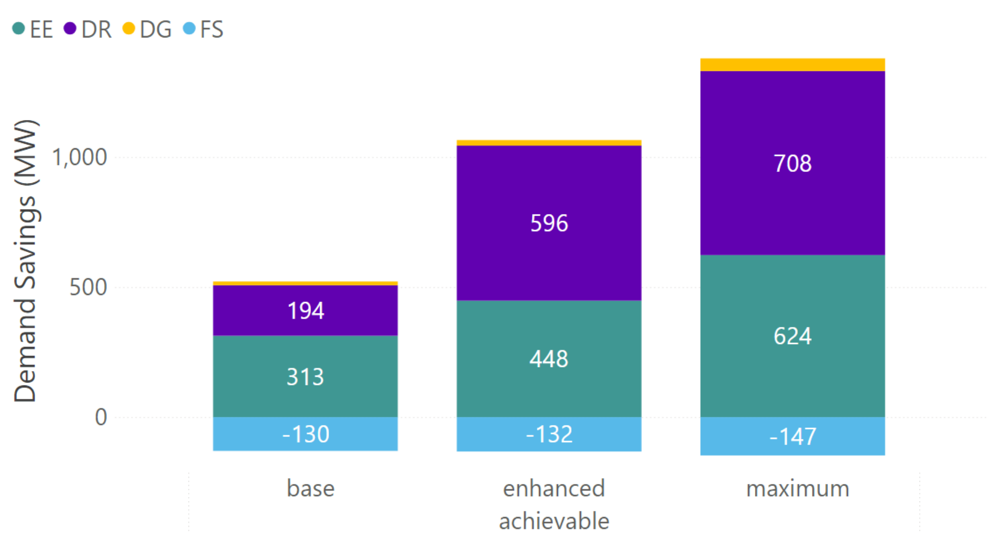
Base scenario savings exceed recent program results and are comparable with FY24/25 planned savings but fall below planned savings in FY26/27 and FY27/28, with marginal year-over-year increase in savings, indicating that program enhancements may be required to meet future planned savings. This is driven in part by energy efficiency savings in the commercial sector falling below planned savings (as is discussed further in section 4.2.3).

- **EE measures account for the majority of savings,** particularly in the base scenario.
- Savings from DG are negligible in the base scenario in the first year of the study period, due to the combined impact of a revised net metering rate and the lack of program incentives[11] – however, **as uptake of rooftop solar photovoltaic (PV) increases overtime as equipment costs decrease (or with increased incentives/enabling activities in the enhanced and maximum scenarios), DG savings potential is also significant.**
- **FS measures lead to some increase in electricity consumption, but net energy savings overall**, as the electrified equipment is typically more efficient than a fuel-fired counterpart (e.g. air-source heat pumps are approximately 3 times more efficient than gas or oil boilers).

3.1.1.2 Peak Demand

Figure 3-5 shows the cumulative achievable peak demand potential over the first fifteen years of the study period. Figure 3-6 shows the achievable first-year peak demand EE, FS, DG, and DR potential with savings per study stream.

Figure 3-5. Achievable EE, FS, DR and DR peak demand reduction potential in FY 39/40 (Cumulative MW)



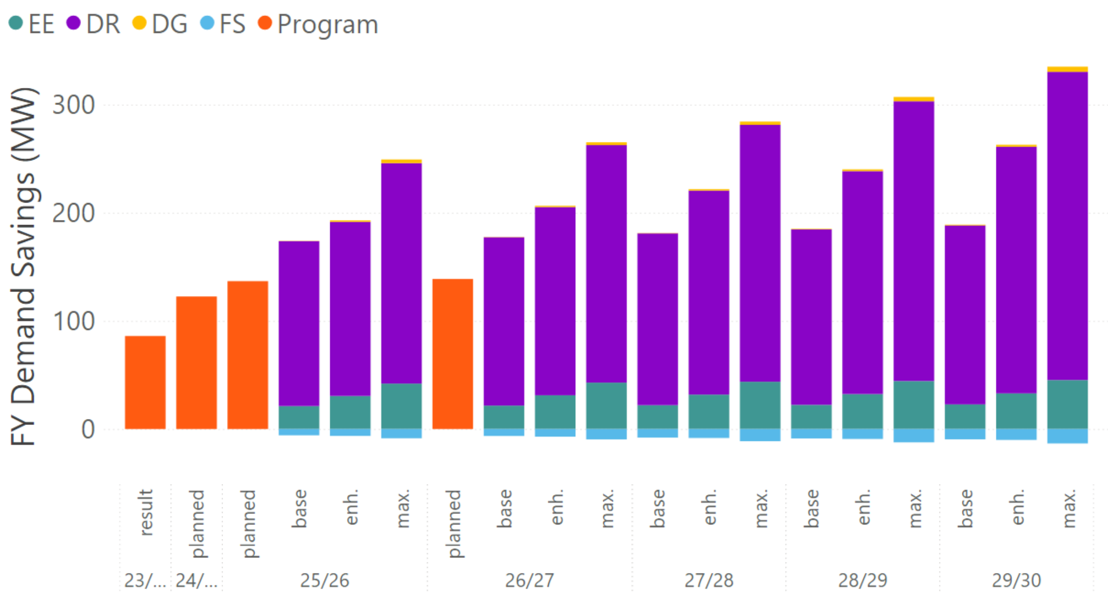
[11] The study considers no incentives for solar PV in the base scenario, in line with the recent EUB decision to remove renewables from existing NB Power programs.

Peak Demand Savings Potential

Although the study assesses technical, economic and achievable potential of peak demand savings, **technical and economic peak demand savings potential are not presented throughout this report.**

While technical and economic potential are reflective of available capacity, **they do not consider actual system needs,** and net impacts taking into account the impacts and interactions between the various measures considered in this study and their impacts on NB Power's typical peak day load shape.

Figure 3-6. Achievable demand EE, FS, DG and DR potential (first-year MW)



Based on these results, the following observations can be made:

- **Base scenario results exceed planned demand savings.** This is largely due to higher than planned participation of commercial and industrial customers in the Peak Rewards demand response program, as is discussed further in section 8.
- **Peak demand savings represent approximately 5-8% of forecasted baseline peak demand.** While demand response measures account for the majority of first-year demand savings, energy efficiency measures contribute nearly half of cumulative demand savings by FY39/40.
- **Demand impacts of distributed generation are relatively negligible, as solar PV generation is very limited during NB Power's winter morning peak.** While storage-paired solar PV systems have greater potential for demand savings, adoption of storage-paired systems is low, as discussed in section 6.
- **Increases in peak demand due to FS are relatively minor.**

3.1.2 Combustible Fuel Savings

Figure 3-7 shows the achievable cumulative combustible fuel savings from EE and FS measures over the first year of the study period, highlighting savings per fuel. Combustible fuel savings throughout this section include both energy efficiency and fuel savings impacts, and include oil, natural gas, biomass and propane savings.

Figure 3-8 shows the achievable first-year combustible fuel savings per study stream over the first five years of the study period.

Figure 3-7. Achievable EE and FS combustible fuel savings in FY 39/40 (cumulative GJ)

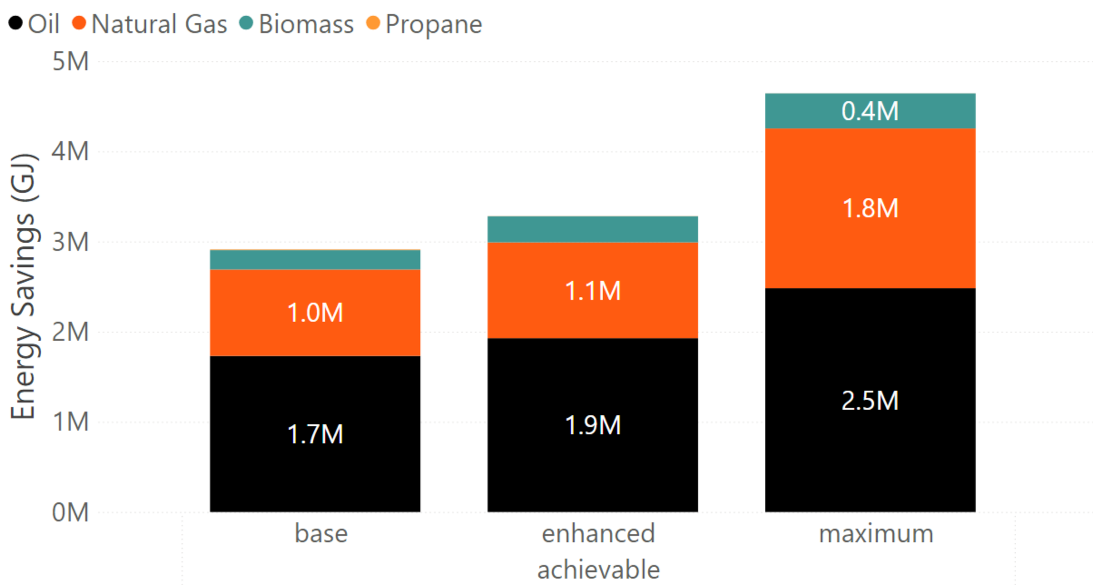
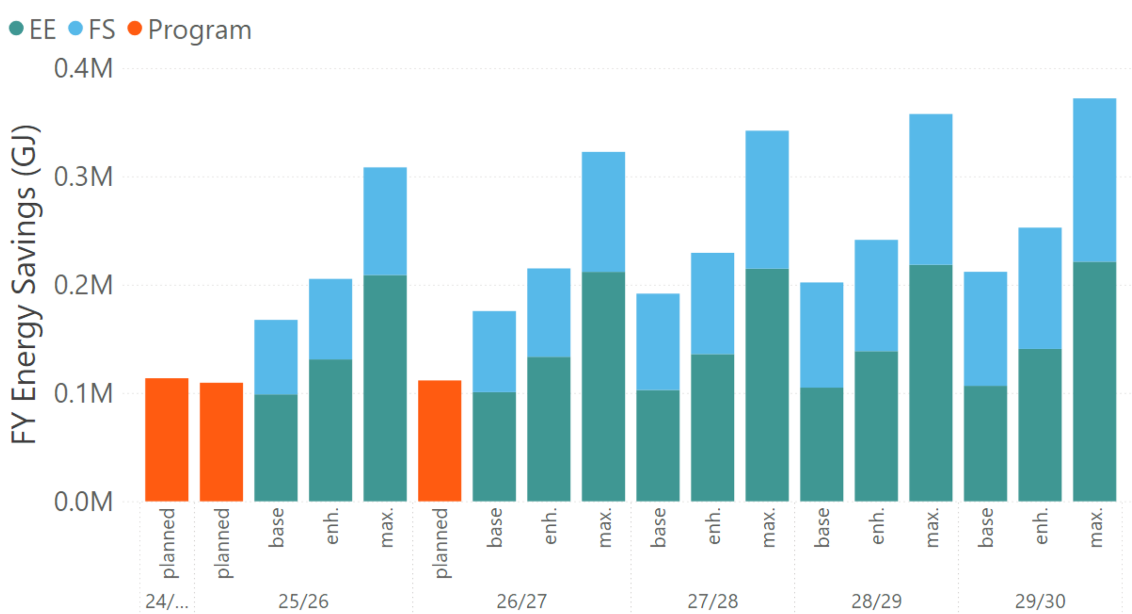


Figure 3-8. Achievable combustible fuel EE and FS potential (first-year GJ)



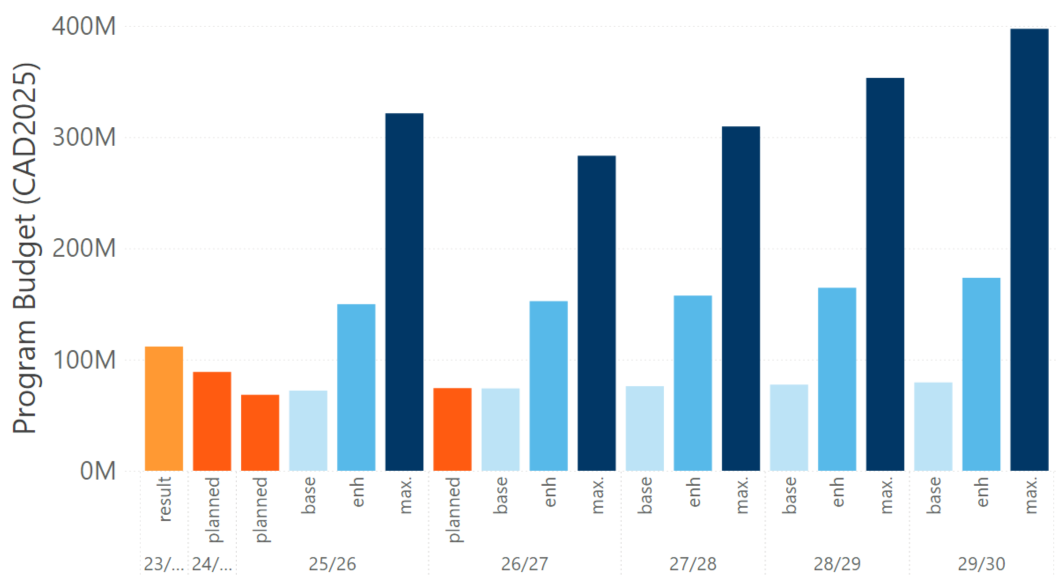
Based on these results, the following observations can be made:

- **Savings are projected to exceed planned savings in the base scenario.** This is largely driven by oil savings over-and-above planned savings due to rapid electrification of oil-heated residential space heating, as well as electrification of oil-heated industrial processes, as discussed in more detail in section 5.
- **Oil savings account for over half of overall combustible fuel savings,** followed by natural gas and biomass. Propane savings are relatively negligible, as this accounts for only a small fraction of overall energy consumption in New Brunswick.
- **Energy efficiency measures account for over half of combustible fuel savings,** while savings from fuel switching are also significant.

3.2 Program Costs and Benefits

Figure 3-9 presents the estimated program costs for the first five years of the study compared to recent spending and planned budgets.

Figure 3-9. Program cost estimates (CAD 2025)



Relative to planned budgets, estimated costs under the base scenario are comparable to the planned budgets over first two years of the study period (25/26 and 26/27).

Average acquisition costs in the base scenario are also comparable to plans.[12] In the enhanced and maximum scenarios, costs increase at a faster rate than first-year savings, resulting in higher average acquisition costs per **first-year** GJ of energy savings as each additional unit of savings comes at a higher marginal cost. This being said, increases in average acquisition cost per **lifetime** GJ of energy savings, taking into account the total savings over a measures' lifetime, increase only marginally between scenarios (Table 3-1).

[12] Implementation Plans indicate an average acquisition cost of 158 $/GJ (first-year savings), considering the average of 24/25, 25/26 and 26/27.

These results indicate a potential opportunity for programs to deliver more sustained, long-term savings with increased investments and enabling activities.

Table 3-1. Program Costs per first-year GJ target fuel savings (CAD2025 per GJ)

Scenario	Base	Enhanced	Maximum
Average $ per GJ *(first-year savings)*	177	190	235
Average $ per GJ *(lifetime savings)*	10	10	12

Table 3-2 shows estimated program costs broken down by incentives and administrative costs. Administrative costs increase between the base and enhanced scenario due to the addition of new demand response programs, particularly targeting the residential sector and EVs. They further increase in the maximum scenario as the analysis accounts for the increased administrative cost required to support an increase in enabling activities.

Incentives also increase between scenarios. In the base and enhanced scenarios, the vast majority of incentives go towards EE and FS measures. In the maximum scenario, DG accounts for a more significant portion of overall incentives, due to the significant increase in incentives for rooftop solar PV and storage considered in this scenario (50% of incremental costs).

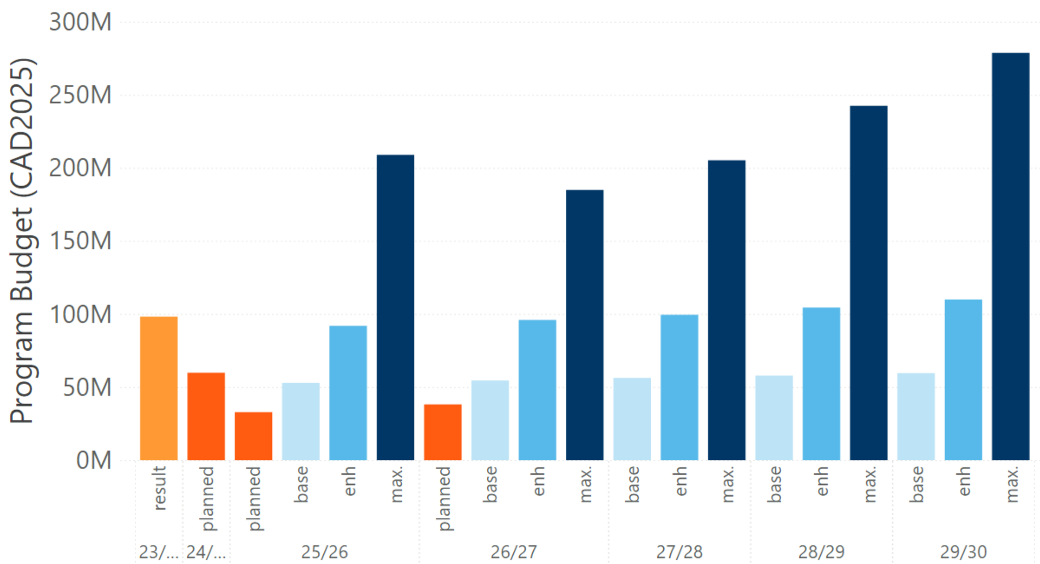
Table 3-2. Program cost estimates by incentives and program administration costs (Million CAD2025)

	FY25/26	FY26/27	FY27/28	FY28/29	FY29/30
Base	**72**	**74**	**76**	**77**	**79**
Incentive Costs	54	56	58	59	60
% EE / FS	*84%*	*84%*	*84%*	*84%*	*85%*
% DG	*0%*	*0%*	*0%*	*0%*	*0%*
% DR	*16%*	*16%*	*16%*	*16%*	*15%*
Administration Costs	18	18	19	19	19
Enhanced	**150**	**153**	**158**	**165**	**174**
Incentive Costs	127	129	134	141	149
% EE / FS	*81%*	*81%*	*80%*	*78%*	*75%*
% DG	*12%*	*11%*	*11%*	*14%*	*16%*
% DR	*7%*	*8%*	*8%*	*9%*	*9%*
Administration Costs	23	23	23	23	23
Maximum	**321**	**283**	**310**	**353**	**397**
Incentive Costs	291	253	279	321	363
% EE / FS	*56%*	*66%*	*61%*	*54%*	*48%*
% DG	*38%*	*26%*	*31%*	*39%*	*45%*
% DR	*7%*	*7%*	*7%*	*7%*	*7%*
Administration Costs	31	30	31	32	34

3.2.1 Residential Programs

Figure 3-10 shows the estimated residential program costs over the first five years of the study period, compared to recent program spending results and planned budgets.

Figure 3-10. Residential portfolio cost estimates (CAD2025)



Program costs exceed planned budgets in the first study years. This is largely driven by higher than planned electricity and fuel savings in the residential sector, as is discussed further in sections 4 and 5.

Table 3-3 shows the residential program PACT ratios, per program and scenario, for the first five years of the study period.

Table 3-3. Residential portfolio PACT ratios

Program	FY25/26	FY26/27	FY27/28	FY28/29	FY29/30
Base					
energy efficient products program - kits stream	1.9	1.8	1.8	1.8	1.8
energy efficient products program - rebate stream	3.2	3.2	3.2	3.2	3.1
enhanced energy savings program - stream 1 (electric)	1.9	1.9	1.9	1.9	1.9
enhanced energy savings program - stream 2 (oil transition)	0.9	1.0	1.0	1.1	1.1
new home energy savings program	1.9	1.9	1.9	1.9	1.9
total home energy savings program	3.1	3.2	3.5	3.6	3.7
Enhanced					
energy efficient products program - kits stream	1.9	1.8	1.8	1.8	1.8
energy efficient products program - rebate stream	2.4	2.4	2.4	2.3	2.3
enhanced energy savings program - stream 1 (electric)	1.9	1.9	1.9	1.9	1.9

Program	FY25/26	FY26/27	FY27/28	FY28/29	FY29/30
enhanced energy savings program - stream 2 (oil transition)	0.9	1.0	1.0	1.1	1.1
new home energy savings program	1.2	1.2	1.2	1.2	1.2
residential dlc - energy storage program	0.0	0.0	0.0	0.0	0.0
residential dlc - heating and ev program	1.0	1.3	1.5	1.7	1.9
residential dlc - smart appliances program	0.0	0.1	0.1	0.2	0.2
total home energy savings program	2.4	2.4	2.4	2.5	2.5
total home energy savings program - solar pv	4.1	4.2	4.3	4.4	4.5
Maximum					
energy efficient products program - kits stream	1.8	1.8	1.8	1.8	1.8
energy efficient products program - rebate stream	2.2	2.2	2.2	2.2	2.2
enhanced energy savings program - stream 1 (electric)	1.9	1.9	1.9	1.9	1.9
enhanced energy savings program - stream 2 (oil transition)	1.1	1.1	1.2	1.2	1.2
new home energy savings program	1.0	1.0	1.0	1.0	1.0
residential dlc - energy storage program	0.0	0.0	0.0	0.0	0.3
residential dlc - heating and ev program	0.9	1.1	1.2	1.4	1.5
residential dlc - smart appliances program	0.1	0.2	0.2	0.3	0.4
total home energy savings program	2.1	2.1	2.2	2.2	2.2
total home energy savings program - solar pv	1.3	1.4	1.4	1.4	1.4

Based on these results, the following observations can be made:

- **Under all scenarios, programs are generally cost-effective, with PACT ratios greater than 1, with a few exceptions.**

  While the enhanced energy savings program for oil customers has a PACT of 0.9 in FY25/26 in the base and enhanced scenarios, on average the PACT is greater than 1 over the first 5 years of the study period.

  An exception to this are some of the residential demand response programs. While the heating and EV program is cost-effective, the residential direct load control (DLC) energy storage and smart appliances programs do not reach cost-effectiveness during the first five years of the study period. While these programs include measures which pass measure-level cost-effectiveness screening, these programs struggle to achieve cost-effectiveness at the program level due to:

(1) New programs are subject to a ramp-up period, which limits the savings that can be achieved by a new program in the first years, and

(2) Overall potential of DR programs targeting storage and smart devices is limited by the uptake of these technologies, which is relatively limited (as discussed in more detail in section 6 for storage-paired solar PV systems).

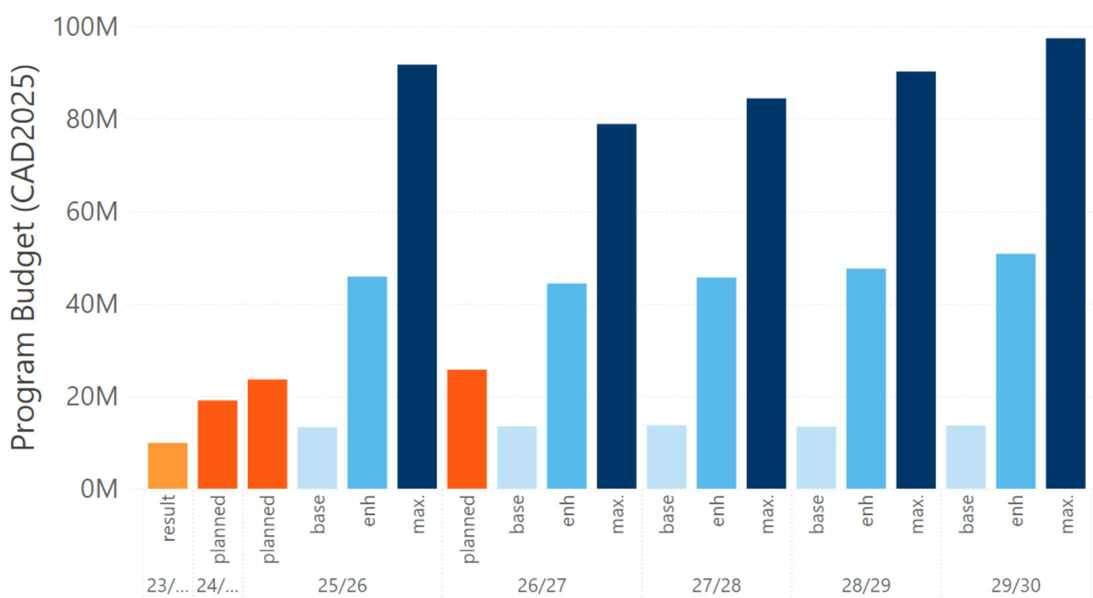
These factors mean that the savings and benefits achieved by these programs are low relative to the program administrative costs required to operate the program. Overall, these results indicate that expansion of residential DR programs should likely focus on targeting heating and EV measures, where there is more cost-effective potential. If a residential storage DR program is pursued, this should also be coupled with efforts to increase adoption of storage-paired solar PV systems, so that the program can bring sufficient benefits to NB Power.

- **In most cases, PACT ratios decline as incentives and enabling activities increase, due to the greater cost incurred to procure savings.**

3.2.2 Commercial Programs

Figure 3-11 shows the estimated commercial program costs over the first five years of the study period, compared to recent program spending results and planned budgets.

Figure 3-11. Commercial portfolio cost estimates (CAD2025)



Program costs exceed recent program spending results (FY23/24) but fall significantly short of planned budgets in the base scenario. This is largely driven by lower than planned electricity savings in the commercial sector, as discussed further in further in section 4.

Table 3-4 shows the commercial program PACT ratios, per program and scenario, for the first five years of the study period.

