ATLANTICA CENTRE FOR ENERGY

Atlantic Canada's Electricity Future Discussion Series

Part 2: Electricity Demand

Discussion Series – Part II

September 2022

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Executive summary

The purpose of the second discussion paper in Atlantic Canada's Electricity Future – Discussion Series is to help Atlantic Canadians better understand how federal regulatory changes and policies aimed at achieving net-zero emission by 2050, as well as evolving consumer behaviours, will likely increase electricity demand across the Atlantic provinces. Like the first paper in this discussion series used federal data publicly available through the Canada Energy Regulator's Energy Future 2021 report, this second discussion paper will do the same to help illustrate forecasts of the changing demand for electricity leading up to 2050.

Utilities across Atlantic Canada have developed their own electricity forecasts and resource planning studies. They are actively taking steps to meet the challenges and opportunities posed by federal regulatory changes and policies relating to the supply and demand of clean electricity. As well, utilities are adapting to evolving consumer preferences, both from residents and businesses, which require increasingly green options at affordable prices. Utilities within the region are working to add or import new sources of clean electricity to enable the phase-out of coal-fired electricity generation and other fossil fuel assets, while meeting growing demands from the electrification of transportation and home heating, among others. At the same time, utilities must ensure our electricity supply remains reliably, accessible and affordable.

The transition to net-zero electricity and overall emissions across Canada by 2050 requires additional infrastructure investments which may lead to cost increases across the Atlantic region. However, it is clear, demand-side management, evolving smart grid technologies and changes to consumer behaviour can play an important role in reducing electricity demand and potentially costs.

As provincial governments and utilities continue to prepare for net-zero futures, Atlantic Canadians must understand the corresponding role federal policies and regulations play in shaping the demand for electricity. For examples, the federal government required all light-duty vehicles purchased in 2035 and beyond to be zero-emission vehicles, and the increasing federal price on carbon for heating fuels will pressure residents to convert from fossil fuels to electricity to heat their homes where possible. Prince Edward Island has the highest percentage of residential properties using home heating oil; two-thirds of properties relied solely on medium-efficiency heating oil in 2019[1]. The federal carbon price may increase the cost of home heating oil from adding zero cents per litre in 2022 to 45.45 cents per litre in 2030[2].

Select findings from this discussion paper on electricity demand, using current forecasts from the Canada Energy Regulator's Energy Future 2021 report, show:

- New Brunswick's forecasted demand for electricity would decrease in the Evolving Policies Scenario. This unlikely result is somewhat refuted by the Net-Zero Electricity Base generation forecast, which shows and increase of nearly 3,000 GWh from 2019 to 2050.

- Nova Scotia and Prince Edward Island will have greater percentage increases in electricity demand leading up to 2050 than New Brunswick in the Evolving Policies Scenario and greater generation in the Net-Zero Electricity Base Scenario.

- Prince Edward Island continues to import in the Net-Zero Electricity Base Scenario, while imports to New Brunswick and Nova Scotia are unclear and, likely, relatively insignificant.

- Newfoundland and Labrador demand grows more than Nova Scotia and New Brunswick in the Evolving Policies Scenario, but generation and exports fall significantly in the Net-Zero Electricity Base Scenario.

It is important to recognize a significant finding from the analysis of this data is the lack of realistic, up-to-date modelling scenarios from the Energy Future 2021 report. Following discussions with several stakeholders across Atlantic Canada, it is clear many major assumptions have changed since the report cut-off took place in August 2021, including new federal policies proposed such as the Clean Electricity Regulations, and work towards an Atlantic Loop. These changes are not an indictment of the Canada Energy Regulator, nor the team developing the Energy Future reports. However, it is important for the federal government to make its most sophisticated and current modelling data available to the public moving forward. Furthermore, ongoing collaboration between federal, provincial and utilities planning teams should show consistent forecasts data than what is currently available to the public.

Seven recommendations are included on Page 17 of this discussion paper, which aim to address these concerns with the Energy Future 2021 report, as well provide additional considerations for governments, utilities and consumers better prepare for net-zero emissions by 2050.