Table 3-4. Commercial portfolio PACT ratios

Program	FY25/26	FY26/27	FY27/28	FY28/29	FY29/30
Base					
business rebate program	4.0	4.1	4.1	4.2	4.2
commercial building retrofit program	3.1	3.1	3.1	3.3	3.3
new construction program	3.4	3.4	3.4	3.4	3.4
peak rebate program	2.2	2.1	2.2	2.2	2.3
Enhanced					
business rebate program	2.7	2.7	2.7	2.7	2.7
commercial building retrofit program	2.4	2.4	2.4	2.5	2.5
commercial building retrofit program - solar pv	2.6	2.7	2.7	2.8	2.9
commercial curtailment - miscellaneous system program	0.2	0.4	0.6	0.7	0.8
commercial dlc - energy storage program	0.4	0.6	0.8	0.9	1.1
commercial dlc -ev smart charging program	0.2	0.5	0.9	1.3	1.6
commercial dlc -heating program	0.2	0.4	0.5	0.7	0.9
new construction program	1.2	1.2	1.2	1.2	1.2
peak rebate program	2.1	2.1	2.1	2.2	2.2
Maximum					
business rebate program	2.4	2.4	2.4	2.4	2.4
commercial building retrofit program	2.2	2.2	2.2	2.3	2.3
commercial building retrofit program - solar pv	1.9	1.9	2.0	2.0	2.1
commercial curtailment - miscellaneous system program	0.3	0.5	0.6	0.8	0.9
commercial dlc - energy storage program	0.4	0.5	0.6	0.7	0.8
commercial dlc -ev smart charging program	0.2	0.5	0.8	1.0	1.3
commercial dlc -heating program	0.3	0.6	0.8	1.0	1.2
new construction program	1.2	1.2	1.2	1.2	1.2
peak rebate program	1.6	1.6	1.7	1.7	1.7

Based on these results, the following observations can be made:

- **Existing commercial programs are cost-effective across all scenarios, with PACT ratios greater than 1.** Although PACT ratios decline from base to enhanced to maximum scenarios, due to increased program spending with increased incentives and enabling activities, the increase in savings and overall benefits mean that programs remain cost effective.
- **New commercial DR programs have PACT ratios below 1 in the first years of the study, but many of these programs see PACT ratios increase to greater than 1 within the first five years of the study period.** Similarly to the new residential DR programs, these programs do not achieve cost-effectiveness in early years due to the ramp-up period and the limited uptake of certain technologies, such as EVs and storage, in the first years of the study period. However, all programs have a PACT ratio of 0.8 or greater by FY29/30, indicating potential for these programs to be cost-

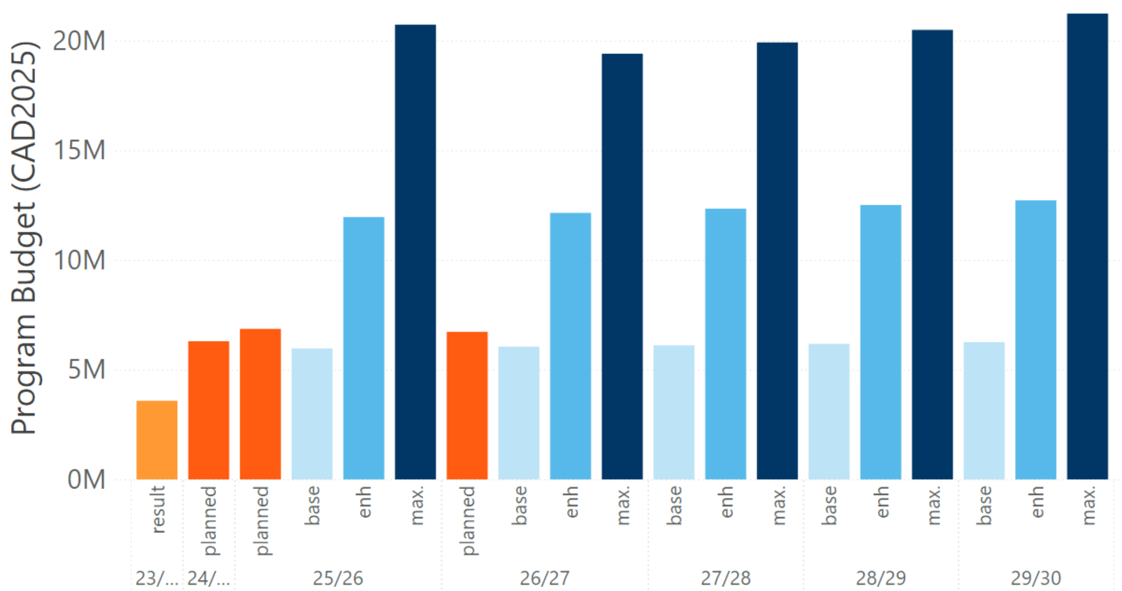
effective as they ramp up and participation increases, bringing more savings and benefits to offset the administrative overhead.

For some of the new commercial DR programs (heating and miscellaneous system curtailment)[13], PACT ratios actually increase from the enhanced to the maximum scenario, indicating a potential to increase benefits at a greater rate than costs through increased incentives and enabling activities, boosting participation. Overall, further detailed program design will be required for new DR programs to find the right balance between increasing participation and program costs.

3.2.3 Industrial Programs

Figure 3-12 shows the estimated industrial program costs over the first five years of the study period, compared to recent program spending results and planned budgets.

Figure 3-12. Industrial portfolio cost estimates (CAD2025)



Program costs fall slightly below planned budgets in the base scenario in the first years of the study period. This is despite higher than planned industrial electricity and fuel savings, as discussed further in sections 4 and 5. This indicates an opportunity to procure industrial savings at a lower cost than is reflected in current plans.

Table 3-5 shows the industrial program PACT ratios, per program and scenario, for the first five years of the study period.

Table 3-5. Industrial portfolio PACT ratios

Program	FY25/26	FY26/27	FY27/28	FY28/29	FY29/30
Base					

[13] Includes curtailment of refrigeration systems and small back-up generators.

Program	FY25/26	FY26/27	FY27/28	FY28/29	FY29/30
industrial energy efficiency program	14.3	14.3	14.4	14.4	14.4
large industrial demand response program	2.0	2.0	2.0	2.1	2.1
Enhanced					
industrial energy efficiency program	5.7	5.7	5.7	5.7	5.7
industrial energy efficiency program - large - solar pv	7.7	7.9	8.2	8.4	8.6
industrial energy efficiency program - small/medium - solar pv	0.0	0.0	4.4	4.5	4.7
large industrial demand response program	2.0	2.0	2.0	2.1	2.1
Maximum					
industrial energy efficiency program	5.6	5.5	5.6	5.6	5.6
industrial energy efficiency program - large - solar pv	1.5	1.5	1.5	1.6	1.6
industrial energy efficiency program - small/medium - solar pv	1.6	1.7	1.7	1.8	1.8
large industrial demand response program	1.5	1.4	1.5	1.5	1.5

Based on these results, the following observations can be made:

- **Under all scenarios, programs are cost-effective, with PACT ratios greater than 1** throughout the first five years of the study period.

  The only exception to this is the small/medium industrial solar PV program in the enhanced scenario, where there is no participation in the first two years of the study period. With greater incentives in the maximum scenario, the small/medium industrial solar PV program sees participation, and PACT ratios greater than one, from FY25/26.

- **PACT ratios decline as incentives and enabling activities increase, due to the greater cost incurred to procure savings.**

3.3 Key Takeaways

Based on the results presented in this section, the following key takeaways emerge:

- **Considering the combination of EE, DG, and FS, electricity savings fall below planned savings in the base scenario.** This indicates that program enhancements may be required in order to achieve planned savings and continue meeting targets over the coming years.
- **Demand reduction potential exceeds planned savings in the base scenario.** While increased incentives and enabling activities can further increase savings, there is additional demand response potential under NB Power's current programs that has not yet been achieved.
- **Combustible fuel savings also exceed planned savings in the base scenario, with over half of achievable fuel savings coming from oil.**

- **Increased incentives and enabling activities increase savings significantly but also come at a higher cost.** Program spending increases at a faster rate than savings, driven by both increased incentives paid as well as an increase in program administration costs required to support increased enabling activities, leading to higher average acquisition costs compared to the base scenario.
- **Existing programs are cost-effective across all scenarios,** based on the program administrator cost test (PACT).

  Some new (DR) programs are not cost-effective during the first years of the study period, as program ramp-up limits the savings achieved relative to the overhead administrative costs – and in some cases, savings, and benefits, are limited by low uptake of technologies, such as storage.

Electricity Energy Efficiency

4. Electricity Energy Efficiency

4.1 Overview

The following chapter presents the assessment of the electric energy savings potential from EE measures as well as the peak electric demand savings (i.e., passive demand reductions) associated with EE measures. The study assesses the market potential for EE measures using a bottom-up modelling approach.

The bottom-up approach leverages Dunsky's Demand and Energy Efficiency Potential (DEEP) model to estimate thousands of "measure-market" combinations and apply program impacts (e.g., incentives and enabling activities that help address market barriers) to assess energy savings potentials across multiple achievable scenarios for prescriptive measures applicable to wide swaths of the residential and non-residential customer populations.

For opportunities applicable to the large industrial segment, the study also relied on primary data collection to support the characterization of energy efficiency measures.

Table 4-1 provides a qualitative description of the achievable potential scenarios for energy efficiency. More detail on the methodological approach is provided in Volume II.

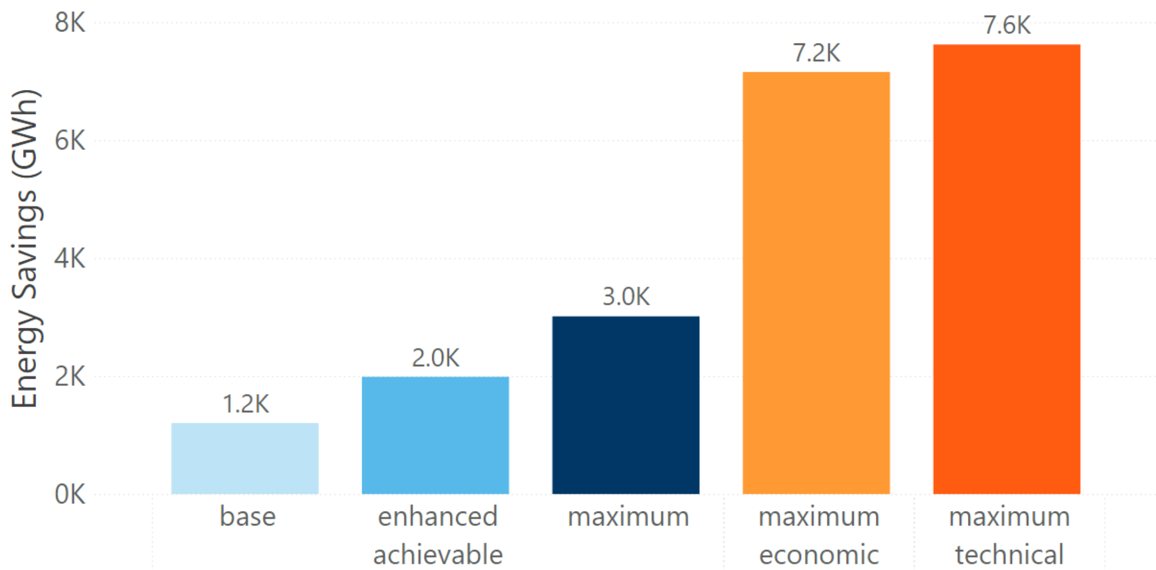
Table 4-1. Energy efficiency achievable potential scenarios

Base	Enhanced (Enh.)	Maximum (Max.)
Applies incentives and enabling activities in line with NB Power's current programs to simulate business as usual. Includes existing and expanded complementary measures.	Applies **increased incentives** above and beyond NB Power's current programs.	Maintains increased incentives from enhanced scenario but **increases enabling activities.**

4.2 Program Savings

Figure 4-1 presents the cumulative technical, economic, and achievable electric energy savings over the first fifteen years of the study period for all EE measures.

Figure 4-1. Technical, economic and achievable electric EE potential in FY 39/40 (Cumulative GWh)



Based on these results, the following observations can be made:

- **Technical electric energy potential is significant – representing 37% of forecasted baseline electricity consumption in FY39/40**.

- **Most savings pass the economic screening threshold**. Net economic potential is 95% of technical potential. This observation is partly explained by the fact that the study focuses on commercially available and viable technologies – measures that may theoretically offer technical potential but are not expected to be cost-effective were largely omitted from the study.

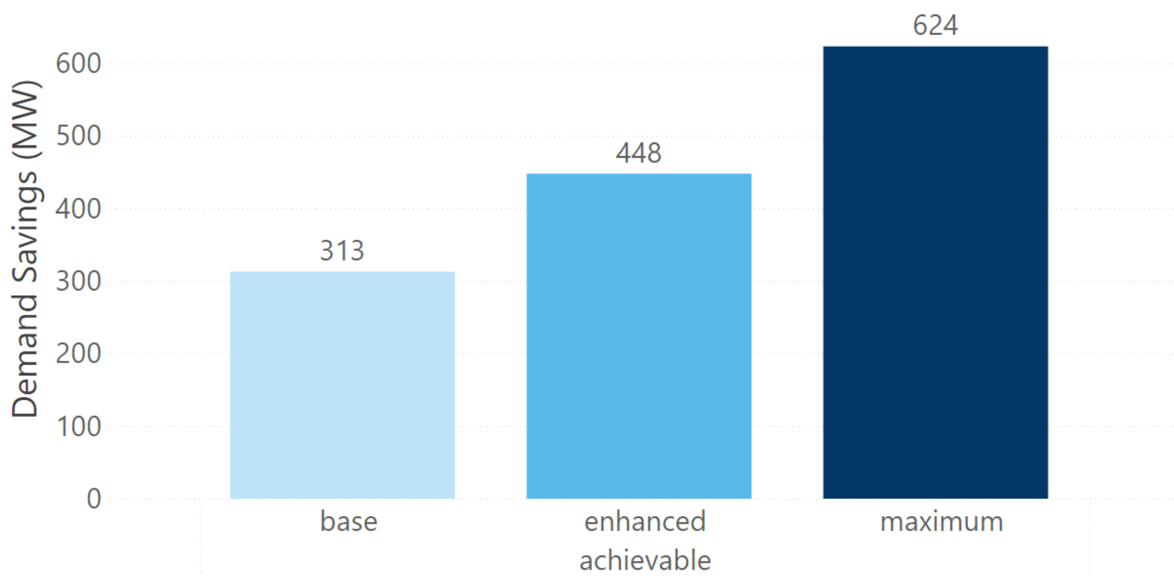
- **The base scenario captures just one-sixth of economic savings.** Under a scenario representative of current programs and incentive levels, 17% of net economic savings are captured through programs. This suggests that there is significant untapped potential for cost-effective electric energy savings, and room to grow savings with increased incentives and enabling activities.

  While not all economic potential is necessarily achievable through voluntary programs alone, other interventions – such as policy and regulation – could also enable NB Power to capture a greater portion of the cost-effective savings potential.

- **Increasing incentives and enabling activities can more than double savings.** Relative to the base scenario, savings increase by 58% in the enhanced scenario and 150% in the maximum scenario. With the combined impact of increased incentives and enabling activities in the maximum scenario, NB Power's programs have the potential to capture nearly half of net economic potential.

Figure 4-2 presents the cumulative achievable passive peak demand savings over the first fifteen years of the study period for all EE measures.

Figure 4-2. Achievable electric EE peak demand reduction potential in FY 39/40 (Cumulative MW)



Based on these results, the following observations can be made:

- **Passive peak demand savings through EE can make a significant contribution to peak demand reductions.** Peak demand reductions are 8% - 16% of baseline peak demand in 2040.

- **Increasing incentives and enabling activities can nearly double savings.** Relative to the base scenario, savings increase by 40% in the enhanced scenario and 95% in the maximum scenario.

4.2.1 Achievable Program Savings

Figure 4-3 shows achievable potential in terms of first-year GWh savings under each scenario, with comparisons to recent results and NB Power's latest DSM plans, and Figure 4-4 shows these savings as a percentage of forecasted baseline electricity consumption.

Figure 4-3. Achievable electric EE savings (First-year GWh)

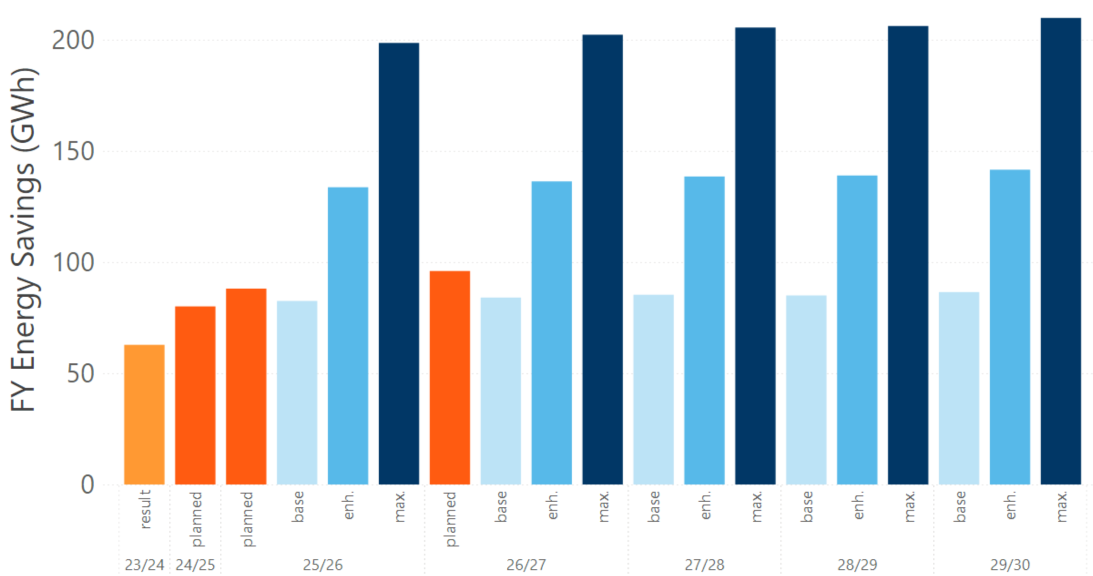
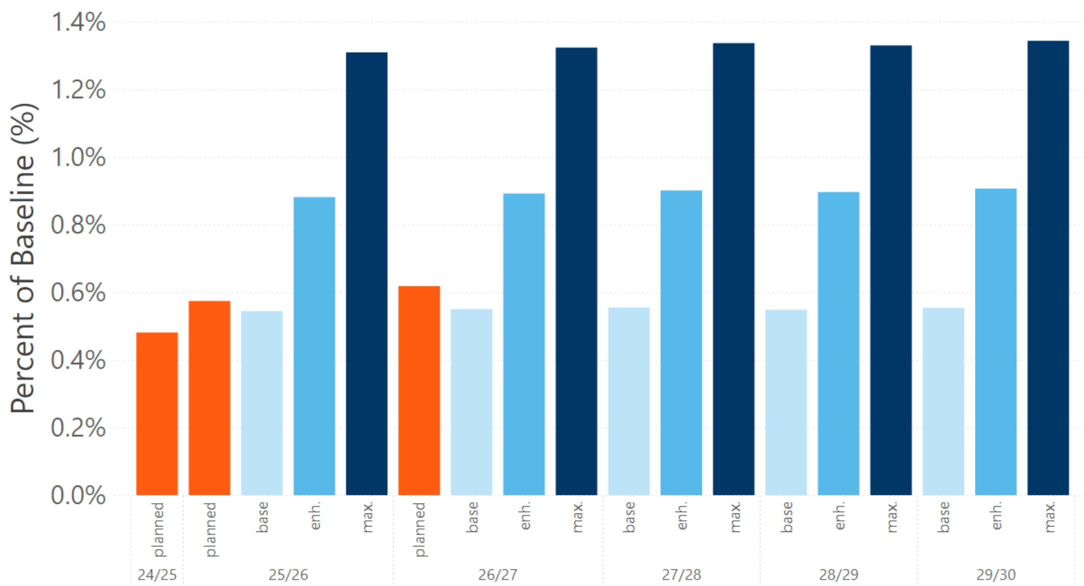


Figure 4-4. Achievable electric EE savings (First-year savings as a % of forecasted baseline consumption)



Based on these results, the following observations can be made:

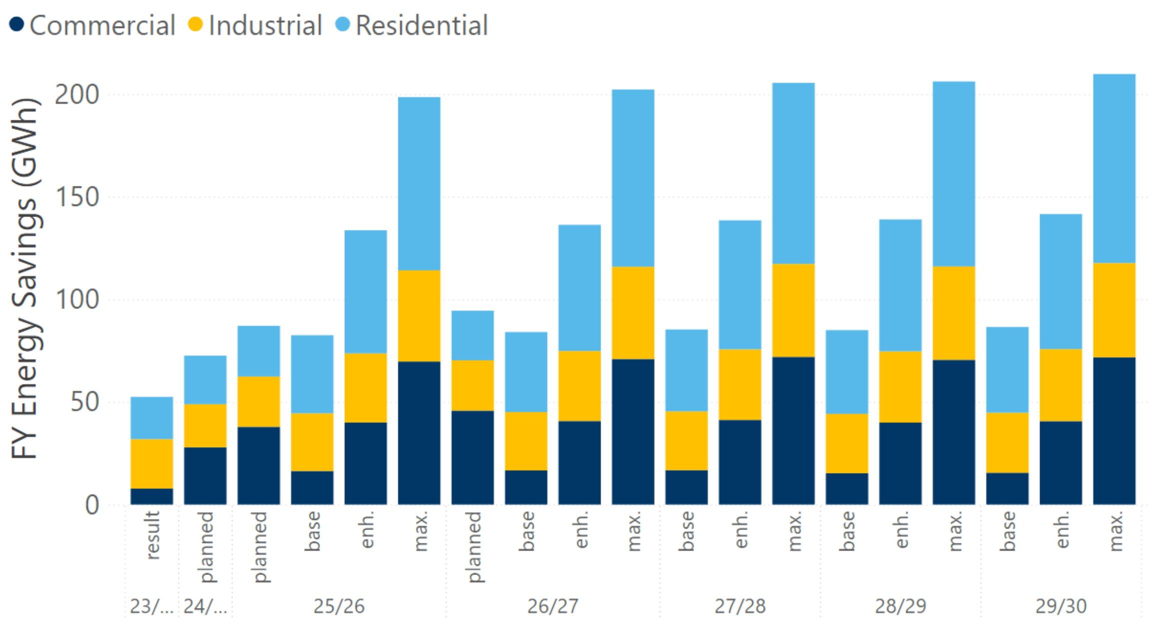
- **Under the base scenario, projected savings fall slightly below plans in FY25/26-26/27.** This indicates that program enhancements may be required to meet forward-looking plans and minimum targets.

  The Energy Efficiency Regulation 2022-74 outlines minimum EE targets for electricity, starting at 0.5% of forecasted in-province electricity sales in FY23/24, and increasing by 0.05% per year to 0.75% in FY28/29. Base scenario savings fall slightly short of the FY25/26 and FY26/27 targets of 0.6% and 0.65%, and increase in year-over-year savings is marginal, indicating that program enhancement may be required to continue meeting minimum targets.[14]

- **Increased incentives and enabling activities increase saving levels above current plans.** In the enhanced and maximum scenarios, achievable savings significantly surpass planned savings.

Figure 4-5 shows the achievable potential for residential, commercial and industrial savings compared to recent results and NB Power's latest DSM plans.

Figure 4-5. Achievable electric EE savings per sector (First-year GWh)



Based on these results, the following observations can be made:

- **Residential first-year savings exceed planned savings under the base scenario.** This is largely driven by higher than planned participation in the enhanced energy savings program, which targets homeowners with a combined gross household income under $70,000, and has significantly expanded the number of customers eligible for incentives covering 100% of incremental costs.
- **Industrial first-year savings are comparable to planned savings under the base scenario.**
- **Commercial first-year savings fall below planned savings under the base scenario.** This is largely due to two factors:
    1. The analysis forecasts **lower than planned program savings from air-source heat pumps.** Currently, planned savings are based on the assumption of an electric resistance baseline for rooftop units – however, it is expected that the market has shifted, and that the baseline for rooftop units can now be considered a standard air-source heat pump. This study therefore considers heat pump measure savings which are more reflective of upgrading from

[14] Government of New Brunswick. (2022). Regulation 2022-74

lower-efficiency standard air-source heat pumps to high efficiency cold climate air-source heat pumps.

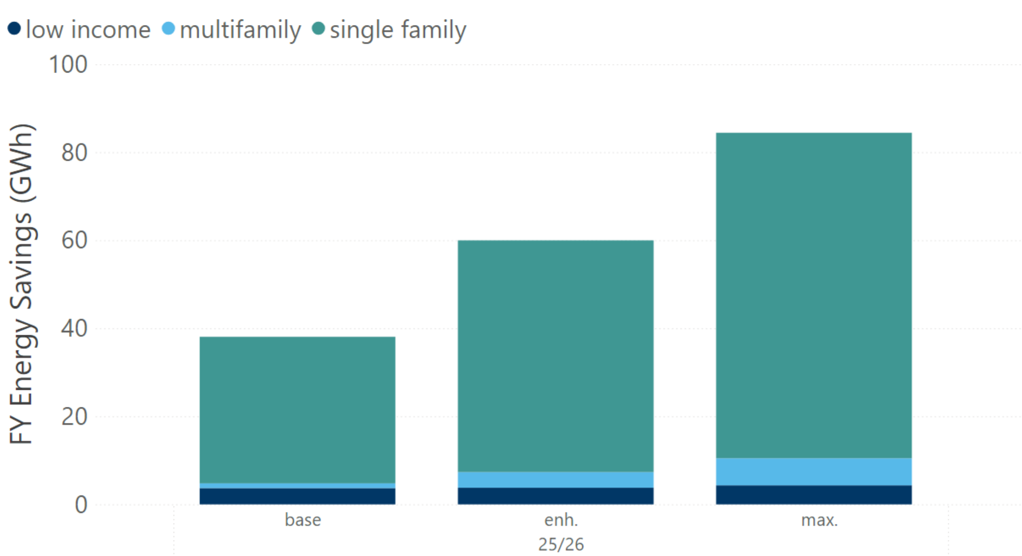
2. The results forecast **lower than planned savings in the commercial business retrofit program** – however, this is aligned with preliminary FY24/25 results which indicate savings are also expected to be significantly lower than planned. This indicates that further program enhancements, either through increased incentives or enabling activities, may be required to meet planned commercial savings.

- **Across all sectors, increased incentives and enabling activities increase saving levels above current plans.** In the maximum scenario, achievable savings significantly surpass planned savings for all sectors. In the enhanced scenario, savings are comparable to current plans for the commercial sector but exceed current plans for the residential and industrial sectors. This further supports the observation that commercial sector programs may require increased investments to achieve the forward-looking plan savings goals.

4.2.2 Residential Savings

Figure 4-6 displays achievable residential electric EE savings potential for each customer segment, in terms of first-year GWh savings in FY25/26. **The majority of savings accrue to the single family segment**, which aligns with this segment's share of consumption.

Figure 4-6. Residential achievable electric EE savings by customer segment (First-year GWh in FY25/26)



4.2.2.1 Savings by End-Use and Top Measures

Figure 4-7 presents residential savings by end-use over the first five years of the study period, and Table 4-2 shows the first-year GWh savings and percent of total residential savings for the top 10 residential electric EE measures.

Figure 4-7. Residential electric EE savings by end-use (First-year GWh)

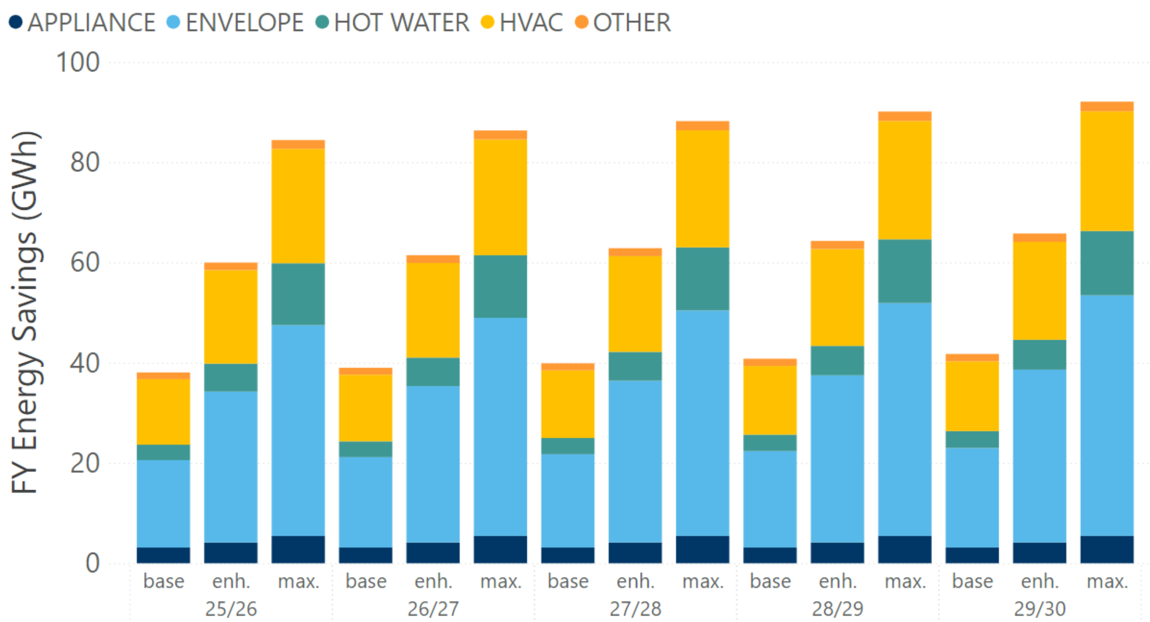


Table 4-2. Top residential electric EE measures first-year GWh savings (% of total residential savings) in FY27/28

Measure	Base	Enh	Max
Mini-split Ductless Heat Pump (DMSHP)	10 (25%)	11 (18%)	13 (14%)
Insulation - Basement	10 (25%)	17 (28%)	21 (24%)
Air Sealing	4 (11%)	6.5 (10.3%)	9 (10%)
Low Flow Shower Head	2.5 (6.3%)	2.6 (4.1%)	2.7 (3.1%)
New Home Construction	2 (5.0%)	5.3 (8.5%)	11 (12%)
Insulation - Attic	1.7 (4.2%)	2.5 (3.9%)	3.5 (4.0%)
Air Source Heat Pump (ASHP)	1.5 (3.6%)	1.7 (2.7%)	2.2 (2.5%)
Advanced Power Strips	1.4 (3.5%)	1.6 (2.5%)	1.8 (2.1%)
Electric Resistance to ASHP	0.2 (0.6%)	3 (4.8%)	3.2 (3.6%)
Water Heater - Heat Pump Water Heater (HPWH)	0.02 (0.04%)	2.1 (3.3%)	7.6 (8.6%)
Total	**34 (85%)**	**54 (86%)**	**75 (85%)**

Note: Top 10 measures sorted and arranged by savings under the base scenario.

Based on these results, the following observations can be made:

- **Envelope measures account for the majority of residential savings, followed by HVAC and hot water measures.** Appliances and "other", which includes savings from advanced power strips, make up a relatively small portion of overall savings.
- **The majority of residential savings (85%) are concentrated in the top 10 measures.** There are significant opportunities for envelope measures (particularly insulation and air sealing), and improving the efficiency of space heating equipment, either by replacing electric resistance heating with heat pumps, or replacing older ducted and ductless air-source heat pumps with higher efficiency models.

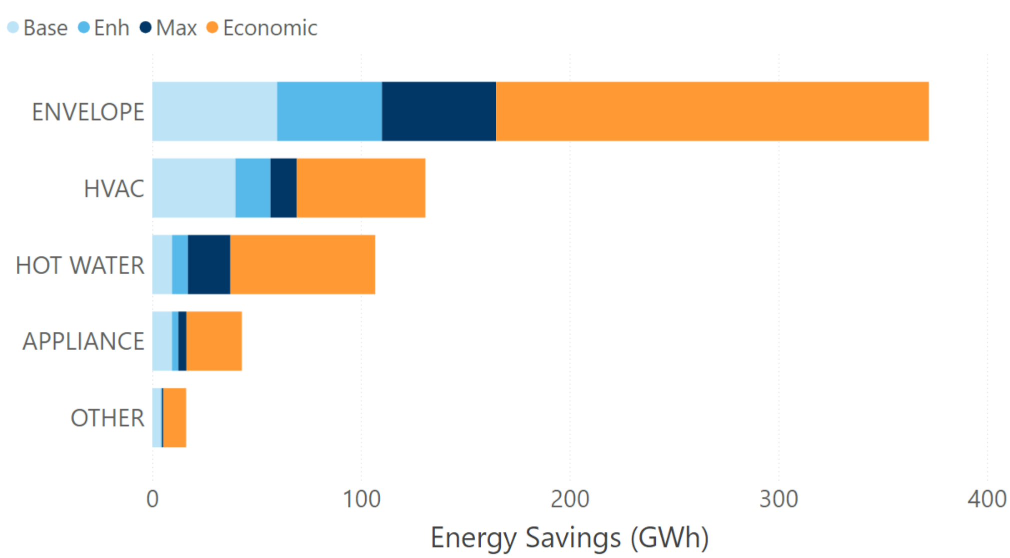
- **New Construction (NC) savings appear to be the most responsive to increased investments.** NC savings increase over five-fold between the base and max scenarios and increasing from 5% to 11% of total residential sector savings. These higher savings levels present NB Power with an opportunity to mitigate increasing loads from market growth, while also helping industry prepare for and apply higher performance construction practices consistent with higher levels of the National Building Code, which in future may be adopted as code requirements in New Brunswick.
- **HPWHs have significant potential but face high barriers and poor customer economics.** Increased incentives and enabling activities can increase achievable potential, as seen in the enhanced and maximum scenarios.

4.2.2.2 Growth Opportunities

Figure 4-8 illustrates the proportion of FY27/28 cumulative economic potential captured under each achievable scenario.

For each end-use, only a portion of economic savings is captured in the achievable scenarios, due to financial and non-financial market barriers. The end-uses that exhibit a significant spread between the economic and achievable potentials may represent cost-effective opportunities for future growth via strategic program adaptations. While not all economic potential is necessarily achievable through voluntary programs alone, other interventions – such as policy changes and/or enabling regulations – could also enable NB Power to capture a greater portion of the cost-effective savings potential.

Figure 4-8. Residential electric EE growth opportunities by end-use (FY27/28 cumulative GWh)



Based on these results, the following observations can be made:

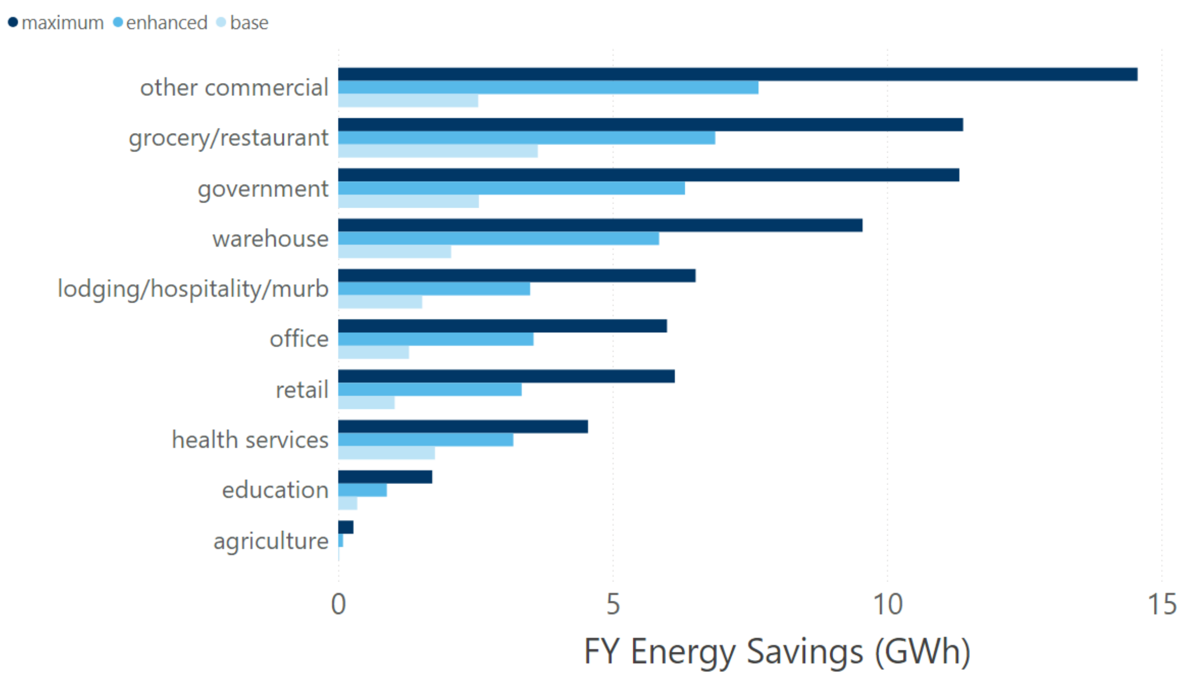
- **Envelope measures represent the biggest economic savings opportunity.** In the maximum scenario, only 44% of economic savings are captured. This being said, there is also significant room to increase envelope savings through both increased incentives as well as enabling activities as seen in the increase from base to enhanced and maximum.

- **HVAC and hot water measures also represent a significant opportunity.** In the maximum scenario, only 53% of HVAC and 36% of hot water savings are captured. Increased incentives have the most significant impact on increasing HVAC savings (enhanced scenario), whereas hot water measures are more impacted by enabling activities (maximum scenario).

4.2.3 Commercial Savings

Figure 4-9 shows the commercial electric energy efficiency savings by segment in FY27/28.

Figure 4-9. Commercial electric EE savings by segment (first-year GWh in FY27/28)



4.2.3.1 Savings by End-Use and Top Measures

Figure 4-10 presents commercial savings by end-use over the first five years of the study period, and Table 4-3 shows the first-year GWh savings and percent of total commercial savings for the top 10 commercial electric EE measures.

Figure 4-10. Commercial electric EE savings by end-use (First-year GWh)

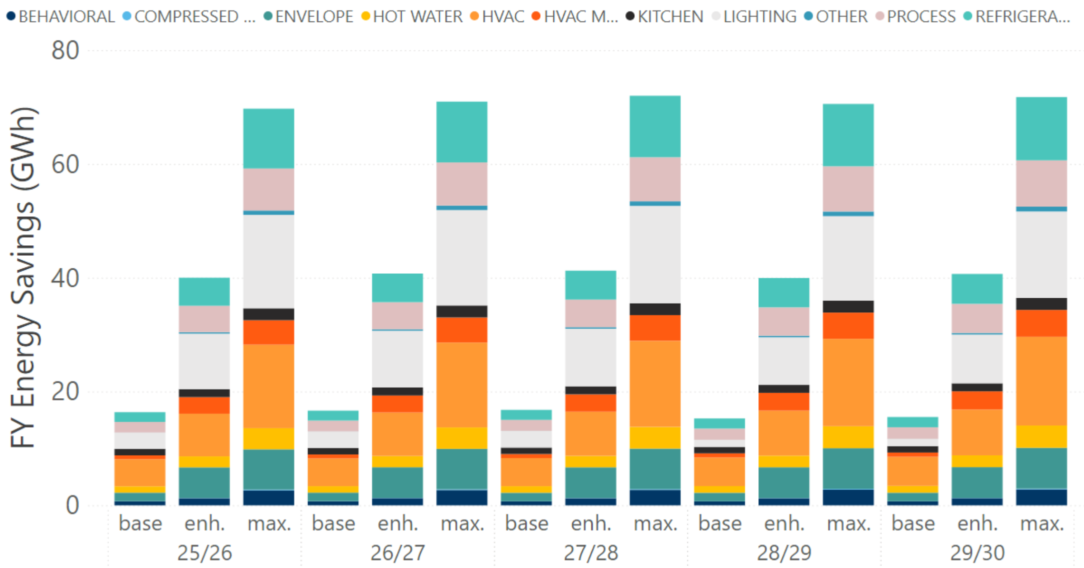


Table 4-3. Top commercial electric EE measures first-year GWh savings (% of total commercial savings) in FY27/28

Measure	Base	Enh	Max
Motor Controls - Process[15]	1.8 (11%)	3.3 (8.1%)	4.6 (6.4%)
Energy Management System (EMS)	1.6 (10%)	2.4 (5.9%)	4.1 (5.8%)
New Construction	1.4 (8.5%)	5.2 (13%)	6.1 (8.5%)
Retro-commissioning Strategic Energy Manager (RCx SEM)	0.7 (4.1%)	1.3 (3.0%)	2.7 (3.8%)
HVAC VFD - Fan	0.5 (3.2%)	2.5 (6.0%)	3.6 (4.9%)
Custom Refrigeration	0.5 (2.8%)	1.2 (2.8%)	3.8 (5.3%)
Lighting Controls (Network)	0.5 (2.8%)	3.4 (8.3%)	6.4 (8.9%)
Lighting Controls (Daylighting)	0.4 (2.4%)	2 (4.9%)	2.9 (4.1%)
Lighting Controls (Occupancy)	0.3 (1.8%)	2.7 (6.4%)	4.9 (6.8%)
Refrigerated Case Night Cover	0.1 (0.3%)	1 (2.4%)	2.7 (3.8%)
Total	**7.8 (46%)**	**25 (61%)**	**42 (58%)**

Note: Top 10 measures sorted and arranged by savings under the base scenario.

Based on these results, the following observations can be made:

- **In the base scenario, HVAC measures account for the majority of first-year commercial savings.** With increased incentives and enabling activities, HVAC savings are increased, but there is also a notable increase in lighting, refrigeration, process and envelope savings, which begin to make up a more significant portion of overall savings in the enhanced and maximum scenarios.

[15] For example, variable frequency drives (VFDs), sensors to improve controls and operation, and improved motor sequencing/loading strategies.

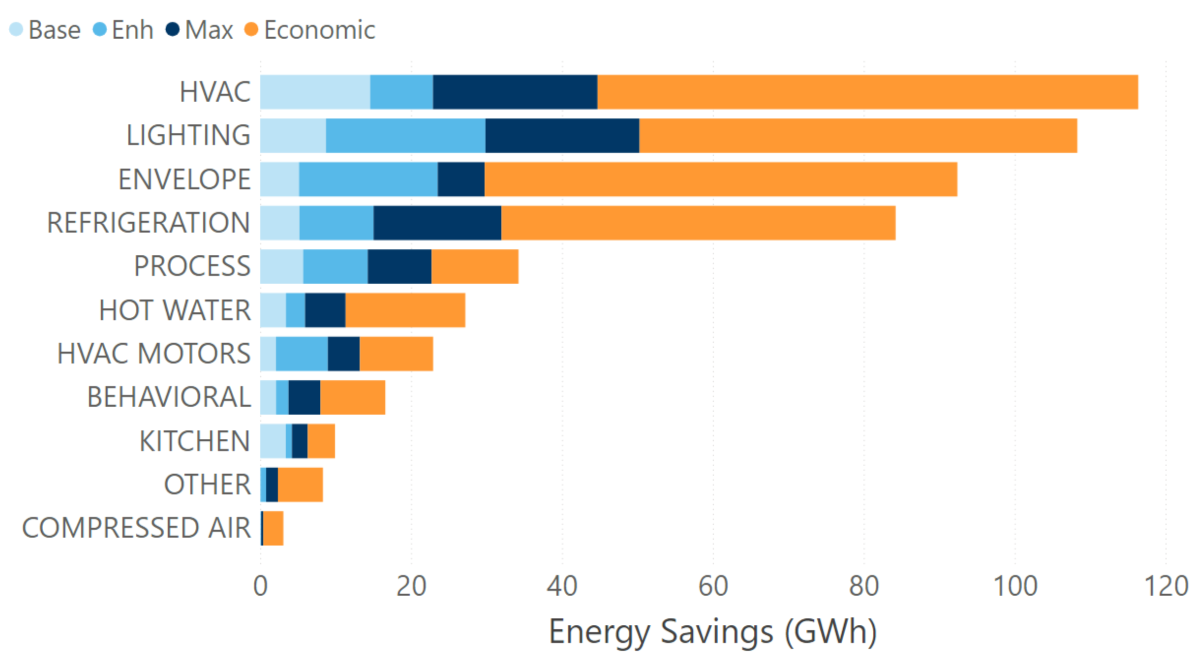
- **Although traditional LED lighting savings are phased out after FY27/28, there is significant room to grow savings from lighting controls.** In the base scenario, LED lighting savings initially account for 60% of overall lighting related savings, leading to a significant reduction in savings post FY27/28. However, there is significant potential for savings from lighting controls, as seen in the enhanced and maximum scenarios, where LED lighting savings make up less than 20% of overall lighting savings, and lighting savings are sustained after FY27/28. The majority of this increase occurs between the base and enhanced scenarios, suggesting that these measures are largely limited by their economics, more than market barriers, and thus increasing incentives could be effective in growing the program savings.
- **Less than 50% of commercial savings are captured by the top 10 measures.** While these measures capture a significant portion of savings, there are other notable opportunities – for example custom HVAC measures, heat pumps, and energy recovery ventilation.

4.2.3.2 Growth Opportunities

Figure 4-11 illustrates the proportion of FY27/28 cumulative economic potential captured under each achievable scenario.

For each end-use, only a portion of economic savings is captured in the achievable scenarios. The end-uses that exhibit a significant spread between the economic and achievable potentials may represent cost-effective opportunities for future growth via strategic program adaptations. While not all economic potential is necessarily achievable through voluntary programs alone, other interventions – such as policy changes and/or enabling regulations – could also enable NB to capture a greater portion of the cost-effective savings potential.

Figure 4-11. Commercial electric EE growth opportunities by end-use (FY27/28 cumulative GWh)



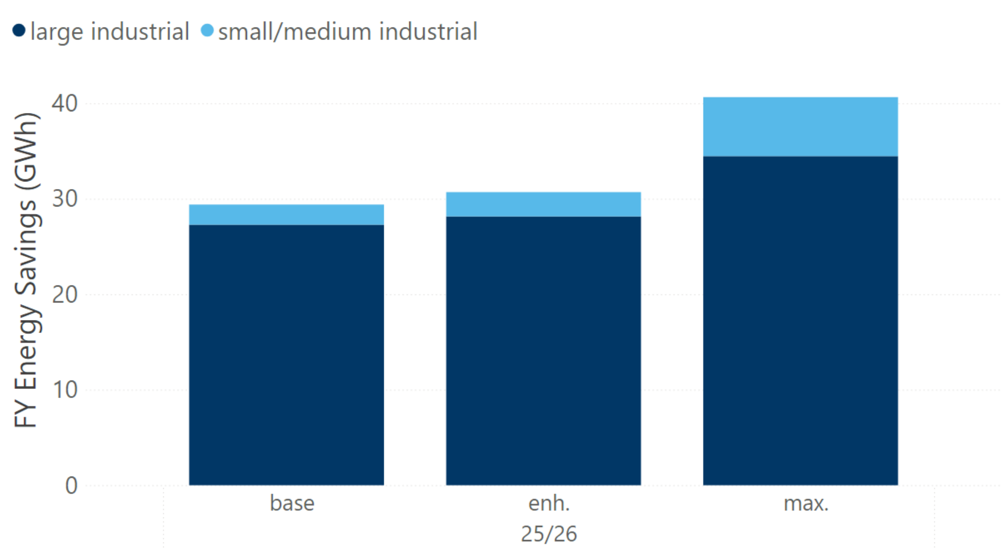
Based on these results, the following observations can be made:

- **HVAC measures represent the biggest economic savings opportunity.** In the maximum scenario, only 38% of economic savings are captured. This being said, there is also significant room to increase HVAC savings through both increased incentives (enhanced scenario) and, in particular, through enabling activities (maximum scenario).
- **Lighting, envelope and refrigeration also represent a significant opportunity.** In the maximum scenario, only 46% of lighting, 32% of envelope and 38% of refrigeration economic savings are captured. Increased incentives have the most significant impact on increasing envelope savings (enhanced scenario), whereas refrigeration measures are more impacted by enabling activities (maximum scenario). Lighting measures see a significant impact from both increased incentives and enabling activities.
- **Lighting, envelope, process and HVAC motors savings appear to be very sensitive to the increased incentives in the enhanced scenario (as compared to the base).** These measure groups appear to offer the potential for notably increased savings by simply raising incentives on a few key measures. Conversely HVAC, Refrigeration, hot water, behavioural and kitchen measures show a proportionally larger increase between the enhanced and max scenarios (compared to the base to enhanced scenario increase), which indicates that these measure groups likely require enabling strategies and market transformation investments to significantly grow their savings.

4.2.4 Industrial Savings

Figure 4-12 displays achievable industrial electric EE savings potential for small/medium and large industrial segments, in terms of first-year GWh savings in FY25/26. **The majority of savings accrue to the large industrial segment**, which aligns with this segment's share of electricity consumption.

Figure 4-12. Industrial achievable electric EE savings by customer segment (First-year GWh in FY25/26)



4.2.4.1 Small/Medium Industrial

Figure 4-13 presents small/medium industrial savings by end-use over the first five years of the study period, and Table 4-4 shows the first-year GWh savings and percent of total small/medium industrial savings for the top 10 small/medium industrial electric EE measures.

Figure 4-13. Small/medium industrial electric EE savings by end-use (First-year GWh)

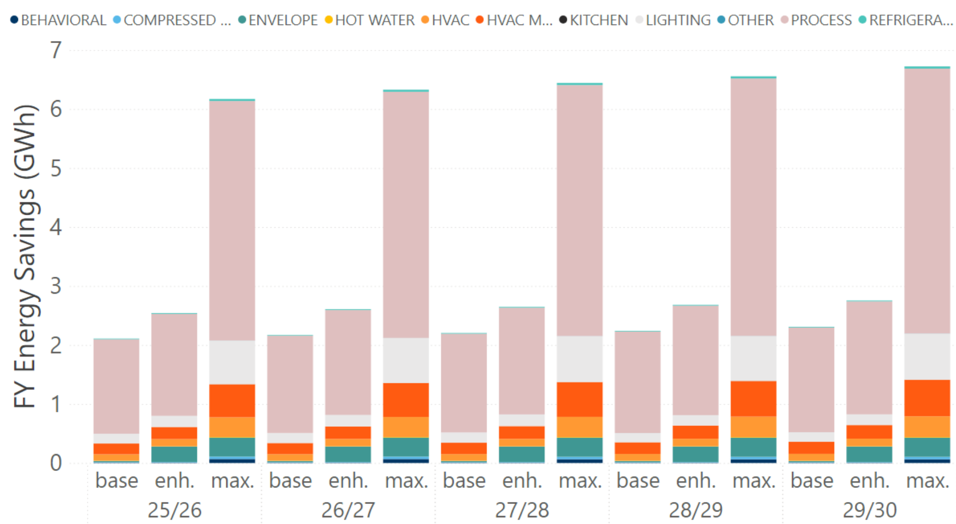


Table 4-4. Top small/medium industrial electric EE measures first-year GWh savings (% of total small/medium industrial savings) in FY27/28

Measure	Base	Enh	Max
Motor Controls - Process	1.4 (65%)	1.5 (58%)	2.8 (43%)
Motor Controls - Pumps	0.2 (8.8%)	0.2 (8.6%)	1.1 (18%)
HVAC VFD - Fan	0.1 (5.3%)	0.1 (4.9%)	0.4 (5.4%)
Lighting Controls (Network)	0.1 (3.7%)	0.1 (3.4%)	0.4 (6.8%)
HVAC VFD - Pump	0.1 (3.3%)	0.1 (3.1%)	0.2 (3.4%)
Energy Recovery Ventilator (ERV)	0.04 (2.0%)	0.05 (1.9%)	0.1 (2.0%)
Lighting Controls (Daylighting)	0.04 (1.8%)	0.05 (1.7%)	0.1 (2.1%)
Motor Controls - Conveyors	0.04 (1.7%)	0.04 (1.7%)	0.3 (4.5%)
Lighting Controls (Occupancy)	0.03 (1.4%)	0.04 (1.3%)	0.2 (2.6%)
New Construction	0.02 (0.9%)	0.3 (10%)	0.3 (4.9%)
Total	**2.1 (94%)**	**2.5 (95%)**	**6 (93%)**

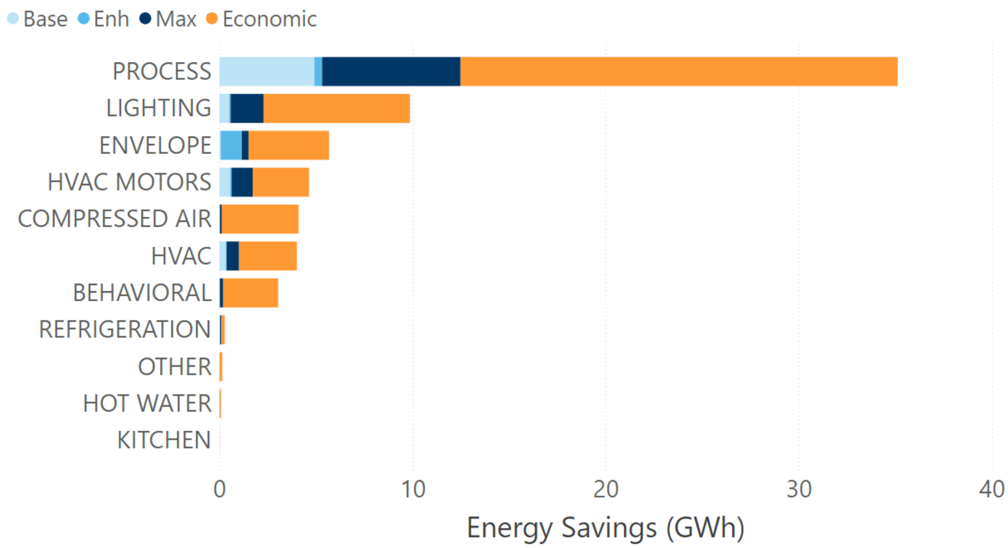
Note: Top 10 measures sorted and arranged by savings under the base scenario.

Based on these results, the following observations can be made:

- **The majority of small/medium industrial savings are related to processes**, particularly from motor controls. Savings from buildings (HVAC, lighting, envelope) are also achievable but make up a smaller portion of overall small/medium industrial savings.