By reading this discussion paper on future electricity demand, as well as its prequel in the series, it is increasingly clear federal policies and regulations have significant impacts on both the supply and demand for electricity across Atlantic Canada. By better understanding the future demand for electricity, decision makers can work to ensure electricity is delivered in the most reliable, accessible and affordable ways moving forward. Better understanding of our future energy challenges and opportunities in Atlantic Canada can help increase public buy-in, which is critical to successfully meeting our ambitious goals for net zero by 2050 (2040 in Prince Edward Island).

Introduction

Transitioning Canada to net-zero emissions by 2050 continues to be one of the top priorities for the current federal government. For nearly eight years, there has been a corresponding shift in policymaking as governments at every level begin to plan for what actions are needed to reach the ambitious goal.

With the objective of producing no more greenhouse gas emissions than Canada can sequester, capture or use, it is abundantly clear that life for all Canadian households and businesses will undergo significant change through this transition to net-zero.

Canadians will see their day-to-day lives incorporate more electricity use driving and heating their homes (given rising fossil fuel prices), to using smart watches and e-readers instead of books. Businesses big and small will electrify many of their processes if it is feasible and makes sense, and clean fuels like green hydrogen made from renewable electricity, will help replace from fossil fuels. At the same time, utilities will reply on smart grids and demand-side management to help control the growing need for electricity (both peak load and annual generation). Similarly, buildings and appliances will continue to become more energy efficient.

The federal government has deployed several policies, regulations and programs to help reach net-zero emission by 2050 including changing how we produce fuels and electricity, and how we use it. The government's 2030 Emissions Reduction Plan was released in March 2022 and outlined the expectations of governments, industries and citizens. The four Atlantic provinces have also outlined steps to and goals to help meet this overarching target as well). These changes will accelerate electrification and the integration of clean fuels into our economy.

For the electricity sector in particular, the incoming Clean Electricity Regulations (formerly the Clean Electricity Standard) will likely require net-zero electricity production across Canada by 2035. For consumers, important federal changes include obligations for automakers to manufacture more zero-emission vehicles with all light-duty vehicles sold after 2034 required to be zero-emission.

Several funding policies at the federal and provincial levels are designed to encourage residents and businesses to electrify heating and industrial processes where possible, among others[3]. For example, on September 15, 2022, the Honourable Steven Guilbeault, Minister of Environment and Climate Change announced $118.5 million in funding over four years for the Atlantic provinces to help low-income residents transition off heating oil for homes to cleaner sources like heat pumps[4].

This second paper in *Atlantic Canada's Electricity Future – Discussion Series* looks at forecasted changes in the demand for electricity across New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador until 2050 to help illustrate how current and incoming federal policies could impact the demand for electricity in particular.

Which regulations are shaping Canada's path to net-zero electricity?

In pursuit of reaching net-zero emissions by 2050, the federal and provincial governments have already developed several policies, regulations and funding programs to help reduce emissions and invest in new infrastructure and technologies. The first paper in this discussion series outlines several of the most influential policies and regulations in detail. However, since the first paper was released in June 2022, several of these policies and regulations have been updated, and other important components have been announced.

The following section outlines the policies and regulations which have changed since the first discussion paper was released. For more information on these policies and others, please refer to the *Atlantic Canada's Electricity Future – Discussion Series Part 1: Electricity Supply*.

Emission reduction targets:

On July 18, 2022, the federal government released a discussion paper to develop more specific sectoral targets for the oil and gas sector. *The Canadian Net-Zero Emissions Accountability Act* currently targets reducing greenhouse gas emissions by 40 to 45 percent below 2005 levels by 2030[5]. The federal government is now developing a mechanism to require the oil and gas sector to reduce their own emissions by 31 per cent below 2005 levels in 2030 (42% below 2019 levels)[6]. Mechanisms currently under consideration include a cap-and-trade system which would set a regulated limit on emissions from the sector, and a modified pollution pricing benchmark to create price-driven limits on emissions from the oil and gas sector. The federal government is also considering including natural gas transmission pipelines and downstream refining in the scope of the oil and gas emissions cap.