Figure 4-14 illustrates the proportion of FY27/28 cumulative economic potential captured under each achievable scenario.

Figure 4-14. Small/medium industrial electric EE growth opportunities by end-use (FY27/28 cumulative GWh)



Based on these results, the following observations can be made:

- **Process measures represent the biggest economic savings opportunity.** In the maximum scenario, only 37% of economic savings are captured. However, there is also significant room to increase achievable savings beyond the base scenario, particularly through enabling activities (as seen in the maximum scenario).
- **Lighting, envelope, HVAC, compressed air and behavioural measures also have notable economic savings opportunities** that are not captured under the achievable potential scenarios.

4.2.4.2 Large Industrial

Table 4-5 shows the first-year GWh savings and percent of total large industrial savings for the top 10 large industrial electric EE measures.

Large industrial EE measures are characterized per industry and classified into four tiers representing different levels of potential and associated cost based on the primary data collection. More information on the specific measures included in each tier can be found below.

Large Industrial Measure Tiers

The large industrial segment measures were characterized leveraging primary data collection from industrial sites. Data collected from sites was used to identify energy efficiency opportunities, which were classified into four tiers per industry (with the exception of behavioral SEM measure and compressed air measures, which were characterized separately).

Energy efficiency opportunities were grouped into tiers according to their cost per unit of savings. Some representative measures included across these tiers include:

- **Tier 1:** Process motor (pumps, fan conveyors, compressors) controls (e.g., through variable frequency drives (VFDs)), improved maintenance, operation optimization.[16]
- **Tier 2:** HVAC heat recovery (e.g., glycol loops, enthalpy wheels), process optimization.
- **Tier 3:** Equipment and process optimization, refrigeration heat recovery, process equipment replacement
- **Tier 4:** Process equipment replacement and re-sizing, process re-configuration.

Table 4-5. Top large industrial electric EE measures first-year GWh savings (% of total large industrial savings) in FY27/28

Measure	Base	Enh	Max
SEM Elec	7.7 (28%)	7.7 (27%)	9.4 (27%)
Oil Gas & Chemical Elec Tier 3	2.7 (10%)	2.7 (9.4%)	3.3 (9.5%)
Pulp & Paper Elec Tier 3	2.5 (9.0%)	2.5 (8.7%)	3.1 (8.7%)
Oil Gas & Chemical Elec Tier 1	2.4 (8.6%)	2.4 (8.4%)	2.9 (8.4%)
Pulp & Paper Elec Tier 4	1.9 (6.8%)	1.9 (6.6%)	2.3 (6.6%)
Energy Management System (EMS)	1.5 (5.2%)	1.5 (5.2%)	1.8 (5.0%)
Pulp & Paper Elec Tier 1	1.3 (4.6%)	1.3 (4.4%)	1.5 (4.4%)
Pulp & Paper Elec Tier 2	1.3 (4.6%)	1.3 (4.4%)	1.5 (4.4%)
Food Processing Elec Tier 1	1.1 (4.0%)	1.1 (3.9%)	1.3 (3.9%)
Other Industries Elec CA Tier 1	0.9 (3.1%)	1.2 (4.2%)	1.5 (4.2%)
Total	**23.1 (83%)**	**23.5 (82%)**	**28.6 (82%)**

Note: Top 10 measures sorted and arranged by savings under the base scenario.

Based on these results, the following observations can be made:

- **Savings from strategic energy management account for over one quarter of overall savings**, highlighting a significant opportunity for behaviour-driven savings in the large industrial segment.
- **Measures targeting the oil, gas & chemical, pulp & paper, and food processing industries account for the majority of savings**, as these industries also account for the largest proportion of large industrial electricity consumption.

These custom tiered measures characterized for the large industrial segment through primary data collection are classified account for the vast majority of large industrial energy savings and economic potential. Only 35% of economic savings of these "other" measures is

[16] Primary data collection findings indicated that there are many existing motors which are now over-sized due to improvements in process efficiency. There is an opportunity to ensure these motors are properly re-sized upon replacement.

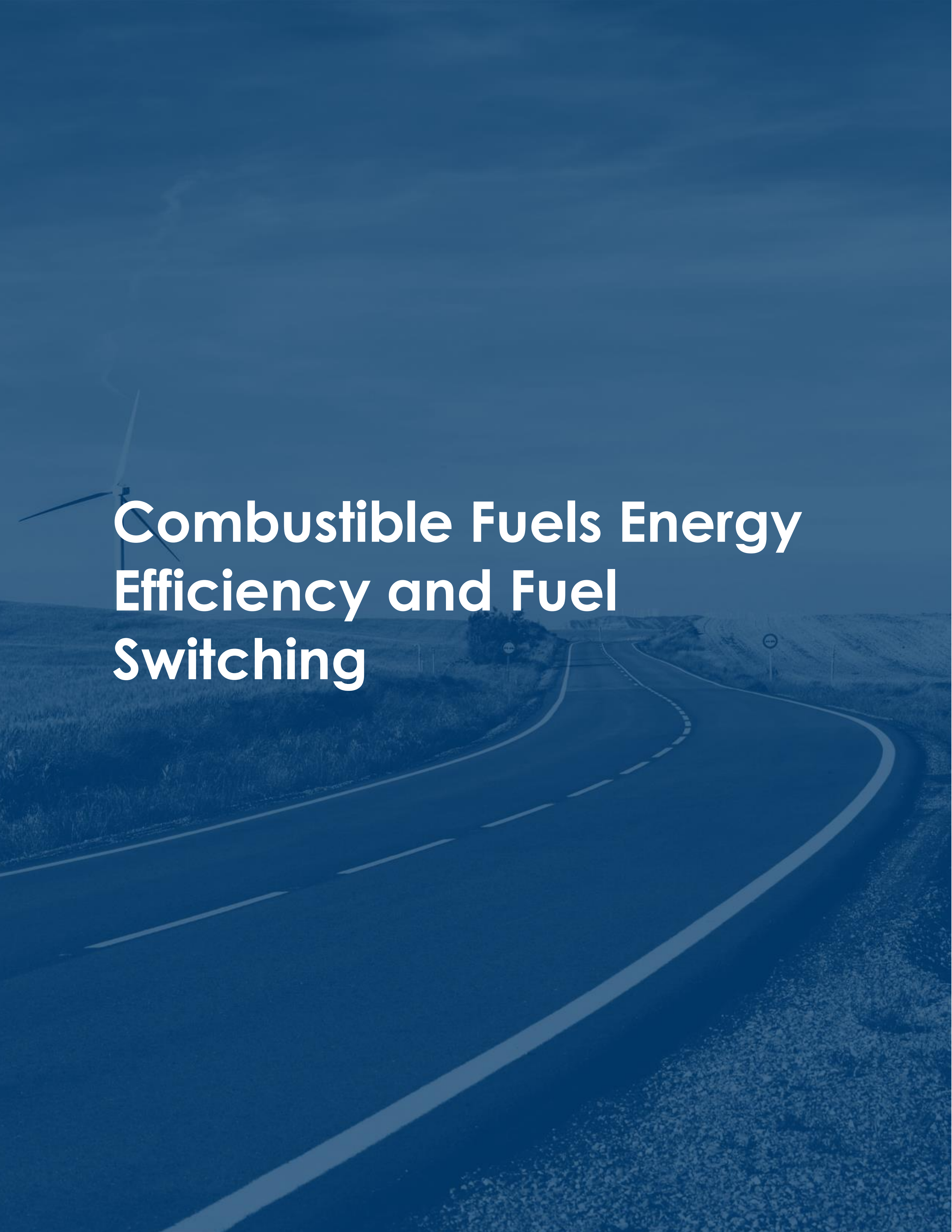
captured in the maximum scenario. Enabling activities play an important role in increasing achievable potential (maximum scenario).

There are also some savings to be achieved through improving the efficiency of large industrial buildings (e.g., HVAC and lighting measures), although these represent a small portion of overall large industrial electric EE savings.

4.3 Key Takeaways

Based on the results presented in this section, the following key takeaways emerge:

- **Under the base scenario, projected savings fall slightly below plans in 25/26-26/27.** This indicates that program enhancements may be required to meet forward-looking plans and minimum targets.
- **Commercial potentials under the base scenario are projected to be lower than NB Power's DSM plan savings goals in the initial years of the study period.** Because the base scenario incentive levels are largely aligned with the current and planned programs, this could indicate that further investments are needed to achieve the plan goals in the coming years, which are slated to increase further from approximately 30 GWh in FY24/25 to 45 GWh in FY26/27.
- The enhanced and maximum scenario results provide **insights into effective strategies for increasing achievable savings for different measure types**, and where significant opportunities exist for growing achievable potential.
    - In the residential sector, **envelope measures show significant opportunity for growth** and can benefit from both increased incentives and enabling activities. HVAC measure savings are also significant, and respond well to increased incentives, whereas enabling strategies are likely required to grow hot water savings.
    - In the commercial sector, **increased incentives can significantly increase savings across most measure types** – particularly lighting (controls), envelope, process and HVAC motors. **For other measure types, enabling strategies are likely be more effective to grow savings** – particularly refrigeration, hot water and behavioural measures. Savings from HVAC and lighting controls can benefit from both increased incentives and enabling activities.
    - In the **industrial sector, there is an important role for behaviour-driven savings through strategic energy management, as well as process-related measures.** Enabling strategies are likely required to grow industrial savings.



Combustible Fuels Energy Efficiency and Fuel Switching

5. Combustible Fuels Efficiency and Fuel Switching Savings

5.1 Overview

The following chapter presents the assessment of the **combustible fuels energy savings potential from EE and FS measures**.

Dunsky's DEEP model assesses the potential for both EE and FS measures and considers the interaction between these measure types in order to provide a realistic projection of savings and avoid double counting. Within a given year of the study, fuel switching measures are applied first, and markets are updated. Energy efficiency measures are then applied to the updated market.

For opportunities applicable to the large industrial segment, the study also relied on primary data collection to support the characterization of EE and FS measures.

Table 5-1 provides a qualitative description of the achievable potential scenarios for EE and FS. More detail on the methodological approach is provided in Volume II.

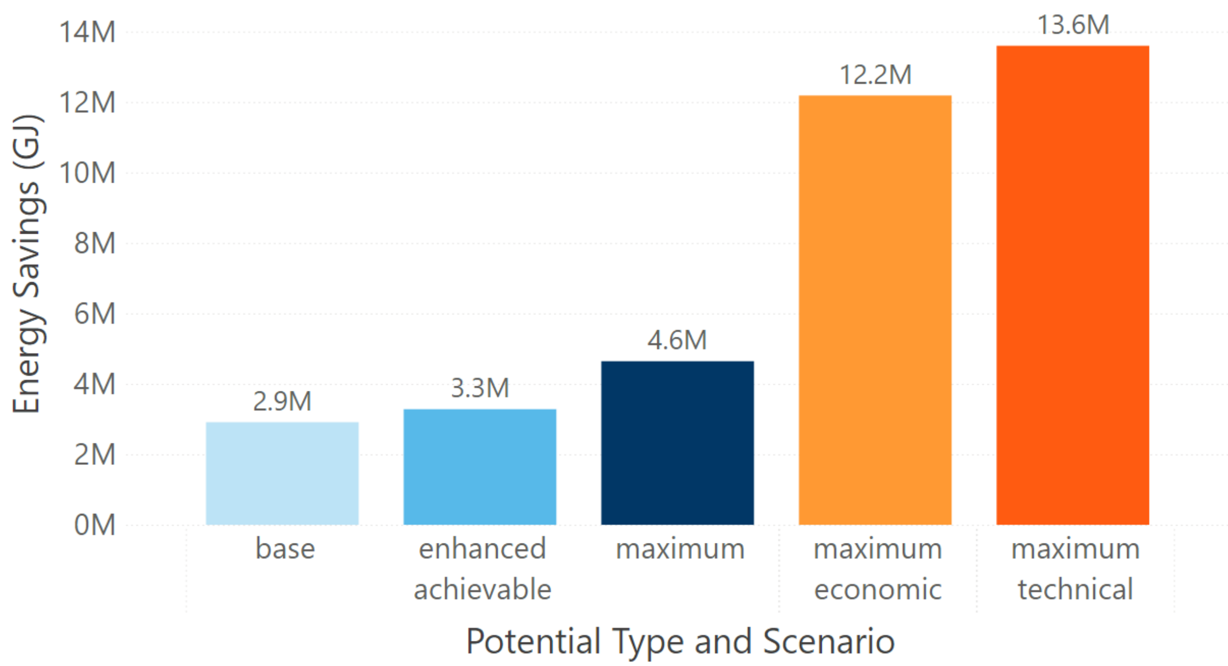
Table 5-1. EE and FS achievable potential scenarios

Base	Enhanced (Enh.)	Maximum (Max.)
Applies incentives and enabling activities in line with NB Power's current programs to simulate business as usual. Includes existing and expanded complementary measures.	Applies **increased incentives** above and beyond NB Power's current programs.	Maintains increased incentives from enhanced scenario but **increases enabling activities.**

5.2 Program Savings

Figure 5-1 presents the cumulative technical, economic and achievable combustible fuel savings over the first fifteen years of the study period for all EE and FS measures.

Figure 5-1. Technical, economic and achievable combustible fuel savings potential in FY 39/40 (Cumulative GWh)



Based on these results, the following observations can be made:

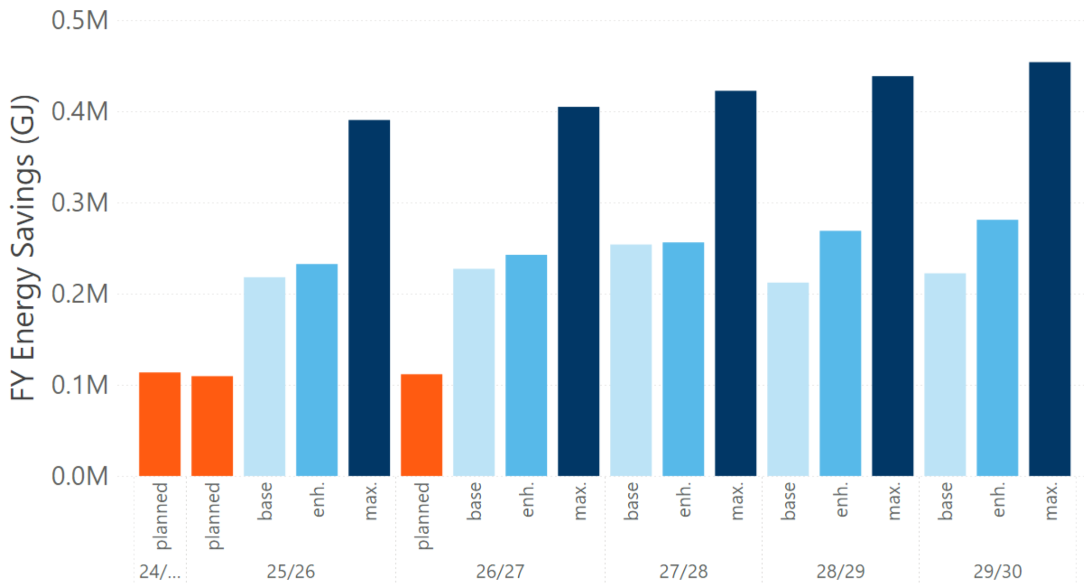
- **Technical combustible fuel savings potential is significant, representing 40% of baseline forecasted fuel consumption in FY39/40.**
- **Most savings pass the economic screening threshold.** Net economic potential is 91% of technical potential. This observation is partly explained by the fact that the study focuses on commercially available and viable technologies – measures that may theoretically offer technical potential but are not expected to be cost-effective were omitted from the study.
- **The base scenario captures just under one-quarter of economic savings.** Under a scenario representative of current programs and incentive levels, 24% of net economic savings are captured through programs. This suggests that there is significant untapped potential for cost-effective electric energy savings, and room to grow savings with increased incentives and enabling activities.

  While not all economic potential is necessarily achievable through voluntary programs alone, other interventions – such as policy and regulation – could also enable NB to capture a greater portion of the cost-effective savings potential.
- **Increasing incentives and enabling activities can almost double savings.** Relative to the base scenario, savings increase by 14% in the enhanced scenario and 57% in the maximum scenario, with enabling activities driving a significant increase in savings. With the combined impact of increased incentives and enabling activities in the maximum scenario, NB Power's programs have the potential to capture 38% of net economic potential.

5.2.1 Achievable Program Savings

Figure 5-2 shows achievable potential in terms of first-year GWh savings under each scenario, with comparisons to recent results and NB Power's latest DSM plans.

Figure 5-2. Achievable combustible fuel EE and FS savings (First-year GJ)

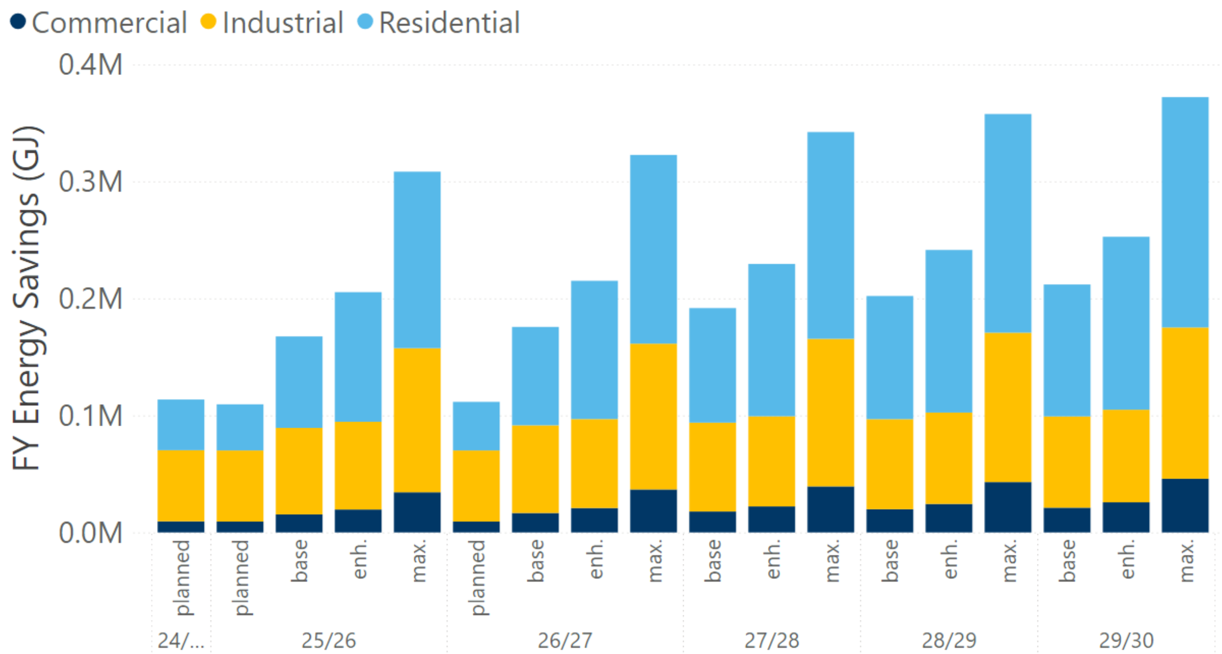


Based on these results, the following observations can be made:

- **Under the base scenario, savings are above planned savings.** This is largely driven by residential and industrial base scenario achievable savings that exceed NB Power's current DSM plans. However, it should be noted that the potential assessment does not account for program or budget caps that may constrain participation in real-world programs. Overall, this result may indicate that this could be a source of expanded savings, should NB Power seek to adjust its portfolio investments.
- **Increased incentives and enabling activities increase saving levels above current plans.** In the enhanced and maximum scenarios, achievable savings significantly surpass planned savings. The greatest incremental increase is observed between the enhanced and max scenarios, indicating the enabling activity and market transformation investments are likely the most effective approach to increasing combustible fuel savings.

Figure 5-3 shows the achievable potential for residential, commercial and industrial savings compared to recent results and NB Power's latest DSM plans.

Figure 5-3. Achievable combustible fuel EE and FS savings per sector (First-year GJ)



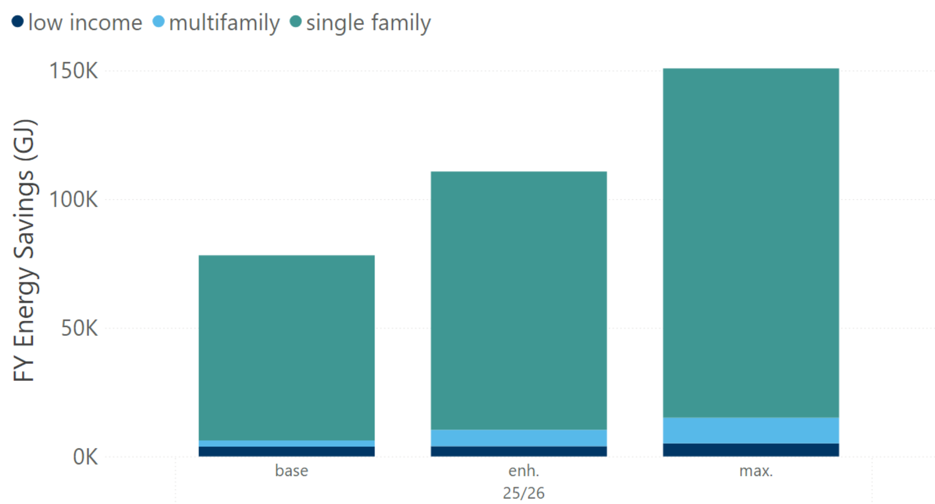
Based on these results, the following observations can be made:

- **Residential first-year savings exceed planned savings under the base scenario.** This is driven by higher than planned participation in the enhanced energy savings program, which targets homeowners with a combined gross household income under $70,000, and has significantly expanded the number of customers eligible for incentives covering 100% of incremental costs.
- **Industrial first-year savings exceed planned savings under the base scenario.** While natural gas savings are approximately aligned with planned savings, this increase in forecasted savings compared to planned is driven by higher than planned oil savings. The results indicate a strong business case for large industrial customers using oil to electrify, which is not fully captured in planned savings.
- **Commercial first-year savings are comparable to planned savings under the base scenario.** Notably, commercial fuel savings represent only approximately 8% of savings in the base scenario, although the commercial sector accounts for approximately 20% of consumption. The commercial segment is sensitive to payback and faces both financial and non-financial barriers to fuel savings – increased incentives and enabling activities can unlock greater savings from the commercial sector.
- **Across all sectors, increased incentives and enabling activities increase saving levels above current plans.**

5.2.2 Residential

Figure 5-4 displays achievable residential combustible fuel EE and FS savings potential for each customer segment, in terms of first-year GWh savings in FY25/26. **The majority of savings accrue to the single family segment**, which aligns with this segment's share of consumption.

Figure 5-4. Residential achievable combustible fuel EE and FS savings by customer segment (First-year GJ in FY25/26)



5.2.2.1 Savings by End-use and Top Measures

Figure 5-5 presents residential savings by end-use over the first five years of the study period, and Table 5-2 shows the first-year GWh savings and percent of total residential savings for the top 10 residential combustible fuel EE and FS measures.

Figure 5-5. Residential combustible fuel EE and FS savings by end-use (First-year GJ)

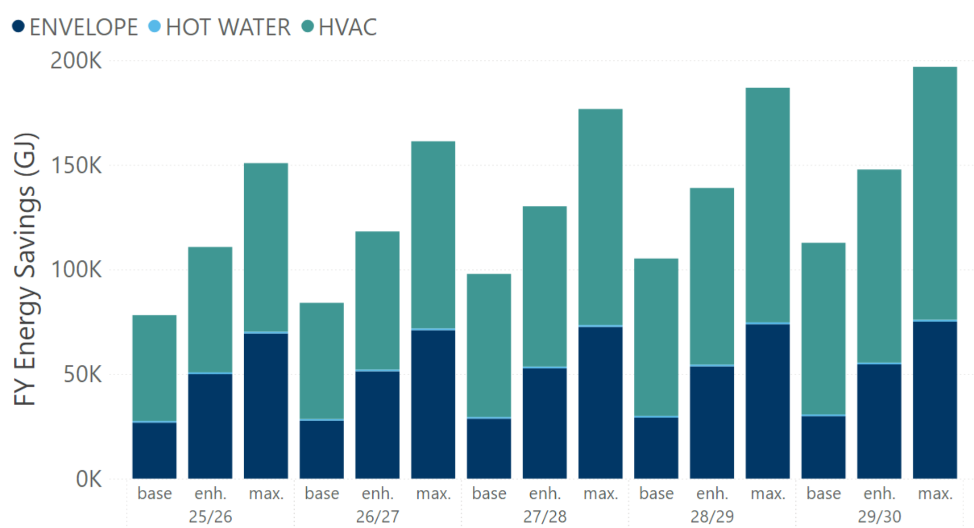


Table 5-2. Top residential combustible fuel EE and FS measures first-year GJ savings (% of total residential savings) in FY27/28

Measure	Base	Enh	Max
Oil Boiler to DMSHP	51,593 (53%)	54,641 (42%)	71,106 (40%)
Insulation - Basement	17,522 (18%)	35,554 (27%)	46,119 (26%)
Oil Furnace to ASHP	9,488 (9.7%)	9,257 (7.1%)	14,560 (8.2%)
Air Sealing	6,475 (6.6%)	10,148 (7.8%)	15,902 (9.0%)
Thermostat Wi-Fi	5,940 (6.1%)	6,216 (4.8%)	7,143 (4.0%)
Insulation - Attic	3,850 (3.9%)	6,059 (4.7%)	9,117 (5.2%)
Insulation - Wall	845 (0.9%)	979 (0.8%)	1,422 (0.8%)
Gas Furnace to ASHP (Partial)	416 (0.4%)	876 (0.7%)	993 (0.6%)
Gas Boiler to DMSHP (Partial)	345 (0.4%)	1,075 (0.8%)	1,516 (0.9%)
Stove	259 (0.3%)	4,479 (3.4%)	7,505 (4.2%)
Total	**96,734 (99%)**	**129,284 (99%)**	**175,383 (99%)**

Note: Top 10 measures sorted and arranged by savings under the base scenario.

Based on these results, the following observations can be made:

- **Combustible fuel savings are split between HVAC and envelope measures.** HVAC measures account for the majority (65%) of savings in the base scenario. This is largely driven by oil-heated homes switching to air-source heat pumps. Due to the high price of oil, customer economics are favourable and while there is room to increase savings through increased incentives and enabling activities, savings are already expected to be significant under NB Power's current programs.

  Envelope measures savings can be notably increased through increased incentives and enabling activities and make up a greater portion of savings in the enhanced and maximum scenarios.

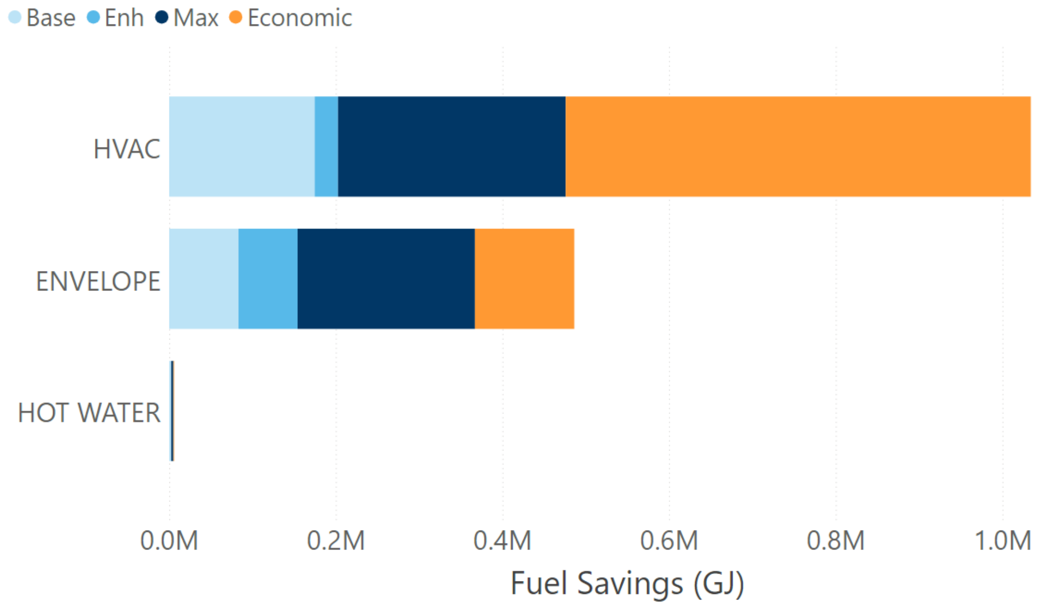
- As mentioned, **a key driver of residential combustible fuel savings is the transition away from heating oil**, as oil-heated homes switch to ducted and ductless air-source heat pumps. Electrification of oil boilers and oil furnaces accounts for approximately 50% of savings across scenarios. This is reflective of the high price of oil, making electrification a cost-effective alternative for customers, as well as the NB Power and governmental programs supporting the transition away from oil heating. Oil also accounts for a larger share of residential heating in New Brunswick compared to natural gas, so oil savings opportunities are greater.

5.2.2.2 Growth Opportunities

Figure 5-6 illustrates the proportion of FY27/28 cumulative economic potential captured under each achievable scenario.

For each end-use, only a portion of economic savings is captured in the achievable scenarios. The end-uses that exhibit a significant spread between the economic and achievable potentials may represent cost-effective opportunities for future growth via strategic program adaptations. While not all economic potential is necessarily achievable through voluntary programs alone, other interventions – such as policy changes and/or enabling regulations – could also enable NB to capture a greater portion of the cost-effective savings potential.

Figure 5-6. Residential combustible fuel EE and FS growth opportunities by end-use (FY27/28 cumulative GJ)



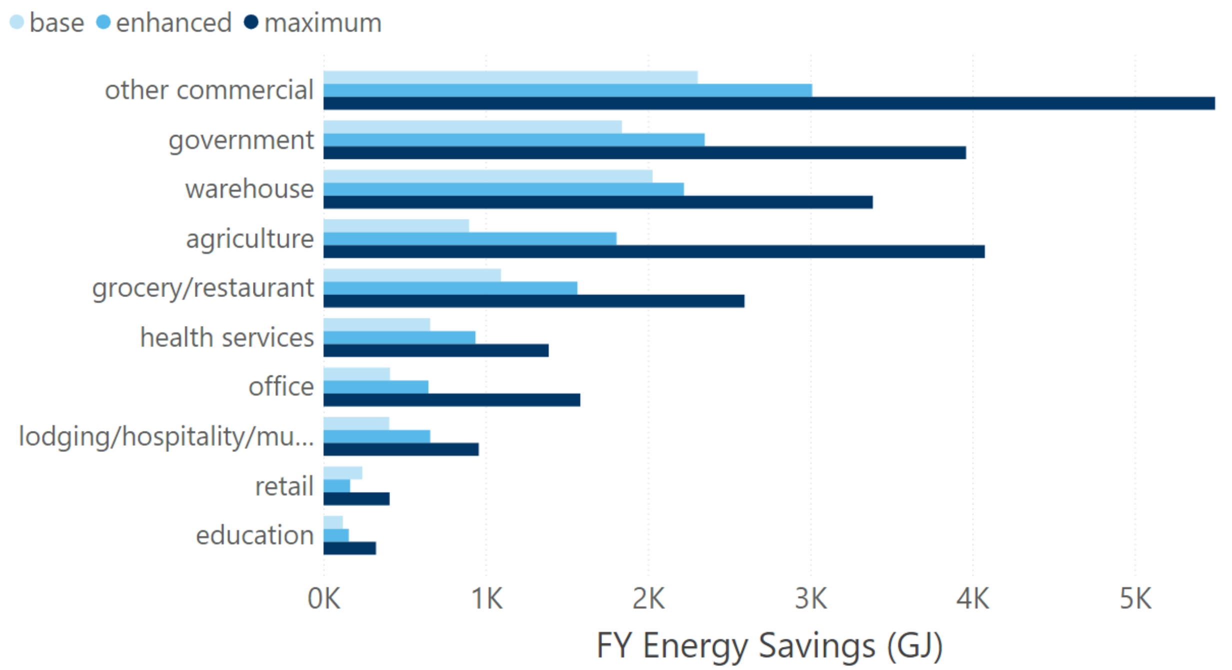
Based on these results, the following observations can be made:

- **HVAC measures represent the biggest economic savings opportunity for combustible fuels.** In the maximum scenario, 44% of economic savings are captured. This being said, there is also significant room to increase HVAC savings – particularly through enabling activities, as seen in the maximum scenario.
- **There is potential to capture up to 75% of economic envelope savings through increased enabling activities.** As seen previously, while envelope savings account for a smaller portion of overall savings in the base scenario, both increased incentives and enabling activities can notably increase achievable savings.
- Combustible fuel **savings, and opportunities, for hot water are limited as the vast majority of customers in NB have electric water heating**.

5.2.3 Commercial

Figure 5-7 shows the commercial combustible fuel EE and FS savings per segment in FY27/28.

Figure 5-7. Commercial combustible fuel EE and FS savings per segment (first-year GJ, FY27/28)



5.2.3.1 Savings by End-use and Top Measures

Figure 5-8 presents commercial savings by end-use over the first five years of the study period, and Table 5-3 shows the first-year GJ savings and percent of total commercial savings for the top 10 commercial combustible fuel EE and FS measures.

Figure 5-8. Commercial combustible fuel EE and FS savings by end-use (First-year GJ)

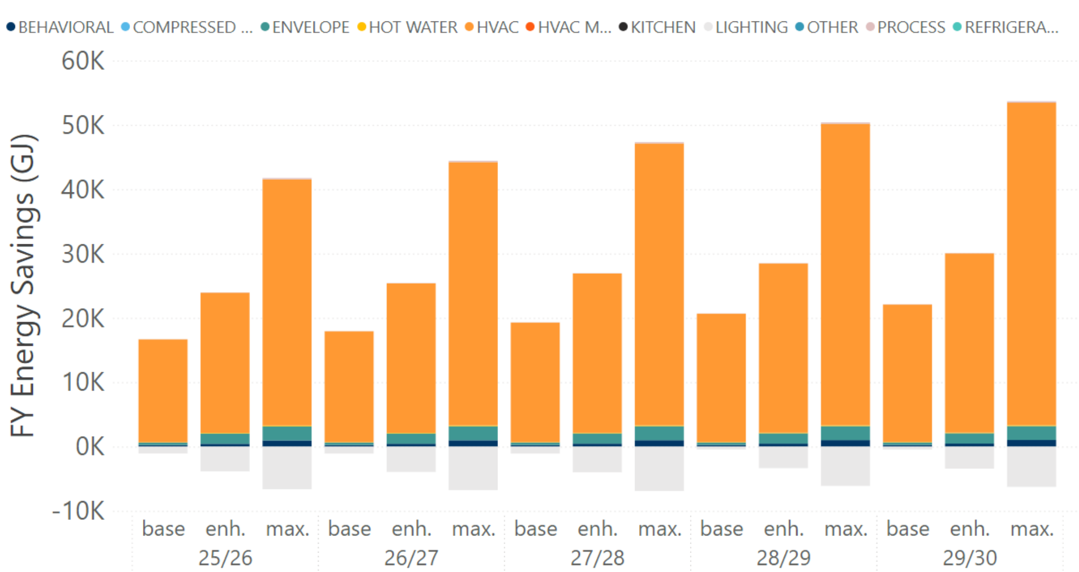


Table 5-3. Top commercial combustible fuel EE and FS measures first-year GJ savings (% of total commercial savings) in FY27/28

Measure	Base	Enh	Max
Oil Furnace to ASHP	2,757 (15%)	3,263 (14%)	4,439 (11%)
Fresh Air controlled by CO2 monitors	2,333 (13%)	3,281 (14%)	5,172 (13%)
Gas Furnace to ASHP (Partial)	2,190 (12%)	2,766 (12%)	4,007 (9.9%)
Custom HVAC	1,970 (11%)	2,151 (9.4%)	2,869 (7.1%)
Condensing Make Up Air Unit	1,291 (7.1%)	1,592 (6.9%)	2,137 (5.3%)
Oil Boiler and RAC blend to DMSHP	1,273 (7.0%)	1,119 (4.9%)	2,642 (6.5%)
Condensing Unit Heater	1,266 (6.9%)	2,226 (9.7%)	4,931 (12%)
Oil Boiler to Hydronic Air Source Heat Pump (Air-to-Water)	1,231 (6.8%)	1,304 (5.7%)	3,139 (7.8%)
Mini-split Ductless Heat Pump (DMSHP)	854 (4.7%)	1,420 (6.2%)	2,947 (7.3%)
Heat recovery	741 (4.1%)	1,431 (6.2%)	2,910 (7.2%)
Total	**15,906 (87%)**	**20554 (90%)**	**35193 (87%)**

Note: Top 10 measures sorted and arranged by savings under the base scenario.

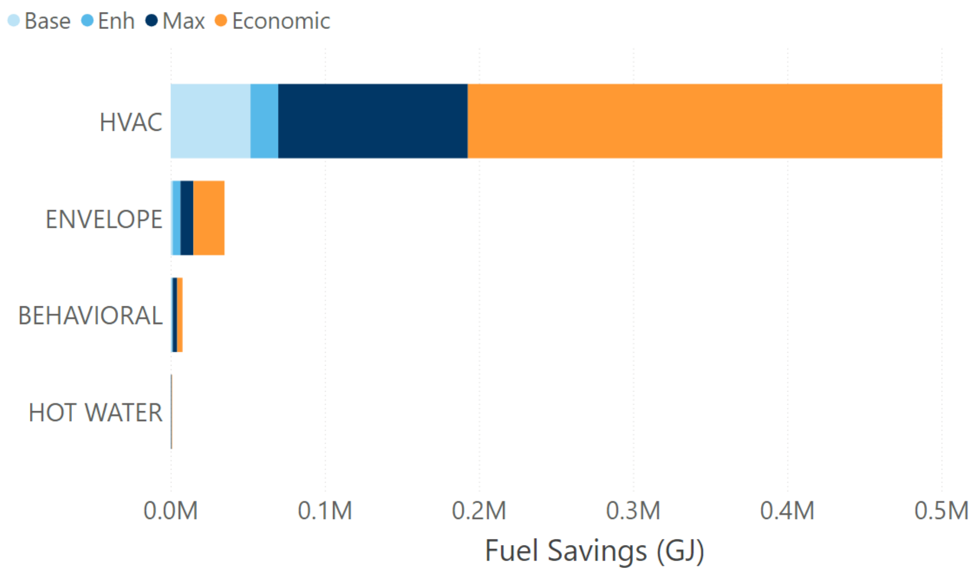
Based on these results, the following observations can be made:

- **HVAC measures account for the vast majority of commercial combustible fuel savings.** The top measures illustrate that both FS (for example, full and partial electrification of oil and gas heating systems) and EE (for example, fresh air controlled by CO2 monitors and custom HVAC measures) play an important role in achieving these savings.
- **Interactive effects with lighting measures lead to a decrease in net savings,** particularly in the enhanced and maximum scenarios where, as seen in section 0, the adoption of lighting measures is increased.
- **Heat recovery savings show significant increase in savings with increased investment.** Investment in heat recovery will also provide savings even if the heating system is later electrified.

5.2.3.2 Growth Opportunities

Figure 5-9 illustrates the proportion of FY27/28 cumulative economic potential captured under each achievable scenario.

Figure 5-9. Commercial combustible fuel EE and FS growth opportunities by end-use (FY27/28 cumulative GJ)



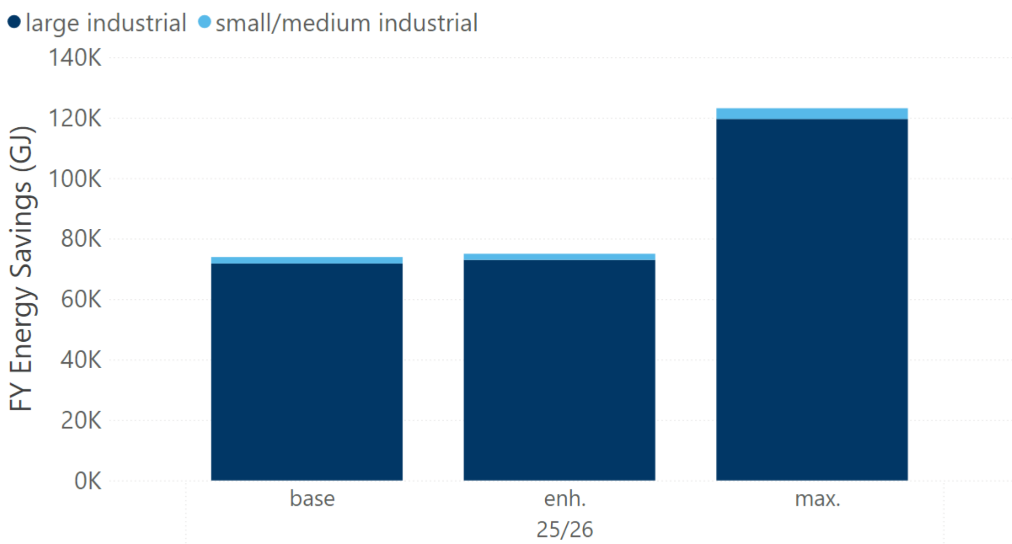
Based on these results, the following observations can be made:

- **HVAC measures are the biggest economic savings opportunity.** In the maximum scenario, 40% of economic savings are captured. There is also an opportunity to increase savings through increased incentives and, to a greater extent, enabling activities, as seen in the maximum scenario.

5.2.4 Industrial

Figure 5-10 displays achievable industrial combustible fuel EE and FS savings potential for small/medium and large industrial segments, in terms of first-year GJ savings in FY25/26. **The majority of savings accrue to the large industrial segment**, which aligns with this segment's share of consumption.

Figure 5-10. Industrial achievable combustible fuel savings by segment (first-year GWh in FY25/26)



5.2.4.1 Small/Medium Industrial

Table 5-4 shows the first-year GJ savings and percent of total small/medium industrial savings for the top 10 small/medium industrial combustible fuel EE and FS measures.

Table 5-4. Top small/medium industrial combustible fuel EE and FS measures first-year GJ savings (% of total small/medium industrial savings) in FY27/28

Measure	Base	Enh	Max
Custom process measure	30,500 (62%)	30,500 (61%)	53,200 (49%)
Oil Boiler and RAC blend to DMSHP	10,950 (22%)	10,950 (23%)	33,900 (31%)
Oil Boiler to Hydronic Air Source Heat Pump (Air-to-Water)	7,800 (16%)	8,160 (16%)	22,000 (20%)
Total	**49,250 (100%)**	**49,600 (100%)**	**109,100 (100%)**

Note: Top 10 measures sorted and arranged by savings under the base scenario.

The majority of small/medium industrial savings are related to custom process measures. There are also significant HVAC savings opportunities for industrial buildings – particularly through electrification of oil-heated buildings.

5.2.4.2 Large Industrial

Table 5-5 shows the first-year GJ savings and percent of total large industrial savings for the top 10 large industrial combustible fuel EE and FS measures.

Large industrial EE and FS measures are characterized per industry and classified into two FS tiers and four EE tiers representing different levels of potential and associated cost based on the primary data collection. More information on the specific measures included in each tier can be found in below.

Large Industrial Measure Tiers

The large industrial segment measures were characterized leveraging primary data collection from industrial sites. Data collected from sites was used to identify energy efficiency opportunities, which were classified into four tiers per industry (with the exception of behavioral SEM measure and compressed air measures, which were characterized separately).

Energy efficiency opportunities were grouped into tiers according to their cost per unit of savings. Some representative measures included across these tiers include:

- **Tier 1:** Heat recovery, steam trap management, steam system assessment and leak repair, pipe insulation.
- **Tier 2:** Flue gas and process heat recovery, boiler insulation
- **Tier 3:** Equipment and process optimization, process equipment replacement
- **Tier 4:** Process equipment replacement and re-sizing, process re-configuration

In addition, there are two fuel switching measure tiers. Tier 1 includes opportunities for electrification of process heating with electric resistance equipment, and Tier 2 includes opportunities for electrification of process heating with high temperature industrial heat pumps.

Table 5-5. Top large industrial combustible fuel EE and FS measures first-year GJ savings (% of total large industrial savings) in FY27/28

Measure	Base	Enh	Max
Pulp & Paper Gas Tier 1	342,867 (29%)	342,867 (29%)	598,171 (31%)
Process heating electrification Oil Tier 2	286,243 (24%)	286,243 (24%)	345,059 (18%)
Other Industries Gas Tier 1	117,923 (10%)	117,923 (10%)	205,730 (10.7%)
Oil low-hanging fruits	87,566 (7%)	87,566 (7.4%)	152,770 (8.0%)
Pulp & Paper Gas Tier 2	79,266 (6.8%)	79,266 (6.7%)	138,288 (7.2%)
SEM Oil	53,314 (4.5%)	53,314 (4.5%)	93,012 (4.9%)
Pulp & Paper Biomass Tier 1	32,075 (2.7%)	32,075 (2.7%)	55,959 (3%)
Other Industries Gas Tier 2	28,352 (2.4%)	28,352 (2.4%)	49,464 (2.6%)
Pulp & Paper Gas Tier 3	23,392 (2.0%)	23,392 (2.0%)	40,810 (2.1%)
SEM Gas	23,378 (2.0%)	23,378 (2.0%)	40,786 (2.1%)
Total	**1,074,376 (92%)**	**1,074,376 (90%)**	**1,720,050 (90%)**

The tiered and behavioural measures characterized for the large industrial segment through primary data collection account for the vast majority of large industrial energy savings and economic potential.

There are also some savings to be achieved through improving the efficiency of large industrial buildings (e.g., HVAC and lighting measures), although these represent a relatively small portion of overall large industrial savings.

5.3 Key Takeaways

Based on the results presented in this section, the following key takeaways emerge:

- **Combustible fuel savings are forecasted to exceed planned savings.** However, it should be noted that the potential assessment does not account for program or budget caps that may constrain participation in real-world programs. Overall, this result indicates that this could be a source of expanded savings, should NB Power seek to adjust its portfolio investments.
- **Oil savings – from both residential and industrial FS – account for a significant portion of combustible fuel savings.** This is reflective of the high price of oil, making electrification a cost-effective alternative for customers, as well as the NB Power and governmental programs supporting the transition away from oil heating, particularly for residential customers.
- The enhanced and maximum scenario provide **insights into effective strategies for increasing achievable savings for different measure types**, and where significant opportunities exist for growing achievable potential.
    - In the residential sector, **HVAC and envelope measures show significant opportunity for growth**, particularly through enabling strategies.
    - In the commercial sector, **HVAC measures show significant opportunity for growth,** particularly through enabling strategies.
    - In the **industrial sector, there is an important role for behaviour-driven savings through strategic energy management, as well as process-related measures.** Enabling strategies are likely required to grow industrial savings.

Distributed Generation

6. Distributed Generation

6.1 Overview

The following chapter presents the assessment of the potential uptake of renewable DG systems. The analysis focuses on customer-sited solar PV potential, including both standalone and storage-paired solar PV systems.

The study assesses the market potential for DG measures using a bottom-up modelling approach that leverages Solar Adoption Model (SAM), taking into account net energy metering (NEM) and program impacts (e.g., compensation rate for excess generation, incentives and enabling activities that help address market barriers) to assess uptake and energy savings potential across multiple achievable scenarios.

Table 6-1 provides a qualitative description of the achievable potential scenarios for distributed generation. More detail on the methodological approach is provided in Volume II.

Table 6-1. Distributed generation achievable potential scenarios

Base	Enhanced (Enh.)	Maximum (Max.)
Applies NB Power's **revised net metering program.**[17]	Maintains NB Power's revised net metering program and **applies equipment incentives.**	Maintains NB Power's revised net metering program and applies **further increased equipment incentives and enabling activities.**

6.2 Results

The following section presents the forecasted customer-sited solar PV adoption under the three achievable potential scenarios. Figure 6-1 shows cumulative solar PV capacity additions throughout the study period. Uptake of rooftop solar PV is expected to continue throughout the study period, reaching 1.4 to 1.7 GW in 2050 installed capacity.

[17] The revised net metering program includes consideration of a revised compensation rate for solar export and assumed new system cap of 500 kW.

Figure 6-1. Cumulative installed solar PV capacity by scenario (MW)

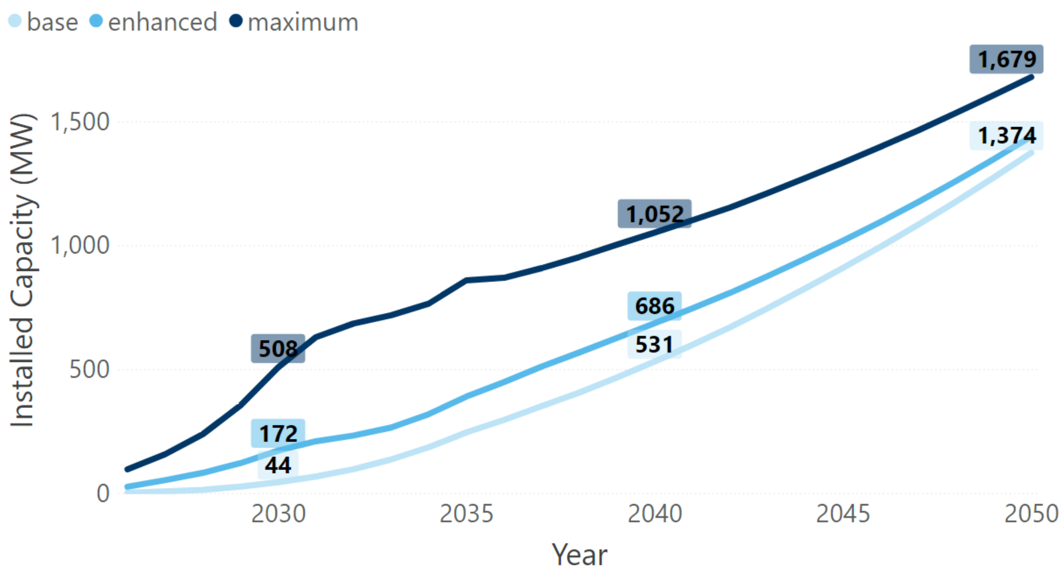
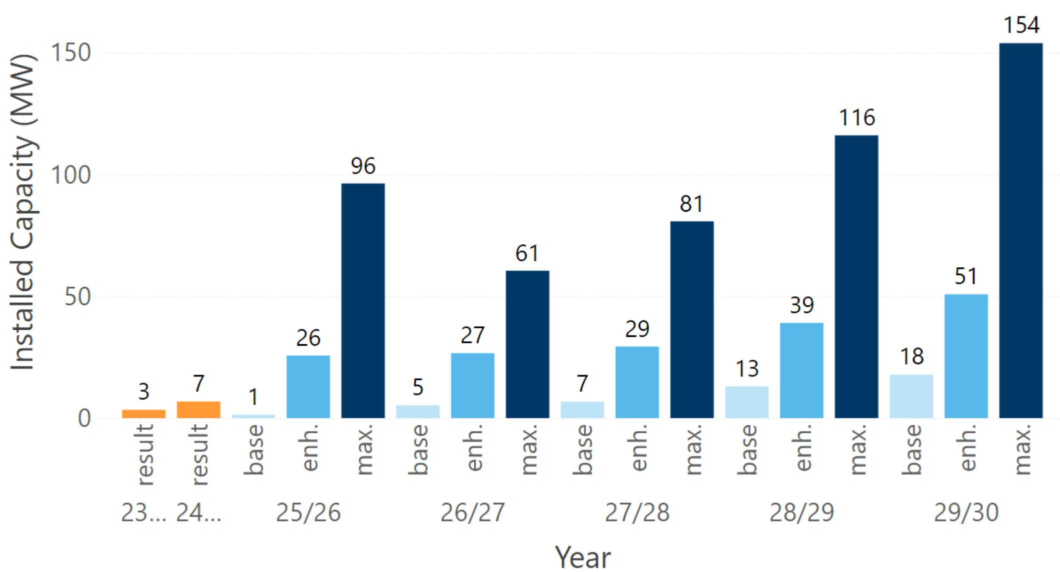


Figure 6-2 shows annual solar PV capacity additions by scenario for the first five years of the study period, compared to historical installations in recent years.

Figure 6-2. Annual solar PV capacity additions (MW)



Note: Historical annual solar PV capacity additions (result) are based on NB Power's net metering program data for 23/24.

Compared to recent adoption levels under the current NEM compensation, annual installations are expected to significantly decrease in the base scenario in the first study year (FY25/26). The projected drop in adoption is the result of removing equipment incentives[18]

[18] The study assumes no incentives for solar PV in the base scenario, due to the recent EUB decision to remove renewables from NB Power's current programs. The Canadian federal government's Greener Homes Grant incentives were also phased out as of March 2024.

coupled with lowered annual compensation under NB Power's proposed new NEM scheme.[19] However, as system costs are projected to continue to decrease, adoption is expected to return to previous levels and continue to grow from FY26/27 onwards in the base scenario.

In the enhanced scenario, the inclusion of incentives over and above past programs offered by NB Power leads to a significant increase in adoption over and above recent years.

In the maximum scenario, further increased incentives combined with enabling activities drives a rapid increase in uptake. This being said, constraints outside the scope of the potential study – such as industry and workforce capacity to respond to customer demand – could potentially hinder the industry's ability to fulfill such a rapid increase in projected demand.