Carbon pricing and output-based pricing:

The federal government requires each province to price fossil fuels based on each fuel's relative greenhouse gas emissions. The emissions pricing will steadily increase each year from $50 per tonne of CO_2e in 2022 to $170/t in 2030. At the time of this paper's release, the federal government is reviewing amended carbon pricing plans including for the four Atlantic provinces which would be in effect from 2023 until 2030[7]. It is undetermined whether the provincially-developed plans will be accepted by the federal government or if the provinces would fall under the Federal Carbon Pricing Backstop Plan. It has also not been released whether the federal government will continue to exempt home heating fuels from the carbon price in Atlantic Canada.

Clean Fuel Regulations:

The Clean Fuel Regulations (formerly the Clean Fuel Standard) was finalized in July 2022. The The Regulations will now decrease the carbon intensity of these fuels by 15 per cent (below 2016 levels) by 2030, up from roughly 13 per cent previously.

Clean Electricity Regulations:

In July 2022, the federal government released the Proposed Frame for the Clean Electricity Regulations (formerly Clean Electricity Standard). The Proposed Frame will require the phase-out of nearly all conventional fossil fuel electricity generation by 2035. The Regulations will focus on an emissions-intensity cap for energy generation where natural gas-fired generation, for example, will still be allowable outside of emergency cases, but must not exceed CO_2 emission intensity threshold which are yet to be determined. It is excepted these emission caps will be very low and will require carbon capture, utilization and storage technology and/or blending with cleaner fuels.

For more information on the Proposed Frame for the Clean Electricity Regulations and the potential implications for Atlantic Canada, read the Atlantica Centre for Energy's Submission.

Understanding the forecasts

This discussion paper uses the latest data publicly available through Canada's Energy Regulator (CER). The CER regulates energy development, trade and pipelines across Canada. The information collected is from CER's latest Canada's Energy Future 2021 report (EF2021). The EF2021 report uses data primarily from Statistics Canada, Environment and Climate Change Canada, and Natural Resources Canada, as well as provincial data sources[8]. All graphs are included in the Appendices and will be referenced based on the Evolving Policies Scenario (EPS) or Net-Zero Electricity Base Scenario (NZE Base) forecasts. Both the demand and generation forecasts are for annual totals cited in Gigawatt hours (GWh).

- Canada's Energy Future 2021 – Report[9]
- Canada's Energy Future 2021 – Open Data Portal[10]
- Canada's Energy Future 2021 – Key Assumptions for the Evolving Policies Scenario[11]
- Canada's Energy Future 2021 – Key Assumptions for the Net Zero 2050 Scenarios[12]
- Canada's Energy Future 2021 – Detailed Domestic Policy Assumptions for the Evolving Policies Scenario[8]
- Canada's Energy Future 2021 – Overview of the Energy Futures Modeling System[13]

Appendices 1.1 and 1.2 provide regional overviews for EPS demand forecasts. Appendix 1.1 illustrates a relative comparison of electricity demand for each Atlantic province under the EPS, while Appendix 1.2 shows a cumulative demand forecast for the Maritime region.

Appendices 1.3 – 1.6 provide two forecasts for each Atlantic province. First, each provincial demand forecast shows EPS data, with an overlaid generation forecast under the NZE Base Scenario. As the NZE Base generation forecast only provides three data points for each province (2019, 2030 and 2050), a trendline is provided which uses a simple two-year moving average. It is important to note the EPS demand and NZE Base generation forecasts are not assumed to be the same, nor will the NZE

Base generation forecast always be the higher of the two as some electricity imports and exports are excluded from the generation forecast.

Secondly, Appendices 1.3 – 1.6 provide more detailed generation forecasts for 2050 (relative to 2019) for each province under the NZE Base Scenario. These generation forecasts outline the relative shares of electricity generation by source for each province in 2019 and in 2050.

The EF2021 report's Evolving Policies Scenario assumes policy actions to reduce greenhouse gas emissions continue to increase at a pace similar to recent history. For example, the federal price on carbon continues to increase by $15/t annually from $170/t of CO_2e in 2030 to $470/t by 2050. This scenario does not model climate goals or targets, so ambitious goals like net zero by 2050 are unlikely to be met. All policies included in this scenario were announced by August 1, 2021[8,9].

For policies more directly relating to future demand, the EPS assumes new sales of zero-emission passenger vehicles reach 100 per cent by 2035. Other assumptions include accounting for increasingly efficient performance of home appliances and commercial space conditioners, and for new buildings to be "net-zero energy ready" by 2030. Additionally, the EPS incorporated provincially led policies aimed at increasing energy efficiency for home heating, especially in the Atlantic provinces.

It is important to note these demand forecasts, especially for the EPS, are related to the forecasts for generation, capacity and interprovincial trade, which are detailed in first discussion paper.

The NZE Base scenario only provide generation forecasts for 2019, 2030 and 2050 on the path to net-zero emissions for each province. The NZE Base scenario does not provide demand or capacity forecasts for each province[9]. The NZE Base scenario also incorporates government policies in place before August 1, 2021, which excludes regulations proposed in the Clean Electricity Regulations. An annually-increasing carbon price is included at higher prices than in the EPS, and electricity demand is 10 – 30 per cent higher than the EPS, depending on the province.

Last, but not least, stakeholders from across the Atlantic region again raised questions and concerns regarding the accuracy of some assumptions in the Energy Future 2021 report. While the EF2021 report provides a wealth of publicly available information to all Canadians, the Atlantica Centre for Energy does not expect the provincial demand forecasts to be completely accurate.

Forecast limitations

Evolving Policies Scenario (EPS):

In the EPS, there is a short-coming of assumptions that would be valid as of September 2022. This is not a criticism of the team developing the Energy Futures report. Instead, it is clear federal and provincial policies aimed at decarbonizing are advancing quickly, and several important policies have not been incorporated into the EPS as a result.

It is reasonable to expect greater electrification for households and businesses, including transportation, than illustrated by the EPS forecasts for the four Atlantic provinces. There will most likely be a corresponding increase in the demand for electricity across the region. While the EPS includes light-duty vehicle electrification policies for 2035, it does not include the same for medium- and heavy-duty vehicles for 2040 and beyond. Electrification for home heating is likely underestimated as well as several provincial and federal funding programs have been enhanced since August 2021. Furthermore, they may be increasingly demand for electricity in the industrial sector given the increasing stringency of the Clean Fuel Regulations and incoming emissions cap for the oil and gas sector[8].

These few examples of shortcoming with the EPS are overshadowed by the most important forecast limit; the EPS does not meet net-zero emissions in 2050. Relative to 2019 levels, the EPS results show unabated fossil fuel consumption is 62 per cent lower in 2050 than the base scenario, while low-emission energy rises and accounts for 67 per cent of energy use in 2050. However, the EPS shows the use of refine petroleum products remains too high to meet the overarching target of net-zero emissions by 2050[9]. It is expected that increased electrification using clean energy, among others, will be needed to bridge this apparent gap.

It is important to note the EPS's resulting lack of net-zero emissions in 2050 serves as an important realization that additional policies and regulations aimed at reducing emissions will be required in order to met or net-zero targets.

Net-Zero Electricity Base Scenario (NZE Base):

While the NZE Base Scenario satisfies the overarching net zero 2050 goal, there are several limitations and concerns with the assumptions and model. As outlined earlier, there are only three time periods included, with no provincial breakdowns for demand, capacity or interprovincial trade[12].

For the Atlantic region in particular, no forecast is provided for an integration of the proposed Atlantic Loop project[14]. Instead, significant interprovincial trade is only referenced for New Brunswick to Prince Edward Island, although details are lacking. Similarly, increasing electrification is incorporated for the Atlantic provinces, but few details are provided for the assumptions and resulting generation growth. Electricity trade across the region remains important, even if the NZE Base Scenario doesn't forecast significant trading growth. Increasing electricity trade across the region will be import but challenging, especially with increasing electrification of home heating, because peak demand is often influenced significantly by weather, which is similar across the Atlantic provinces and in Québec.