6.2.1 Storage-Paired Solar PV Systems

The study considered adoption of both standalone and storage-paired solar PV systems. Figure 6-3 shows the cumulative installed battery storage capacity (MW) from storage-paired solar PV systems.

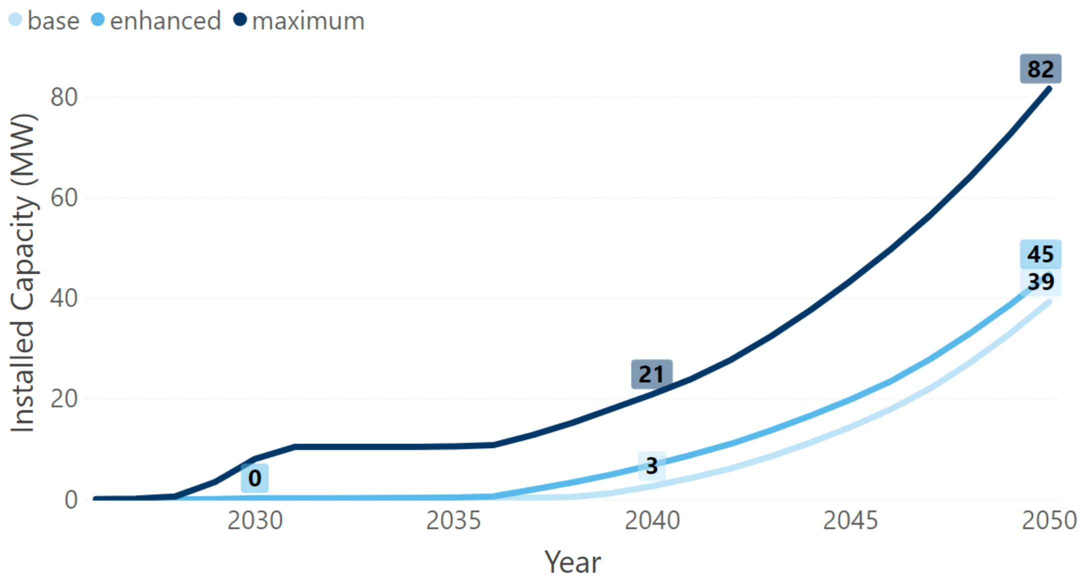
As standalone rooftop solar PV systems benefit from much better customer economics compared to storage-paired systems, storage-paired systems remain a relatively small share of the overall market.

- **In 2030:** Storage-paired systems account for <1% to 4% of cumulative solar PV installations.
- **In 2040:** Storage-paired systems account for 1% to 5% of cumulative solar PV installations.
- **In 2050:** Storage-paired systems account for 7% to 12% of cumulative solar PV installations.

Overall, this leads to 39 to 82 MW of installed storage capacity by 2050.

[19] The study assumes that the proposed new NEM scheme takes effect as of 25/26. However, the timeline may be delayed.

Figure 6-3. Cumulative battery storage capacity from storage-paired solar PV systems (MW)



In the absence of incentives (base scenario) or with moderate incentives (enhanced scenario), poor customer economics as well as other market barriers lead to relatively negligible adoption of storage until post-2035, when declining equipment costs begin to lead to increased uptake.

With significant incentives as considered in the maximum scenario (50% of cost) as well as increased enabling activities, uptake of storage-paired systems begins earlier (pre-2030) – however, uptake is sensitive to the phase-out of incentives from 2030-2040.

Customer sited storage, when paired with self generation through a solar PV array, can offer substantial system benefits when managed to meet NB Power's needs via a Virtual Power Plant. Storage-paired systems offer some benefits to customers, through (1) increasing self-consumption of solar generation[20] and (2) offering the opportunity to manage their demand and demand charges.[21] However, customer benefits from storage remain limited relative to costs under current rates and proposed NEM scheme. The results indicate that to encourage greater adoption of solar-paired, new strategies and additional supports are likely required. For example, NB Power could explore opportunities to derive grid benefits from customer sited-batteries, and a compensation mechanism that fairly shares these benefits with the host customers.

[20] Given that the compensation for exported solar generation is lower than customers' retail energy rates, increasing self consumption can increase customer benefits.
[21] The proposed NEM scheme is expected to increase customer benefits from demand management, compared to the legacy program.

6.3 Key Takeaways

Based on the results presented in this section, the following key takeaways emerge:

- **Uptake of behind-the-meter rooftop solar PV is projected to continue increasing across all scenarios and reach 1.4 to 1.7 GW of installed capacity in 2050.** In the base scenario, uptake is projected to drop in the short term, as a result of removing equipment incentives, coupled with lower annual compensation under NB Power's proposed new NEM scheme. However, as system costs are projected to continue to decrease, adoption is expected to return to previous levels and continue to grow from FY26/27 onwards.
- **Under current rates and proposed NEM scheme, customer benefits from storage are limited relative to costs, and storage-paired systems are projected to account for a relatively small share** of the total installed solar PV systems (7-12% in 2050). These results indicate that new strategies and additional support are likely required to encourage greater uptake of storage-paired systems.

Clean Transportation

7. Clean Transportation

7.1 Overview

The following chapter presents an assessment of the potential uptake of CT technologies. The analysis focuses on three main components:

1. **Electrification of on-road vehicles.** The study assessed the market potential for on-road vehicle electrification using a bottom-up modelling approach that leverages Dunsky's Electric Vehicle Adoption Model (EVA), taking into account total cost of ownership of internal combustion engine (ICE) vs. electric vehicles, as well as other dynamics that impact adoption of EVs such as access to home and public charging and vehicle model availability. The study considered light-duty vehicles (LDVs) (passenger and commercial), buses, and medium and heavy-duty vehicles (MHDVs)
2. **Alternative fuels and fuel saving devices for on-road vehicles.** Beyond electrification, alternative fuels (such as hydrogen and biofuels), as well as fuel saving devices that increase vehicle efficiency, can also support transportation decarbonization and lead to fuel and GHG savings. The study applied a top-down approach to assess the market potential for hydrogen fuel cell vehicles, fuel saving devices and biofuel blending.
3. **Shore Power for marine vessels.** This refers to the process of supplying electricity from the land (shore) to marine vessels while they are docked at port. Rather than running their onboard diesel engines to generate power, they connect to the local electrical grid. Ships require power when docked at port for "hotelling", which includes continuing to run on-board systems such as lighting, HVAC systems, refrigeration, pumps, and other amenities. Shore power is primarily used for ships which often spend long hours at berth and require significant power for these onboard systems – such as cruise ships, ferries, and container ships. The study applied a top-down approach to assess the market potential for shore power at New Brunswick's ports.

Table 7-1 provides a qualitative description of the achievable potential scenarios for clean transportation. More detail on the methodological approach is provided in Volume II.

Table 7-1. Clean transportation achievable potential scenarios

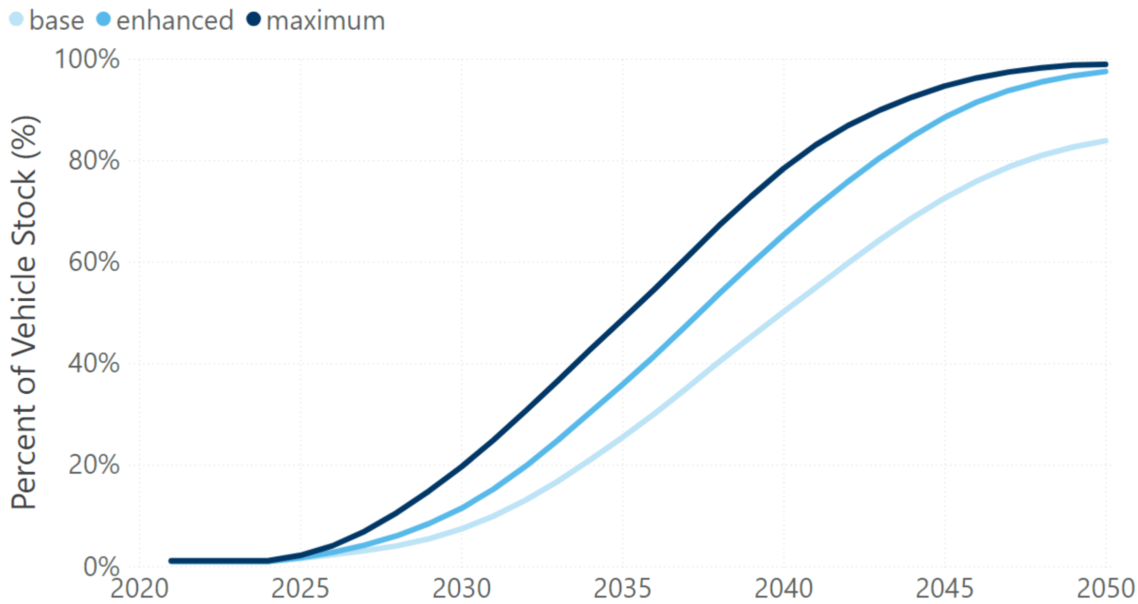
Study Stream	Base	Enhanced (Enh.)	Maximum (Max.)
CT: **Electric Vehicles**	Applies **current incentives and rate of charging infrastructure growth.** Assumes the federal zero emission vehicle (ZEV) mandate is rescinded.	Applies current **incentives with an extended phase-out period and increased charging infrastructure deployment.** Assumes the federal ZEV mandate target date is delayed to 2040.	Applies current incentives with a **further extended phase-out period, and significant charging infrastructure deployment.** Assumes federal **ZEV mandate is maintained and provincial ZEV mandate is enacted.**
CT: **Alternatives**	Applies **no hydrogen FCEVs, and minimal vehicle retrofits and biofuel blending.**	Applies **moderate uptake** of FCEVs, vehicle retrofits and biofuel blending.	Applies **high uptake** of FCEVs, vehicle retrofits and biofuel blending.
CT: **Shore Power**	Assumes shore power supplies **50% of hotelling load by 2050.**	Assumes shore power supplies **100% of hotelling load by 2050.**	Assumes shore power supplies **100% of hotelling load by 2030.**

7.2 On-road Vehicle Electrification

Figure 7-1 shows the cumulative percentage of the total on-road vehicle stock in New Brunswick that is electric throughout the study period. Uptake of EVs is projected to increase significantly across all scenarios, reaching 7-20% in 2030, 50-78% in 2040 and 84-99% in 2050.

Although the pace of EV uptake varies between scenarios, the declining total cost of ownership of EVs relative to their ICE counterparts, as well as increasing access to charging and vehicle availability, leads to significant uptake of EVs by the end of the study period.

Figure 7-1. Electric vehicles percent of total vehicle stock (cumulative %)



7.2.1.1 Light-duty Vehicles

Light-duty vehicles account for the majority of the overall vehicle stock and follow the trend highlighted in Figure 7-1, reaching 85%-100% of the overall LDV vehicle stock in 2050 (including both commercial and passenger LDVs).

The increasing penetration of EVs as a proportion of total vehicle stock is driven by an increase in annual sales of light-duty EVs. **While EVs accounted for approximately 8% of annual vehicle sales in FY24/25 (over 2,800 vehicles), this is forecasted to increase to 30-70% by FY29/30 (13,300-31,800 vehicles)** (Figure 7-2, Figure 7-3).

In the base scenario, EVs do not reach 100% of annual vehicle sales, but account for >95% of annual vehicle sales after 2045. In the enhanced and maximum scenarios, EVs reach 100% of annual vehicle sales as of 2040 and 2035, respectively, driven in part by the ZEV mandate. However, prior to 2035 or 2040, EV adoption is accelerated in the enhanced and maximum scenarios compared to the base scenario due to an extended phase-out of incentives, increased investment in charging infrastructure, and increased home charging access, largely due to EV-ready retrofits of multi-unit residence buildings (MURBS).

Figure 7-2. Annual LD-EV sales (% of total annual LDV vehicle sales)

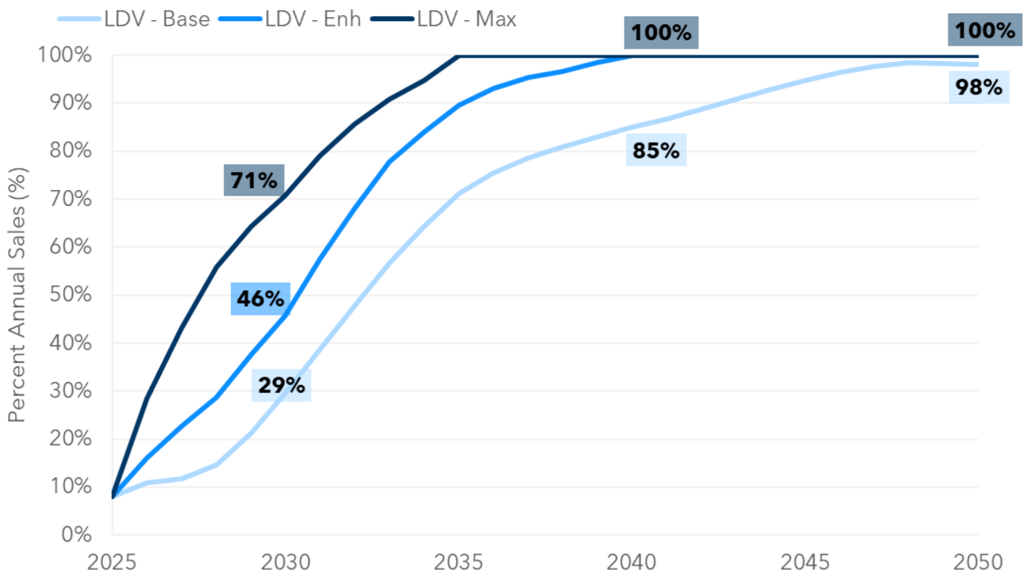
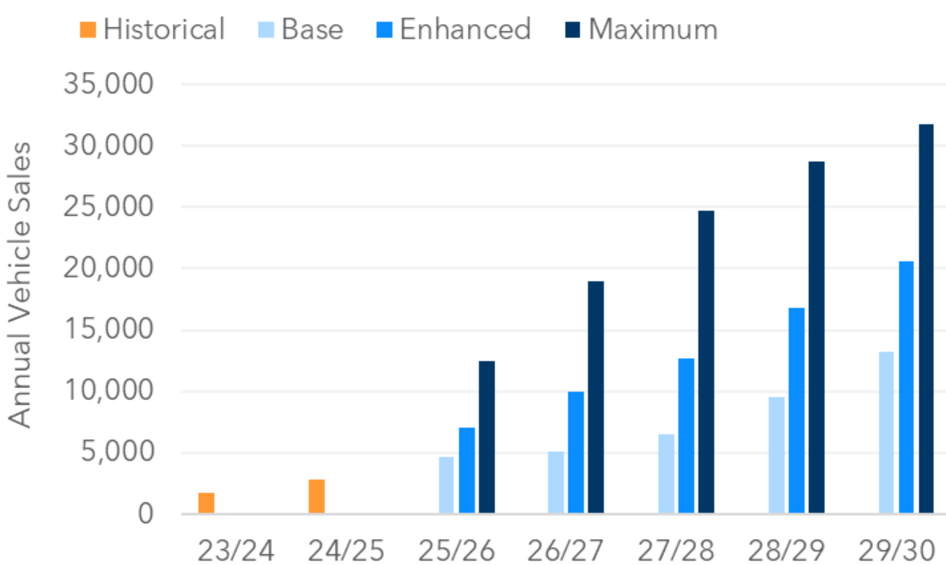


Figure 7-3. Annual LD-EV sales



7.2.1.2 Buses, Medium and Heavy-Duty Vehicles

In the bus and MHDV segments, vehicle electrification is also significant – however, trends vary depending on the vehicle segment.

- **Buses:** EVs account for 93-96% of the vehicle stock by 2050. The target of 100% procurement of electric vehicles for new transit and school buses (by 2032 in the enhanced scenario and 2027 in the maximum scenario) contributes to a more rapid increase in annual percentage of EV sales – however, even in the base scenario, this segment sees significant uptake of EVs. Buses benefit from a strong business case for electrification due to consistent daily usage and high overall driving distances. The non-electrified portion of buses primarily includes long-distance coach buses, which can experience technical challenges related to range requirements.

- **Medium-Duty Vehicles (MDVs):** EVs account for 85-97% of the vehicle stock by 2050. This segment is largely comprised of delivery vehicles, which benefit from a strong business case for electrification due to consistent daily usage and high overall driving distances. In the enhanced and maximum scenarios, the ZEV mandate also drives increased uptake.
- **Heavy-Duty Vehicles (HDVs):** EVs account for 44-68% of the vehicle stock by 2050. Electrification is particularly lower among long-haul vehicles, where EVs account for 8-41% of the vehicle stock in 2050. This segment can experience technical challenges (range requirements, payload capacity) and weaker economics (in the case of vocational trucks, with lower annual driving distances and fuel savings potential). In the enhanced and maximum scenarios, the ZEV mandate also drives increased uptake – however, these factors also make this vehicle segment a more viable candidate for other energy efficiency and decarbonization pathways – including alternative fuels and vehicle retrofits, as discussed in the following section.

The increasing penetration of EVs is driven by a rise in the proportion of annual vehicle sales that are EVs across each of these segments. **Within the bus segment, EVs account for 48-95% of annual vehicle sales in 2030, and 96-97% in 2050** (Figure 7-4). The jump in percent of annual sales in the enhanced (2032) and max (2027) scenarios is driven by the assumption of a 100% public procurement target for new transit and school buses.[22] However, even without these targets, EVs account for a steadily increasing portion of annual vehicle sales and 96% of sales by 2050 in the base scenario, due to the strong business case for bus electrification.

Within the **MDV segment, EVs account for 29-42% of annual vehicle sales in 2030, and 94-100% in 2050** (Figure 7-5). Both the enhanced and maximum scenario include a federal ZEV mandate, with 100% of annual vehicle sales assumed to be required to be ZEVs by 2045 in the enhanced scenario and 2040 in the maximum scenario, which contributes to the high penetration of EV sales. Prior to 2040, an extended phase-down of incentives and increased investment in charging infrastructure also drive more rapid vehicle electrification compared to the base scenario. However, even in the absence of a ZEV mandate (base scenario), EVs account for a steadily increasing portion of annual vehicle sales and 94% of sales by 2050, as MDVs benefit from a strong business case for electrification.

Within the **HDV segment, EVs account for 11-22% of annual vehicle sales in 2030, and 60-84% in 2050** (Figure 7-6). In the case of HDVs, the ZEV mandate significantly increases sales in the enhanced and maximum scenario relative to the base scenario – although sales do not reach 100%, as a portion of the HDV segment may also meet ZEV requirements through other decarbonization pathways, such as FCEVs. Although some vehicles in the HDV segment (particularly long-haul vehicles) may face greater technical challenges and weaker economics for electrification, EVs still show significant potential and account for 60% of vehicle sales by 2050 in the absence of a ZEV mandate in the base scenario.

[22] This target is not applied to long-distance coach buses.

Figure 7-4. Annual Bus EV sales (% of total annual bus sales)

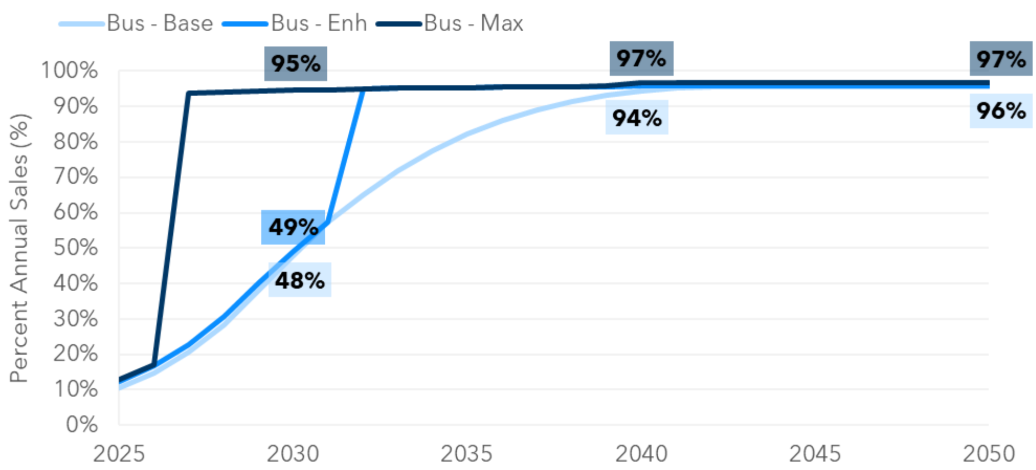


Figure 7-5. Annual MD-EV sales (% of total annual MDV sales)

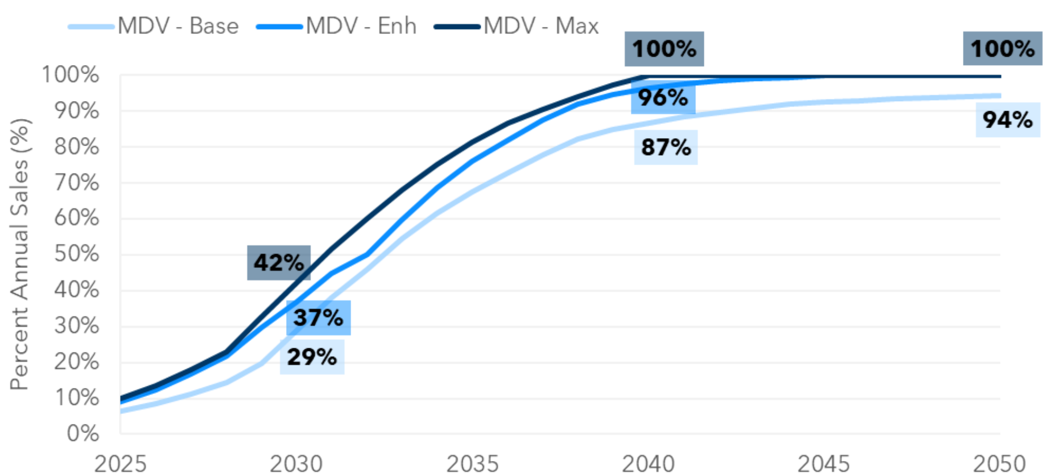
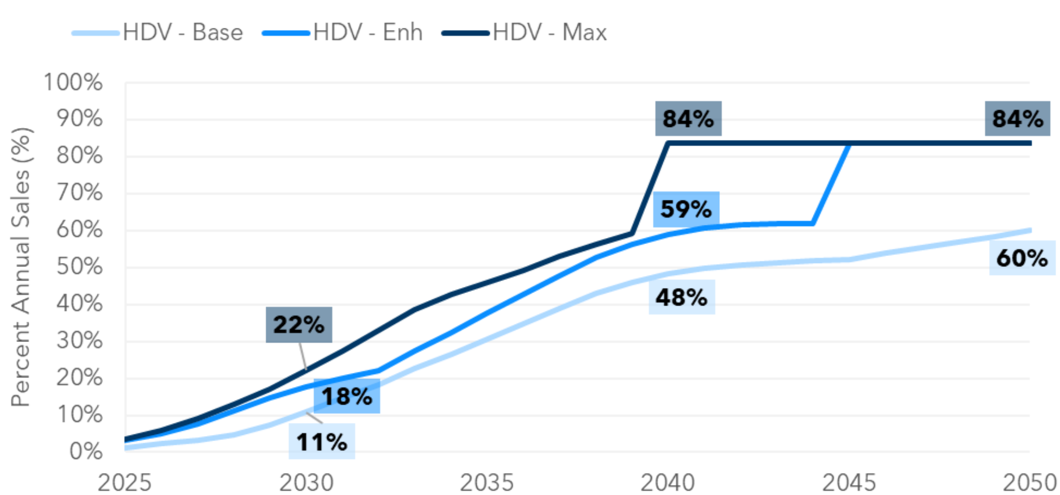


Figure 7-6. Annual HD-EV sales (% of total HDV sales)

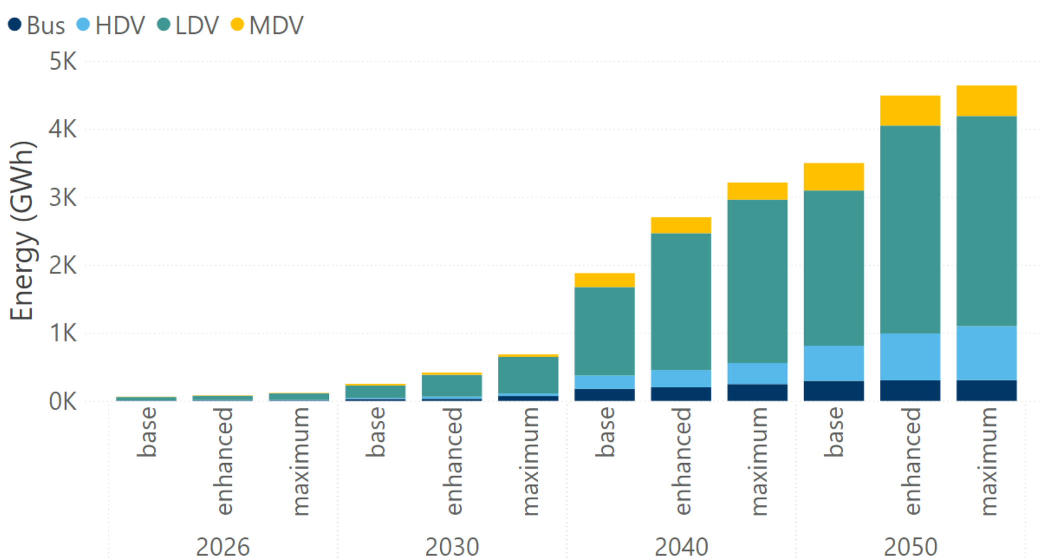


7.2.1.3 Electricity System Impacts

Electrification of on-road vehicles will increase both electricity consumption (Figure 7-7) and peak demand (Figure 7-8) – however, **the overall impact on NB Power's system will be determined by the interaction between all components considered in this study.**

The majority of energy and peak demand impacts is driven by LDVs, which account for the greatest share of the overall vehicle stock. In 2040, EVs increase energy consumption by 10-20% (Figure 7-7).

Figure 7-7. Electricity consumption impacts of electric vehicles (Cumulative GWh)



Considering NB Power's current winter morning peak window, EVs increase peak demand by 150MW-360 MW (6%-11%) in 2040 (Figure 7-8). However, **EV peak impacts are more than double that during the winter evening peak window (420-800 MW in 2040). As the difference between NB Power's winter morning and evening peak is currently approximately 300 MW, this highlights the potential for NB Power's system peak to shift from its current pattern of winter morning peaks to winter evenings**, when the majority of EV charging occurs.

This is even more likely when taking into account the other factors considered in this study, such as EE, heating electrification and DR, which decrease the winter morning peak.

This underscores the importance of developing a robust managed charging program to leverage the flexibility of EV loads and mitigate peak impacts.

Figure 7-8. Peak demand impacts of electric vehicles (Cumulative MW, Winter Morning Peak)

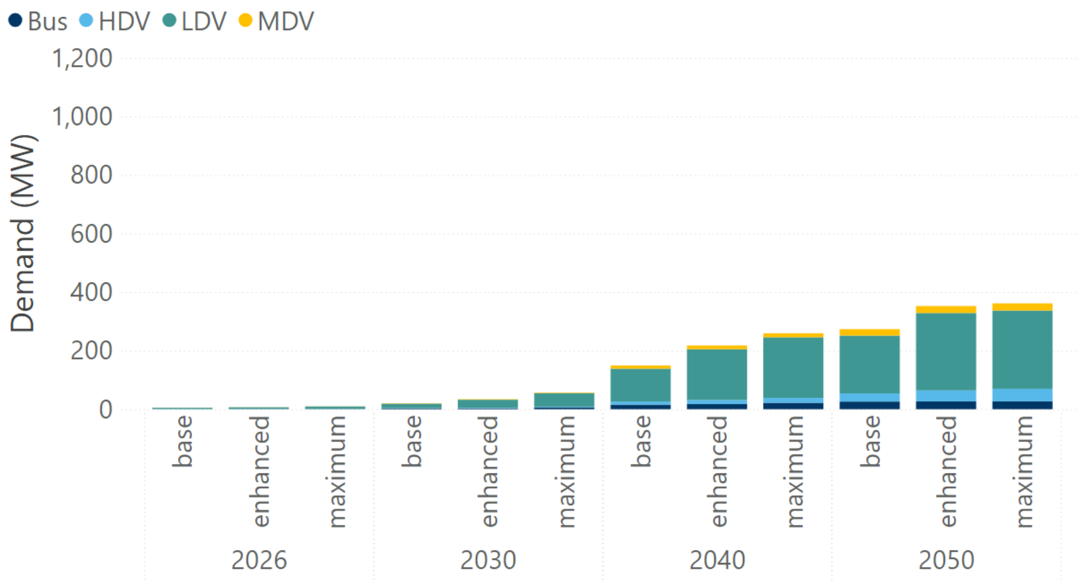
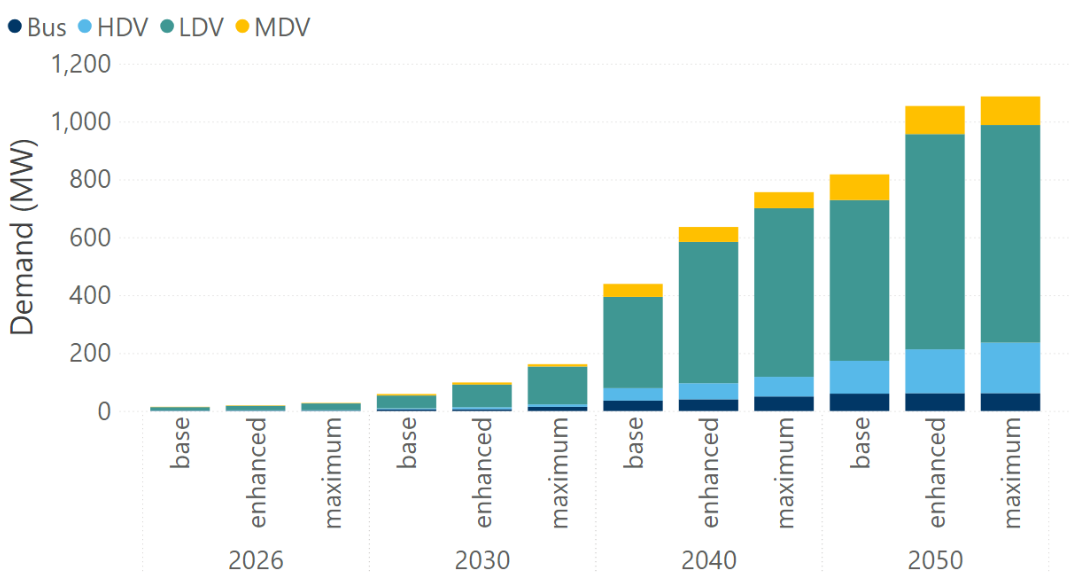


Figure 7-9. Peak demand impacts of electric vehicles (Cumulative MW, Winter Evening Peak)



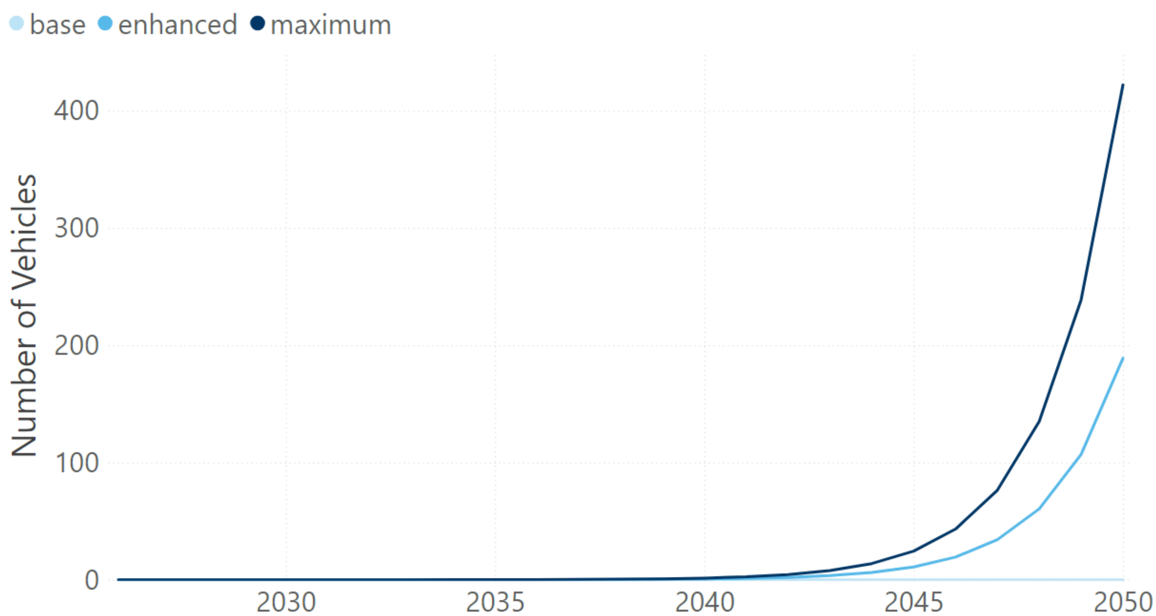
7.3 Alternative Fuels and Fuel Saving Devices

While electrification is expected to be the primary pathway to fuel savings and decarbonization for on-road vehicles, for certain vehicle segments – particularly heavy-duty vehicles – where electrification is more challenging or costly, alternative fuel vehicles – such as hydrogen fuel cell electric vehicles (FCEVs) – as well as retrofitting internal combustion engine (ICE) vehicles with fuel saving devices, will also play a targeted role.

There are several barriers to the adoption of FCEVs, including high purchase prices of hydrogen fuel, insufficient infrastructure for hydrogen supply and refueling stations, an absence of qualified maintenance facilities and trained personnel, and gaps in standards and regulations that lead to safety concerns and lack of certainty for fleets. Due to this, **uptake of FCEVs is subject to significant uncertainty, and expected to be limited overall.**

The results project uptake beginning post-2040. The maximum scenario assumes that more vehicle models become available, and that policies and regulations require and incentivize a greater share of zero-emission vehicles in the MHDV fleet, which leads to increased uptake. However, even in this scenario, potential for FCEVs is limited. Cumulative uptake of hydrogen FCEVs is expected to reach 190-420 vehicles on the road by 2050 in the enhanced and maximum scenarios (Figure 7-10).[23]

Figure 7-10. Uptake of hydrogen FCEVs per scenario (Cumulative vehicles)



Adoption is primarily concentrated in the heavy-duty vehicle segment, while buses account for only a handful of total hydrogen FCEV vehicles (Figure 7-11). **While adoption appears to increase rapidly post-2040, there is limited potential for further growth.** In the maximum scenario, electric vehicles account for 85% of all vehicle sales by 2050, and with approximately 1,000 annual HDV sales, **annual FCEV sales are limited to the remaining approximately 200 vehicles per year** (Figure 7-12).

[23] The base scenario assumed no uptake of hydrogen FCEV vehicles.

Figure 7-11. Cumulative FCEVs per vehicle segment in the maximum scenario

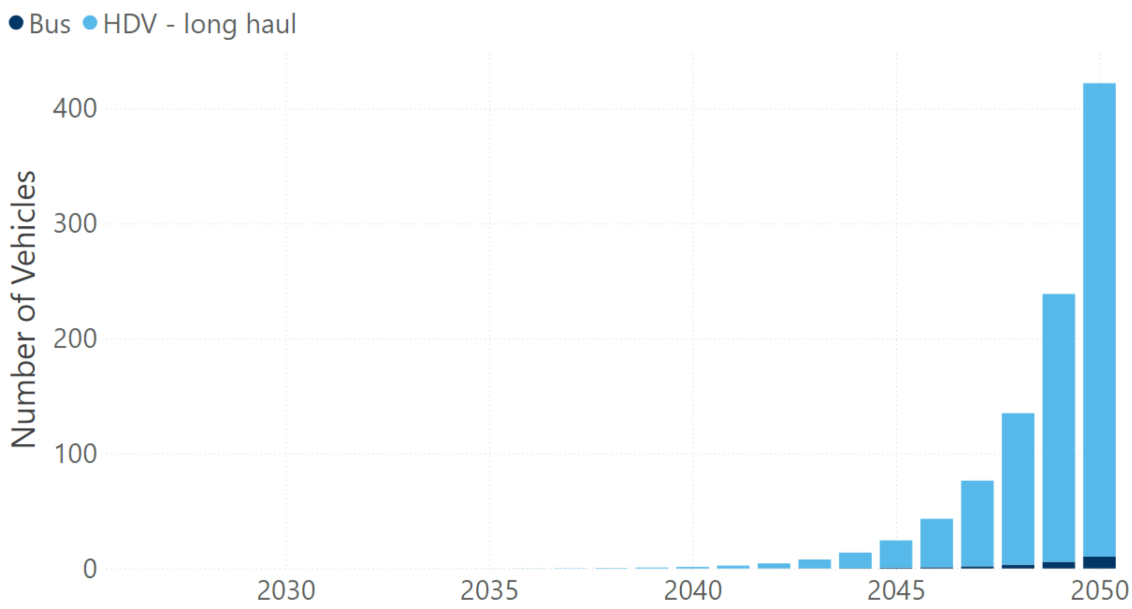
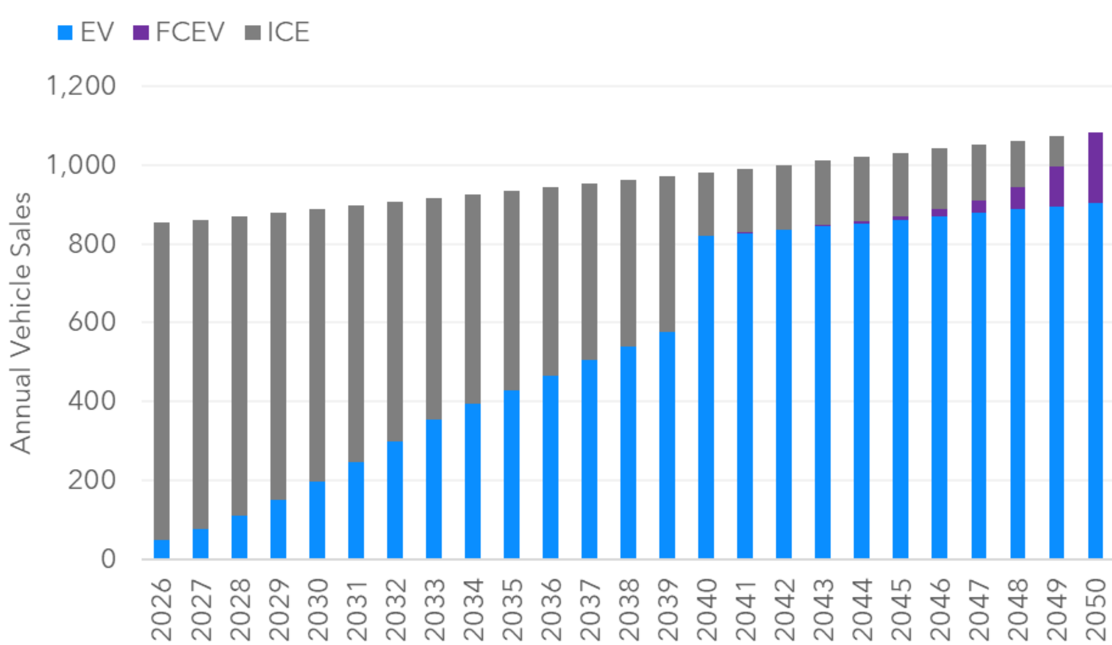


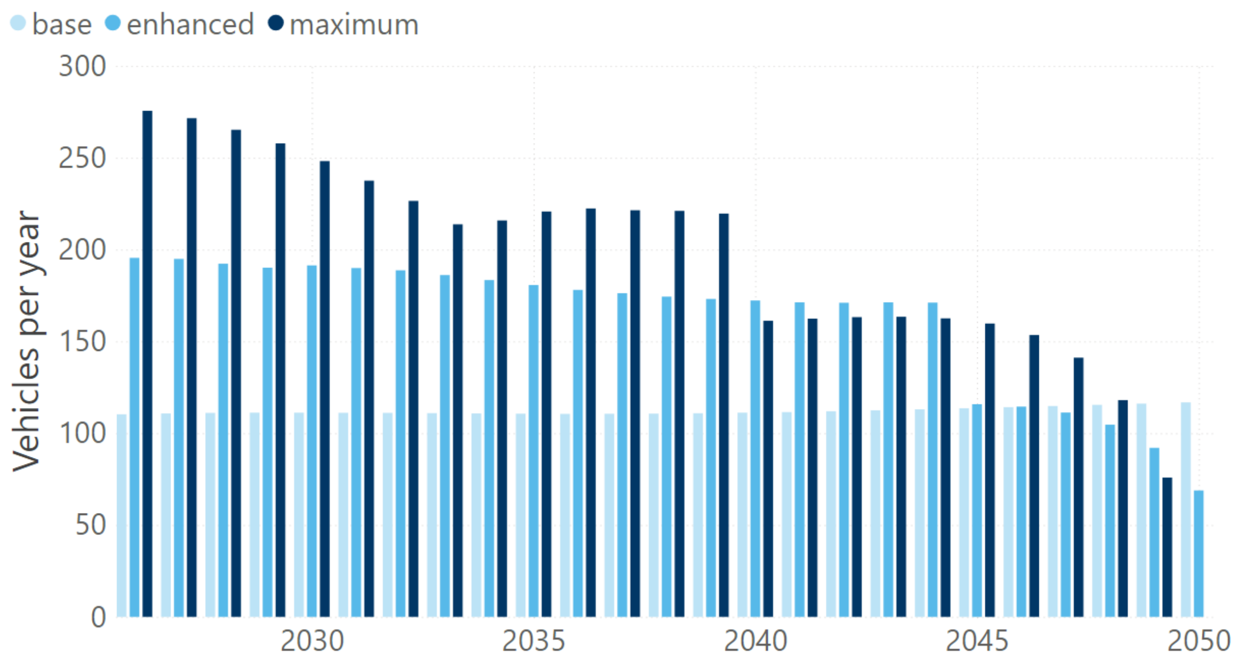
Figure 7-12. Annual HDV sales per drivetrain type in the maximum scenario



Retrofits of ICE vehicles with fuel saving devices is targeted toward the HDV segment. The results project that 100-260 vehicles will be retrofitted per year during the first five years of the study period (Figure 7-13).

Overall, vehicle retrofits are dependent on the number of ICE vehicles remaining – as vehicles are increasingly electrified, the number of efficiency retrofits decrease overall, and the scenario trends begin to reverse – by 2050, there are fewer remaining ICE vehicles in the enhanced and maximum scenarios, and therefore fewer vehicle retrofits compared to the base scenario.

Figure 7-13. Annual number of vehicle retrofits per scenario (Annual vehicles)



7.4 Shore Power Potential

This study assessed the potential for shore power at five New Brunswick ports – Saint John, Belledune, Caraquet, Dalhousie and Shediac. Of these five ports, three – Caraquet, Dalhousie and Shediac – are generally characterized by low traffic volumes with primarily coast guard, fishing, special purpose and tug vessels. These vessels are generally not considered viable candidates for shore power – therefore, this study assumes that there is no potential for shore power at these ports.

Saint John and Belledune ports are both viable candidates for shore power. The use of shore power will lead to an increase in electricity consumption and peak demand (Figure 7-14, Figure 7-15):

- **In 2030:** 3-36 GWh and 4-45 MW
- **In 2040**: 9-44 GWh and 11-55 MW
- **In 2050:** 15-54 GWh and 19-67 MW

Overall, these impacts are relatively minor compared to NB Power's total electricity sales (<1%) and peak demand (<1 to 1.5%).

Figure 7-14. Cumulative shore power electricity consumption (GWh) per scenario

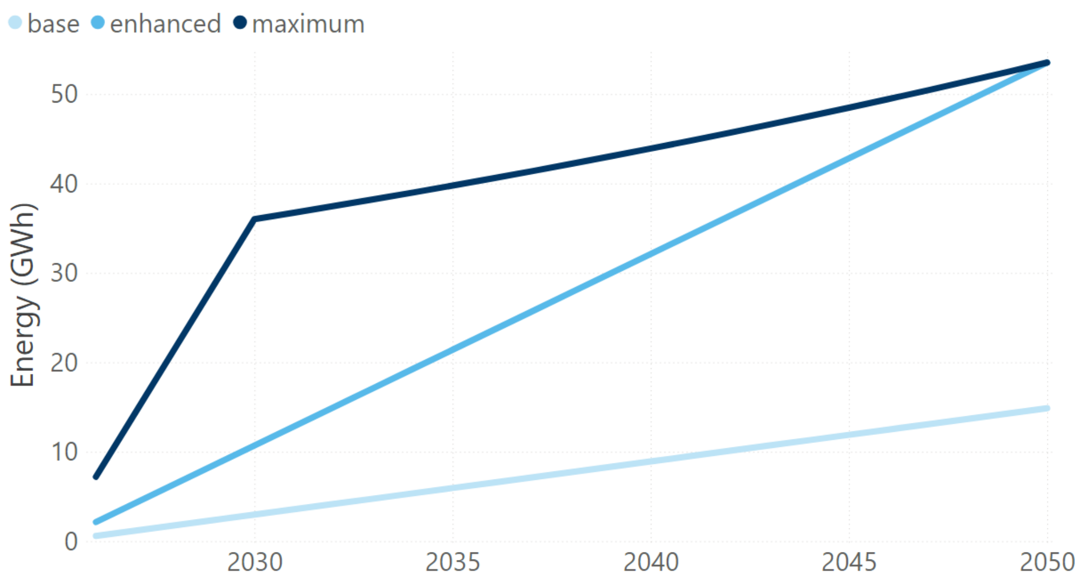
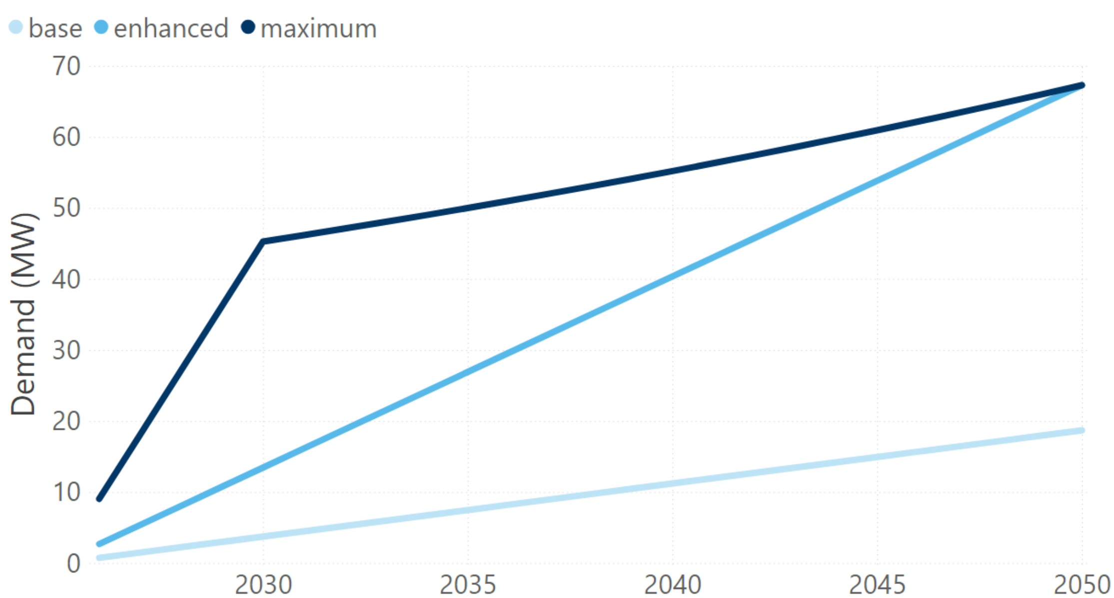


Figure 7-15. Cumulative shore power peak demand impacts (MW) per scenario



7.5 Key Takeaways

- **Uptake of EVs is projected to increase across all scenarios**, with EVs reaching 84-99% of the total vehicle stock in 2050. Vehicle electrification is projected to be the dominant pathway for vehicle decarbonization, with FCEVs and vehicle retrofits possibly playing a targeted and uncertain role primarily in the long-haul heavy-duty vehicle segment.

- **If unmitigated, EVs will have a significant impact on peak demand and will likely shift NB Power's system from a winter morning to a winter evening peak.** This underscores the importance of implementing and scaling managed charging programs to leverage the flexibility of EV loads and mitigate peak impacts.

- **Of New Brunswick's five ports, two (Saint John and Belledune) are viable candidates for shore power.** Impacts on electricity consumption and peak demand are projected to be relatively minor compared to on-road vehicle electrification and baseline consumption.

Demand Response

8. Demand Response

8.1 Overview

The following chapter presents the results for electric DR potential. The assessment leveraged Dunsky's DEEP model to assess economic and achievable potential of DR measures, combined with a load curve tuning analysis to verify the overall peak demand impacts.

Table 8-1 provides a qualitative description of the demand response achievable potential scenarios. More detail on the methodological approach is provided in Volume II.

Table 8-1. Demand response achievable potential scenarios

Base	Enhanced (Enh.)	Maximum (Max.)
Applies incentives, enabling activities and programs **in line with NB Power's current DR programs**, with expanded participation and **complementary measures.**	Applies **expanded DR programs**, through the addition of residential and EV programs and direct load control type initiatives.	Maintains the expanded programs from enhanced scenario and **applies increased incentives and enabling activities.**

8.2 Results

Figure 8-1 shows the achievable DR potential (MW) in FY39/40, excluding EV demand response measures (smart charging and vehicle-to-grid).

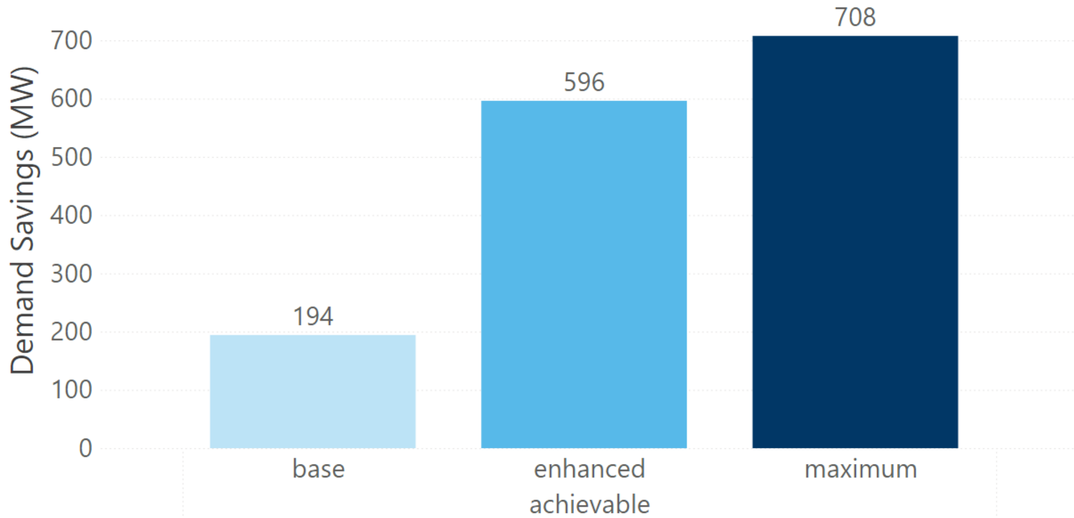
Demand Response Potential

As mentioned previously, although the study assesses technical, economic and achievable potential of peak demand savings, **technical and economic peak demand savings potential are not presented throughout this report.** While technical and economic potential are reflective of available capacity, **they do not consider actual system needs,** and net impacts taking into account the impacts and interactions between the various measures considered in this study and their impacts on NB Power's typical peak day load shape.

Achievable demand response potential reflects not just enrolled capacity, but the projected annual peak reduction potential considering opt-outs, overrides, connectivity issues, and other factors that may reduce performance during peak events.

This being said, **achievable potential is not equivalent to net peak demand reduction.** A holistic analysis considering all hours of the typical peak winter day is required to assess net reduction in peak demand, as discussed in more detail in this section.

Figure 8-1. Achievable DR potential (MW, FY39/40)



Based on these results, the following observations can be made:

- **Achievable potential for DR in FY39/40 represents 5%-20% of forecasted baseline peak demand.**
- This potential is based on **winter morning peak reductions from residential, commercial and industrial DR measures, and winter evening peak demand reductions from EV measures.** As the uptake of EVs increases, and the combined impact of various factors considered in this study (EE, DG, and other DR measures) decrease the winter morning peak, there is a possibility that NB Power's system will shift to a winter evening peak sometime between 2035 and 2040. Therefore, as EV penetration increases, EV DR measures show increasing potential to target the winter evening hours when the majority of EVs are charging. If the evening peak remains sufficiently pronounced other measures could also be adapted to reduce evening peak through a dual peak strategy.
- **Increased program offerings, incentives and enabling activities can increase achievable potential by a factor 3.5.** Achievable potential increases threefold from the base to enhanced scenario with expanded programs and measures. The inclusion of EV DR programs is a key driver of this increase, as the penetration of EVs is significant by FY39/40. Potential increases further by a factor of 3.5 from the base to the maximum scenario with the combination of expanded programs and measures, as well as increased incentives and enabling activities.

Figure 8-2 and Figure 8-3 below present the achievable DR potentials in comparison to recent NB Power DR program performance, and planned expansion of DR program enrollment in the coming years.