Deployable technologies for generation are limited and do not include several which remain in development including geothermal, tidal, long-term batteries (12-hours). Furthermore, hydrogen development for export is not included. Similarly, international electricity trade is not included.

Significant omissions also include the Clean Electricity Regulations not incorporated into the forecasts as they have not been finalized, so some unabated fossil fuel-fire electricity generation remains in the Atlantic provinces and beyond. Furthermore, the NZE Base Scenario does not include Demand-Side

Management, which will likely play an important role in helping manage peak demand, among other benefits.

Other federal electricity modelling:

The federal government, in partnership with Atlantic provinces and utilities, released the Clean Power Roadmap for Atlantic Canada: Final Report in March 2022. The Roadmap studied the future supply and demand for electricity across Atlantic Canada and provided recommendations and additional areas of study for the viability of an Atlantic Loop to share more clean electricity across the region[14]. The Roadmap referred to modelling done for the study - E3 Electrification and Resource Options Study for the Clean Power Roadmap for Atlantic Canada. In discussions with stakeholders, it is clear this modelling is more sophisticated than that for Energy Futures 2021, and the assumptions more accurately reflect the opinions of utilities within the region.

In part, using this E3 data, the Roadmap found electricity demand is expected to increase significantly across the region between 2020 and 2050; driven, in large part, by "population growth and increased electrification in the transportation, space heating and industrial sectors[14]." Growth in Nova Scotia and Prince Edward Island would see a larger impact given their relatively low levels of space heating.

However, the E3 data forecasted a 74 per cent reduction in emissions from the electricity sector in the region in 2035 from 2005 levels, eventually reaching 95 per cent emissions reduced in 2050. It is unclear if the corresponding results would satisfy the incoming Clean Electricity Regulations, or if any changes to produce increasing clean electricity in the short-term would have a corresponding impact on electricity demand.

Forecast notes

These notes refer to Appendices 1.1 to 1.6.

Regional and sectoral overviews:

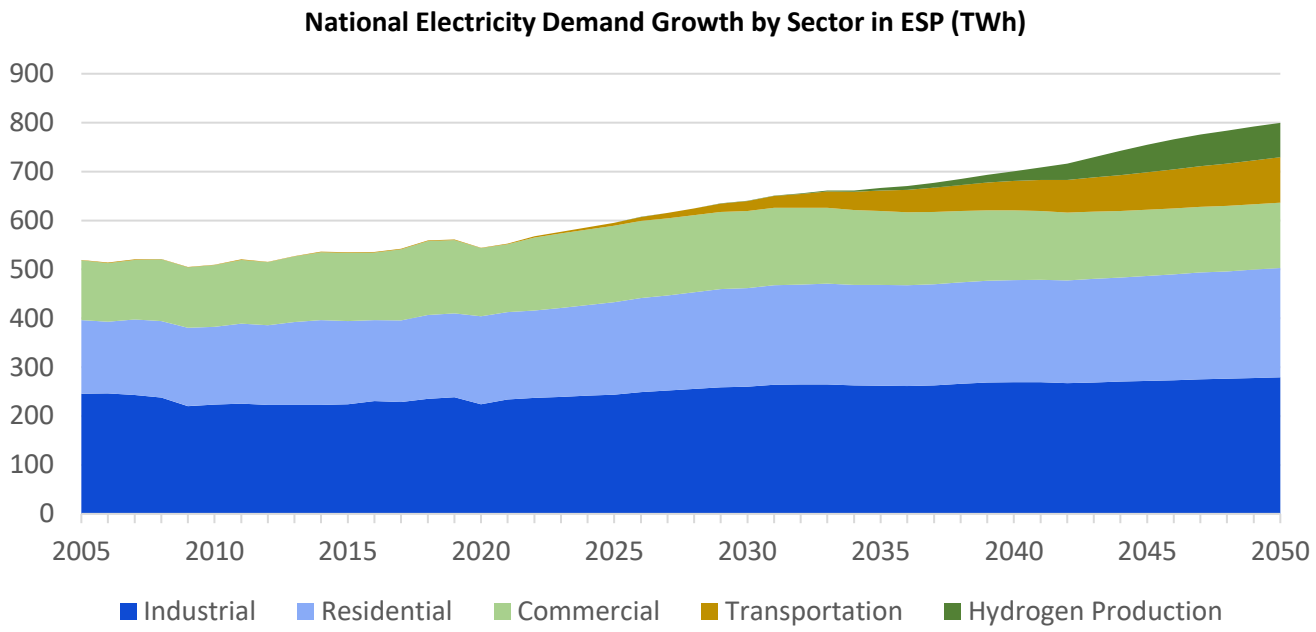
Based on the Canada Energy Regulator's provincial and territorial profiles, New Brunswick has highest combined end-use energy demand of the Atlantic provinces at 233PJ in 2019[15,16,17,18]. However, New Brunswick also has the lowest share of energy demand from fossil fuels (refined petroleum products and natural gas combined (63% in New Brunswick, 68% in Nova Scotia, 69% in Prince Edward Island and 72% in Newfoundland and Labrador). It is not surprising then to see New Brunswick with the lowest forecasted growth in electricity demand in both the Evolving Policies and Net Zero Base Scenarios.