Figure 8-2. Achievable DR potential (MW) per scenario

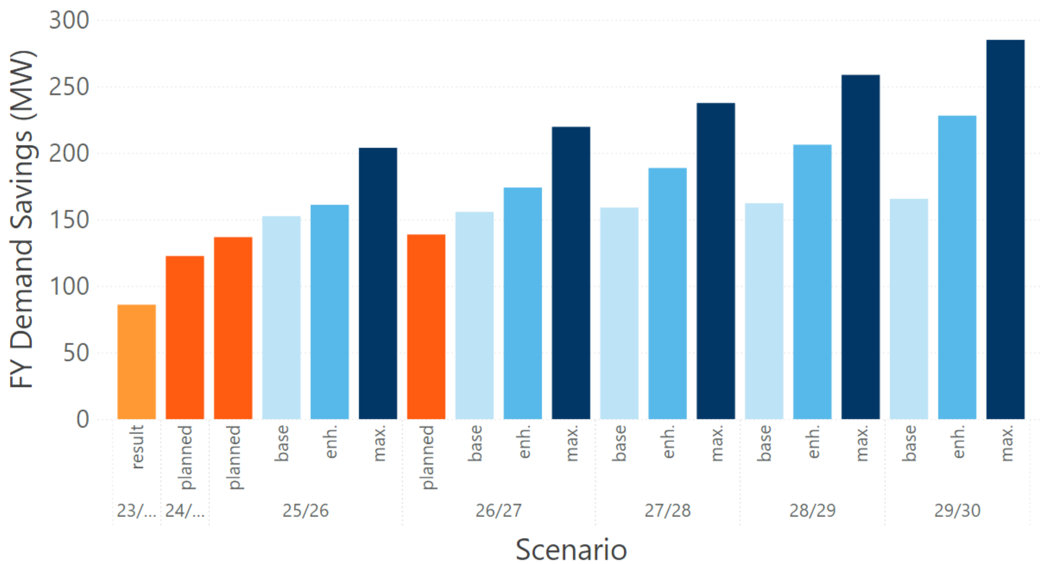
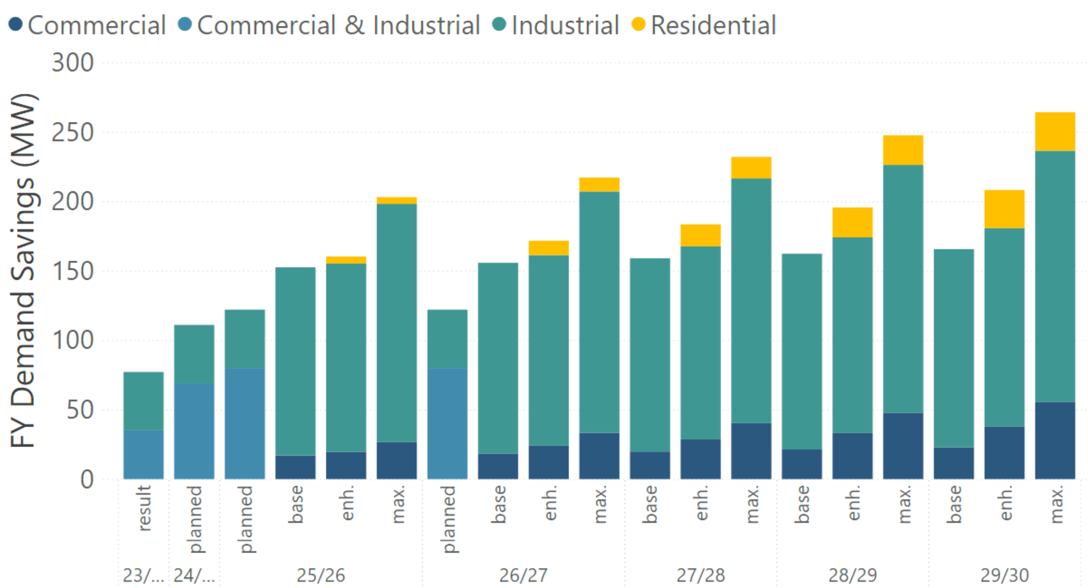


Figure 8-3. Achievable DR potential (MW) per sector and scenario



Based on these results, the following observations can be made:

- **Under the base scenario, savings are comparable with, but slightly exceed, planned savings.** As the base scenario considers only existing programs, this potential is concentrated in the industrial sector (where eligible customers participate in the large industrial DR program as well as the Peak Rebate program), and the commercial sector (where eligible customers participate in the Peak Rebate program).

  NB Power is planning for a significant increase in participation in the Peak Rebate program by FY25/26 (increasing from approximately 35 MW result in FY23/24 to 80

MW planned in FY25/26). The results suggest that this is likely achievable under current programs.

- **There is significant opportunity to increase achievable potential through expanded DR programs and measures, as well as increased incentives and enabling activities.** Current programs apply only to industrial and commercial customers able to curtail at least 100 kW, with a focus on manual curtailment.
- Introducing new programs for the residential sector can increase potential (as seen in the enhanced and maximum scenarios) – however, new programs will take time to design, launch and enroll participants, so this potential becomes more significant after FY27/28 and continues to increase as programs reach their full enrollment potential.

  Potential from EV DR measures also becomes significant only after FY27/28, due to both the ramp up of new programs as well as the fact that potential is directly linked to the uptake of EVs, and there are fewer EVs on the road in the early years of the study period, as seen in section 7.
- **In the first year of the study period (FY25/26), DR savings represent 5-6% of forecasted baseline peak demand.** While this is a notable degree of peak load reduction from DR program, comparable to other utility portfolios, this analysis shows that there remains much room to grow the impact of DR to mitigate NB Power's growing peak demands. As noted above, the Max scenario offers up to 20% peak load reduction by 2040.

Time-Varied Rates

Different forms of dynamic pricing or time-varied rates (TVR) – such as time-of-use (TOU) rates, critical peak pricing (CPP), or a peak-time rebate – can also be leveraged as a form of demand response and is another lever NB Power could use to mitigate peak demand.

The impacts of TVR depend on the peak to off-peak price ratio, as well as whether or not the approach is purely behavioral, or also introduces an enabling technology to support customers in shifting their load, such as a programmable thermostat (Figure 8-4). [24,25]

A meta-analysis of customer responses to time-varying rates shows that **for a peak to off-peak price ratio of 3.5** (aligned with the ratio used in the Shediac pilot program), a **peak reduction per participant of 9-14% could be achieved.**[24,26]

Although a majority of jurisdictions included in the meta-analysis are summer peaking, Hydro-Québec, which is winter peaking, achieved even better results, demonstrating a 20% peak reduction per customer on average with a 6.5 peak to off-peak ratio and without introducing enabling technology (Figure 8-4).[25]

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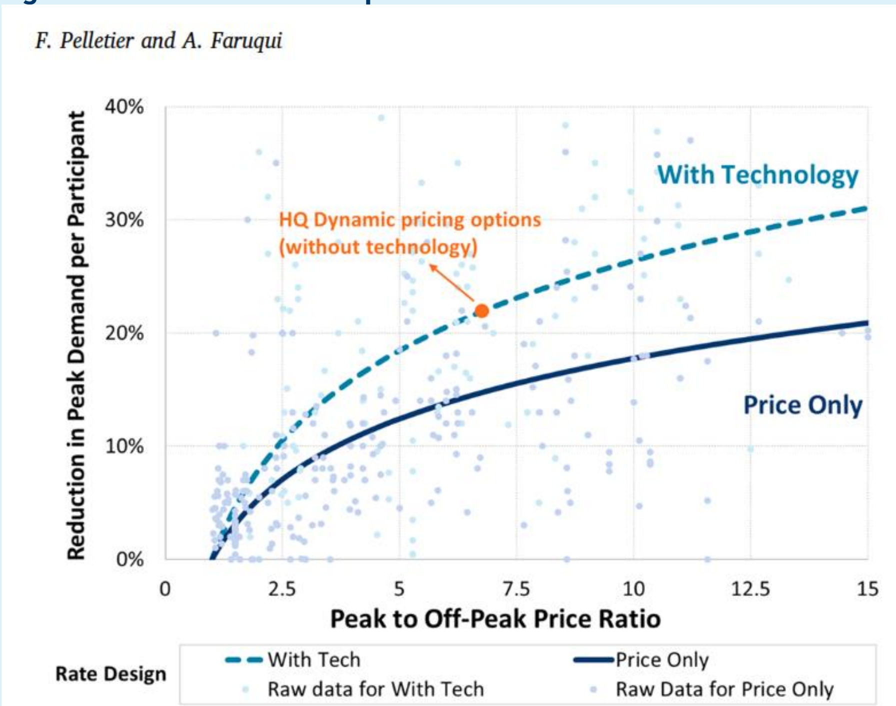
[24] F. Pelletier, A. Faruqui. (2022). *Does dynamic pricing work in a winter-peaking climate? A case study of Hydro-Québec.*

[25] S. Sergici, A. Faruqui, S. Tang. (2023). *Do customers respond to time-varying rates: a preview of Arcturus 3.0.*

[26] Note that the Shediac pilot project demonstrated a peak load reduction of 1-5% per customer with a time-of-use (TOU) rate with a peak to off-peak ratio of 3.5. Further analysis would be required to understand the factors contributing to lower-than-expected performance and ensure a rate/program design that leads to greater peak reduction per participant.

Figure 8-4. The Arc of Price Responsiveness



In addition to the peak to off-peak ratio and the presence of enabling technology, **design of the rate or program also plays an important role in the impact of TVR.** For example, empirical data shows that CPP can significantly increase the per-customer impact compared to PTR or TOU. However, PTR may be more appealing to customers, particularly those that are risk averse.[24,25]

Having a diversified offering tailored to different customer types can help to increase enrollment and overall impacts. For example, Hydro-Québec offers both CPP and PTR options.[25]

8.2.1 Residential

Table 8-2 presents the MW savings and percent of total residential savings for the top 10 residential DR measures.

Table 8-2. Top residential DR measures MW savings (% of total residential savings) in FY27/28

Measure	Base	Enh	Max
Electric Resistance Storage Water Heater Control	-	5.8 (36%)	0.28 (1.8%)
Wi-Fi Thermostat, Baseboard, Direct Install	-	5.8 (36%)	8.4 (54%)
Wi-Fi Thermostat, Furnace, Direct Install	-	2.0 (12%)	2.9 (18%)
Wi-Fi Thermostat, ccASHP, Direct Install	-	1.1 (7.2%)	1.7 (11%)
Wi-Fi Thermostat, Baseboard, BYOD	-	0.6 (3.7%)	1.1 (7.1%)
Wi-Fi Thermostat, Furnace, BYOD	-	0.4 (2.4%)	0.8 (5.1%)

Measure	Base	Enh	Max
Wi-Fi Thermostat, ccASHP, BYOD	-	0.1 (0.7%)	0.2 (1.1%)
Spa Hot Tub Control	-	0.1 (0.6%)	0.2 (2.1%)
Smart Clothes Dryer Control	-	0.01 (0.04%)	0.0001 (0.1%)
Battery Energy Storage	-	0.00002 (0.0001%)	0.0004 (0.1%)
Total	**-**	**16 (100%)**	**16 (100%)**

Note: Top 10 measures sorted and arranged by savings under the enhanced scenario, as there are no residential DR programs in the base scenario.

Based on these results, the following observations can be made:

- **Wi-fi thermostats and electric resistance storage water heater controls account for the majority of residential DR potential**. However, electric resistance storage water heater controls does not pass economic screening in the maximum scenario due to the increased level of incentives. (However, some hot water peak savings remain in the low-income segment, where measures are not passed through economic screening).

  The market for bring-your-own-device (BYOD) wi-fi thermostats measures is limited by uptake of these devices for energy efficiency, thus there is greater potential for a demand response program that includes provision and installation of the device. In FY27/28, potential, the majority of electrically heated homes still use electric resistance heating such as baseboards, however, this will evolve as adoption of heat pumps increases.
- **While battery storage potentials are minimal (in FY27/28 and beyond) in this analysis, they do offer significant room for growth.** The battery storage results are based on the projected uptake of storage-paired solar PV measures, as presented in Section 6 above. However, considering the flexibility of customer-sited battery storage and the associated system benefits they provide, the DR potential could grow significantly if NB Power was to establish a compensation mechanism that provides a greater share of these benefits to customers, thereby encouraging an expansion of battery storage adoption.

8.2.2 Commercial

Table 8-3 presents the MW savings and percent of total commercial savings for the top 10 commercial DR measures.

Table 8-3. Top commercial DR measures MW savings (% of total commercial savings) in FY27/28

Measure	Base	Enh	Max
Manual Curtailment, HVAC	15 (78%)	16 (55%)	21 (53%)
Automatic Curtailment, HVAC	-	7.7 (27%)	11 (26%)
Central Thermal Energy Storage	1.7 (8.8%)	1.9 (7%)	3.7 (9.1%)
Manual Curtailment, Lighting	0.9 (4.1%)	0.9 (3.0%)	1.2 (3.1%)
Automatic Curtailment, Lighting	-	0.5 (1.8%)	0.7 (2.1%)
Backup Generator, BYOD	0.4 (2.9%)	0.4 (1.5%)	0.6 (2.1%)
Manual Curtailment, Other	0.4 (2.1%)	0.4 (1.3%)	0.5 (1.1%)
Electric Resistance Storage Water Heater Control	0.3 (1.1%)	0.3 (1.1%)	0.6 (1.1%)

Measure	Base	Enh	Max
Wi-Fi Thermostat, BYOD	0.2 (1.1%)	0.3 (0.9%)	0.5 (1.1%)
Refrigeration System Curtailment	0.2 (1.1%)	0.2 (0.6%)	0.3 (1.1%)
Total	**20 (100%)**	**29 (100%)**	**40 (100%)**

Note: Top 10 measures sorted and arranged by savings under the enhanced scenario, as some measures are not applicable in the base scenario.

HVAC curtailment (manual or automatic) and thermal energy storage account for the majority of commercial DR potential.

8.2.3 Industrial

Table 8-4 presents the MW savings and percent of total industrial savings for the top 5 industrial DR measures.

Table 8-4. Top DR measures MW savings (% of total industrial savings) in FY27/28

Measure	Base	Enh	Max
Manual Curtailment, Other	133 (95%)	133 (95%)	163 (95%)
Manual Curtailment, HVAC	6 (4%)	5.8 (4%)	8 (4%)
Manual Curtailment, Lighting	0.2 (0.1%)	0.2 (0.1%)	0.2 (0.1%)
Backup Generator, BYOD	0.1 (0.1%)	0.1 (0.1%)	0.2 (0.1%)
Total	**139 (100%)**	**139 (100%)**	**176 (100%)**

Note: Top 10 measures sorted and arranged by savings under the enhanced scenario.

The vast majority of industrial DR potential is from manual curtailment of process-related loads (manual curtailment, other).

8.2.4 Load Curve Impacts Analysis

To assess the apparent system-wide peak impact of DR measures as well as the associated risk for rebound effects of peak shift measures to create a secondary peak, a load curve impact analysis was conducted. The apparent peak reduction is defined as the delta between the pre-DR measure system peak on the representative peak day, compared to the maximum demand on the same representative peak day after DR measure impacts are applied. This is assessed by applying the DR measures to the representative annual peak day load curves, and accounting for their impact across the peak event window as well as any associated pre-charging and rebound impacts.

The results of this analysis are shown in Figure 8-5 to Figure 8-8, which compare the pre and post DR load curves in 2030 and 2040 for the Base and Enhanced scenarios, respectively. In each case, DR measures for all end-uses other than EV charging are applied to the morning peak, as per NB Power's current projection of the timing of its peak throughout the study period. However, EV DR measures are applied to the evening peak, to better align with the timing of EV charging loads on the system.

Overall as the majority of DR potential comes from commercial and industrial curtailment, **rebound effects are minimal and do not create secondary peak impacts.**

The overall **net impact of DR is primarily impacted by the interplay between DR and the uptake of electric vehicles increasing the evening peak.**

In the initial 5-10 years of the study period for all scenarios, NB Power's system remains predominantly winter-morning peaking. While the penetration of EV's remains limited, NB

Power's system continues to exhibit a winter morning peak, and peak reductions are aligned with the DR potential for residential, commercial and industrial measures that target these winter morning peak hours (Figure 8-5 and Figure 8-6). Thus, the DR potentials largely translate directly into the apparent annual peak load reductions because all significant DR measures can effectively target the predominant winter morning peaks.

Figure 8-5. Pre- and post-DR load typical peak winter day 24h load curve (base scenario, 2030)[27]

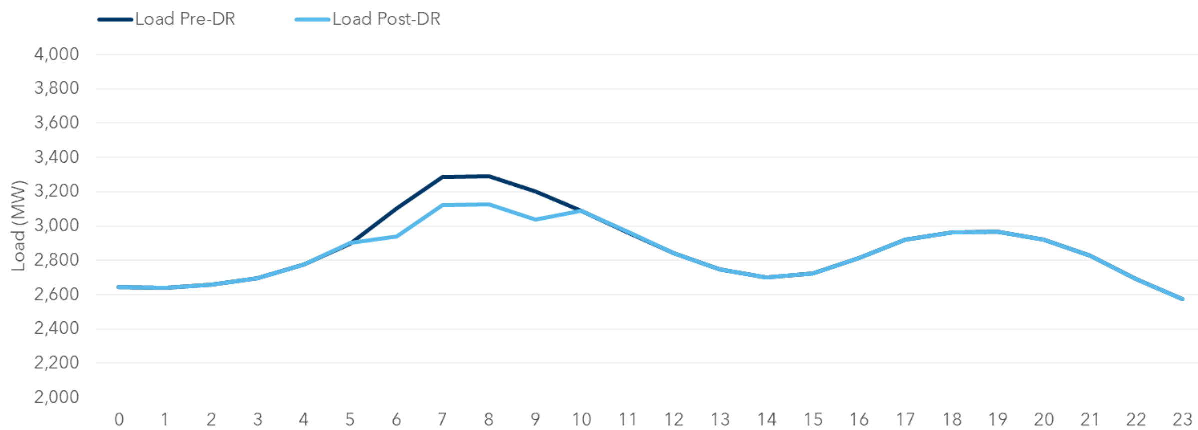
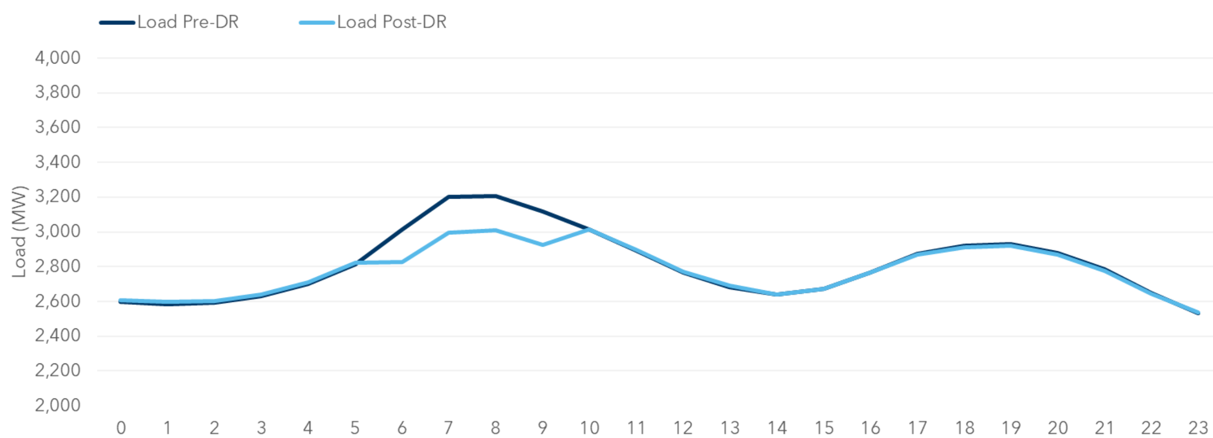


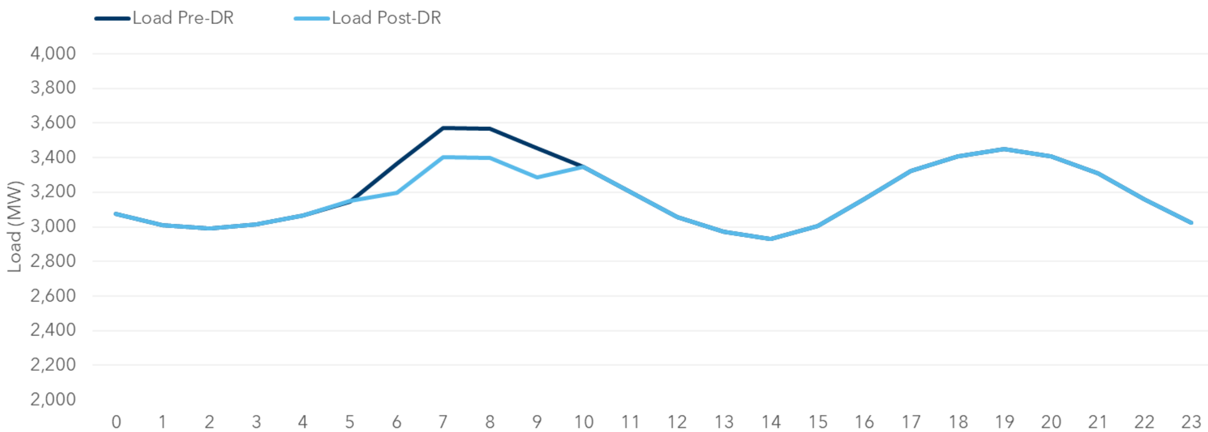
Figure 8-6. Pre- and post-DR typical peak winter day 24h load curve (enhanced scenario, 2030)



However, by 2040, EV penetration becomes more pronounced, and NB Power's system begins to exhibit an evening and/or dual peaking pattern (winter morning and evening). Figure 8-7 and Figure 8-8 present the representative peak day load curve in 2040 under the Base and Enhanced scenarios respectively. In the Base scenario, where EV penetration is somewhat lower and no EV DR measures are applied, all DR potential is derived from addressing the morning peak. However, because of EV load increasing the evening peak, the net DR potential becomes constrained by the unaddressed evening peak. Under this scenario, the DR measures and programs would need to be adapted to apply dual peaking strategies in order to achieve the full achievable potential.

[27] Pre-DR load curves include the impacts of EE, FS, DG and CT for the indicated scenario.

Figure 8-7. Pre- and post-DR typical peak winter day 24h load curve (base scenario, 2040)



Under the Enhanced scenario, once again the net DR potential is notably less than the achievable potential as presented above. In this case, EV DR measures (smart charging and vehicle-to-grid) contribute to reducing the evening peak – however, the system remains evening peaking. Thus, the DR measures are applied to their respective peaks, and the overall net reduction is less than the sum of all DR measure potentials. Once again, this would require an adjustment of the DR measures and programs to account for the dual peaking nature of the system.

Figure 8-8. Pre- and post-DR typical peak winter day 24h load curve (enhanced scenario, 2040)

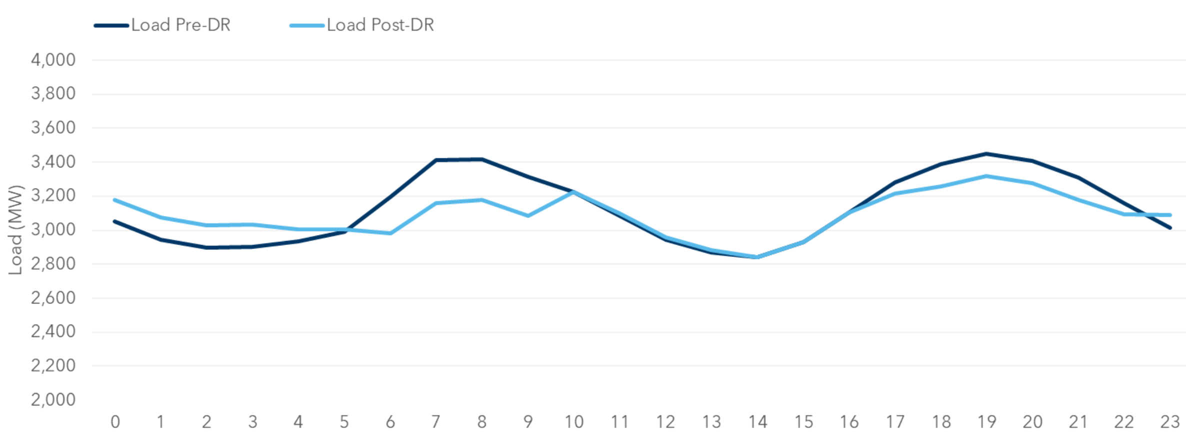


Table 8-5 presents the achievable potentials in 2030 and 2040 alongside the net peak load reduction as derived from the load curve analysis. The achievable potential is reflective of the capacity under DR program control (after accounting for factors such as opt-out and connectivity issues), whereas the net peak load reduction takes into account the effective impact on peak demand.

The impact of the emergence of the dual peaking regime under each scenario is 2040 observable through the diminishing net peak load reduction values. Considering the limitations of this study, **further detailed analysis would be required to fully optimize the use of the available DR potential across all hours and maximize the net peak reductions**

that can be achieved in the later years of the study period. Net peak load reduction could be improved through a staged dispatch of DR measures and leveraging measures which could target both the morning and evening peaks. **This would require adjustments to current strategies and program requirements.**

Table 8-5. Net peak reduction (MW) in 2030 and 2040 for the base and enhanced scenarios

	Achievable Potential		Net Peak Load Reduction	
Scenario	**2030**	**2040**	**2030**	**2040**
Base	166	194	165	136
Enhanced	226	596	192	149
Max	285	708	195	155

8.3 Key Takeaways

Based on the results presented in this section, the following key takeaways emerge:

- **NB Power can increase achievable DR potential both through increased participation in current programs, as well as expanded program offerings.** The results project that in the base scenario, participation in the Peak Rewards program will increase significantly compared to recent program results. In the longer term, however, expanding program offerings to cover residential and managed EV charging opportunities will be key to unlocking further potential.
- **With increasing penetration of EVs, robust managed charging programs will be key to managing peak impacts.** As uptake of EVs increase, and the combined impact of various factors considered in this study (EE, DG, and other DR measures) decrease the winter morning peak, there is a possibility that NB Power's system will shift to a winter evening peak, when the bulk of EV charging occurs. Therefore, as EV penetration increases, it will be necessary to target the winter evening hours when the majority of EVs are charging.
- **NB Power will need to keep a close eye on the magnitude and single/dual peaking nature of demand on its representative peak day and tailor its DR program designs and strategies to the evolving system needs.** The load curve analysis demonstrates that keeping to a rigid morning only or evening only approach for specific DR measures and programs may limit the actual peak reduction benefits available to the DR programs in future years.

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