It is also worth noting New Brunswick's end-use energy demand is dominated by the industrial sector (53%)[15,16,17,18]. In contrast, combined energy demand by the industrial sectors in Newfoundland and

Labrador, Nova Scotia and Prince Edward Island were 42 per cent, 20 per cent and 19 per cent respectively. As a result, the rate of electrification in the industrial or commercial sectors may have a significant influence on future electricity demand in New Brunswick in particular.

Nationally, the industrial sector forecast has the greatest end-use electricity demand in 2050 in the evolving policies scenario (279TWh) but the residential, transportation and hydrogen production sectors all grow at faster rates) (see Figure 1)[9].

Figure 1: End-use electricity demand by sector, Canada, Evolving Policies Scenario (TWh)[9]



Source: Canada Energy Regulator, Canada's Energy Future 2021. Figure R.23.

Nova Scotia:

In Appendix 1.3, the Nova Scotia End-Use Electricity Demand Forecasts show electricity demand growth from 2019 to 2050 with the Evolving Policies Scenario and electricity generation growth in the Net Zero Base Scenario. The two-period-moving-average measure projects significant generation growth in the NZE Base Scenario – well beyond the EPS and a greater gap than any other Atlantic province.

This growth is likely related to the high number of residential and commercial properties still using heating oil for space heating, which would transition to electric heat-pumps, among other cleaner heating technologies leading to 2050. In contrast, there is a greater share of residential and commercial properties in New Brunswick using electric heating as of 2019.

Under the NZE Base Scenario, generation grows significantly up to 2050, led almost entirely by a combination of added wind and solar generation, deploying batteries for added storage. This is consistent with national trends. Interestingly, in the NZE Higher Carbon Price Scenario from the Energy Future 2021 report (not pictured), showed future Nova Scotia generation added in-part with nuclear energy, from small modular reactors[9]. It is also important to note Nova Scotia's interprovincial electricity imports to not increase significantly in the NZE Base Scenario[9].

New Brunswick:

In Appendix 1.4, the New Brunswick End-Use Electricity Demand Forecasts show electricity demand decrease from 2019 to 2050 with the Evolving Policies Scenario, but and electricity generation growth in the Net Zero Base Scenario. The two-period-moving-average measure projects generation growth in the NZE Base Scenario, but roughly half the gap seen in the Nova Scotia forecasts. This is likely, in part, because a larger share of New Brunswick's housing and commercial building stocks are already electrified than in the other three Atlantic provinces[19]. As well, the overall demand growth for the Maritime provinces decreases over the 2005-2050 period in the EPS due to the drop in forecasted electricity demand decrease in New Brunswick (see Appendix 1.2).

In contrast, NB Power's forecasts in the 2020 Integrated Resource Plan show provincial load increasing from 14,446 GWh and a peak load of 3,142MW in 2021, to 16,501GWh and 3,340MW in 2040 (before Energy Smart NB Impacts)[20].

Under the NZE Base Scenario, New Brunswick's forecasted generation grows slightly from 2019 to 2050 (with a decline in 2030). It is important to recognize the NZE Base forecast also notes New Brunswick exports more electricity to Prince Edward Island in 2050 (about 30% more). Of the generation added in the NZE Base Scenario, New Brunswick would see reduction in electricity generated by natural gas and other fossil fuels, as well as hydro, and replaced in large part by wind and solar generation, as well using battery storage.

It is unknown why hydro generation decreases significantly in the NZE Base Scenario; this may be relating to a forecasted retirement of the Mactaquac Dam which currently generates roughly 1,600GWh annually, if favor of alternative generation sources. However, according to New Brunswick Power's 2020 Integrated Resource Plan, the Mactaquac Life Achievement Project should be completed by 2033 and would see continued future generation of 668MW until at least 2068 (the Dam would operate at a slightly reduced capacity (556 MW) during the refurbishment period)[20].

Nuclear generation would continue in the province in the NZE Base Scenario, although current capacity would be partially replaced by small modular reactors, with less nuclear generation in 2050 than 2019. New Brunswick would be Ontario would be the only two provinces with nuclear generation in 2050 in the Scenario. However, in 2022, the governments of Alberta, Saskatchewan, Ontario and New Brunswick released a joint Strategic Plan for the Deployment of Small Modular Reactors[21].

Prince Edward Island:

In Appendix 1.5, the Prince Edward Island End-Use Electricity Demand Forecasts show electricity demand growth from 2019 to 2050 with the Evolving Policies Scenario and electricity generation growth in the Net Zero Base Scenario. Prince Edward Island has the greatest demand growth rate of the four Atlantic provinces in the EPS, as well as the greatest growth rate in the generation forecast in the NZE Base Scenario. However, electricity demand (ESP) in 2050 remains greater than generation (NZE Base) so it is clear Prince Edward Island will continue importing a significant share of electricity needed from New Brunswick (the Energy Future 2021 report indicates New Brunswick to Prince Edward Island electricity exports in 2050 are about 30 per cent higher than current levels)[9].

The Island's Energy generation is forecasted to be bridged by significant additions to wind and solar energy, as well as battery deployment for storage.

Newfoundland and Labrador:

In Appendix 1.6, the Nova Scotia End-Use Electricity Demand Forecasts show electricity demand growth from 2019 to 2050 with the Evolving Policies Scenario and electricity generation growth in the Net Zero Base Scenario. This growth is the greatest amount of the four Atlantic provinces between 2019 and 2050. However, the two-period-moving-average measure projects significant decrease generation growth in the NZE Base Scenario between 2030 and 2050, after a forecasted increase between 2019 and 2030. It is unclear by the NZE Base Scenario forecast decreases after 2030 but could be related to the unknown future of the Churchill Falls project (34,000GWh generated in 2018)[22,23]. It is important to note hydro generation in the EPS supply forecasts showed no corresponding decrease (see *Atlantic Canada's Electricity Future – Discussion Series Part 1: Electricity Supply*, Appendix 1.7). Newfoundland is one of four provinces, where electricity generation is dominated by hydropower (British Columbia, Manitoba, and Québec are the others)[9].

Comparison with Nova Scotia Power forecasts

In November 2020, Nova Scotia Power released its 2020 Integrated Resource Plan (2020 IRP), which outlined, in great detail, the utility's forecasted capacity, generation, demand and costs until 2045[24]. The 2020 IRP provided low, mid and high scenarios for pricing, longevity of assets, energy efficiency, demand-side management, and demand response, among others[25,26]. Modelling for the 2020 IRP also considered the impacts of distributive energy, like rooftop solar installations, as well as the ability of the Nova Scotia grid to integrate more renewable electricity generation.

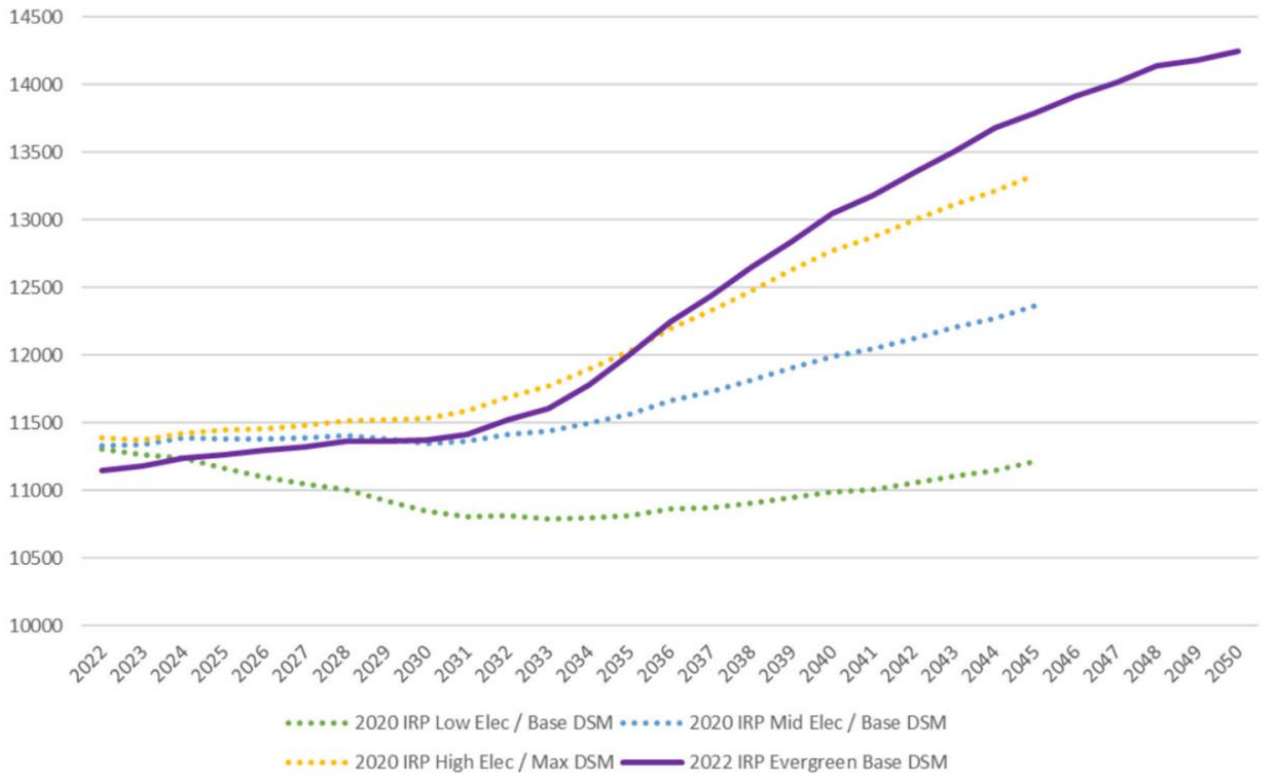
The 2020 IRP's modelling was more in-depth than those used in the Energy Future 2021 report and arguably used accurate assumptions as it is being done by the utility itself. The corresponding demand from the high-electrification, base demand-side management model (Figures 1 and 2) is greater than the forecast in the EPS. However, demand is much lower than generation in the NZE Base Scenario.

Nova Scotia Power is currently developing its 2022 Evergreen Integrated Resource Plan (2022 IRP), which is scheduled to provide final modelling results by late 2022. The 2022 IRP will include a net-zero 2050 scenario and modelling scenarios to reflect the province's Renewable Electricity Standard, the Clean Electricity Regulations, and potential hydrogen export, among others. Importantly, the 2022 IRP will also include scenarios with an Atlantic Loop and without[27].

It is noteworthy the 2022 IRP's draft cost assumptions for the varying electricity sources differ from those used in the NZE Base Scenario. Most costs are higher than those in the NZE Base Scenario. In particular, the cost of four-hour battery storage, used in part to help integrate more wind energy onto the grid, is roughly 2.5 times the 2030 capital cost in the NZE Base Scenario[12, 26].

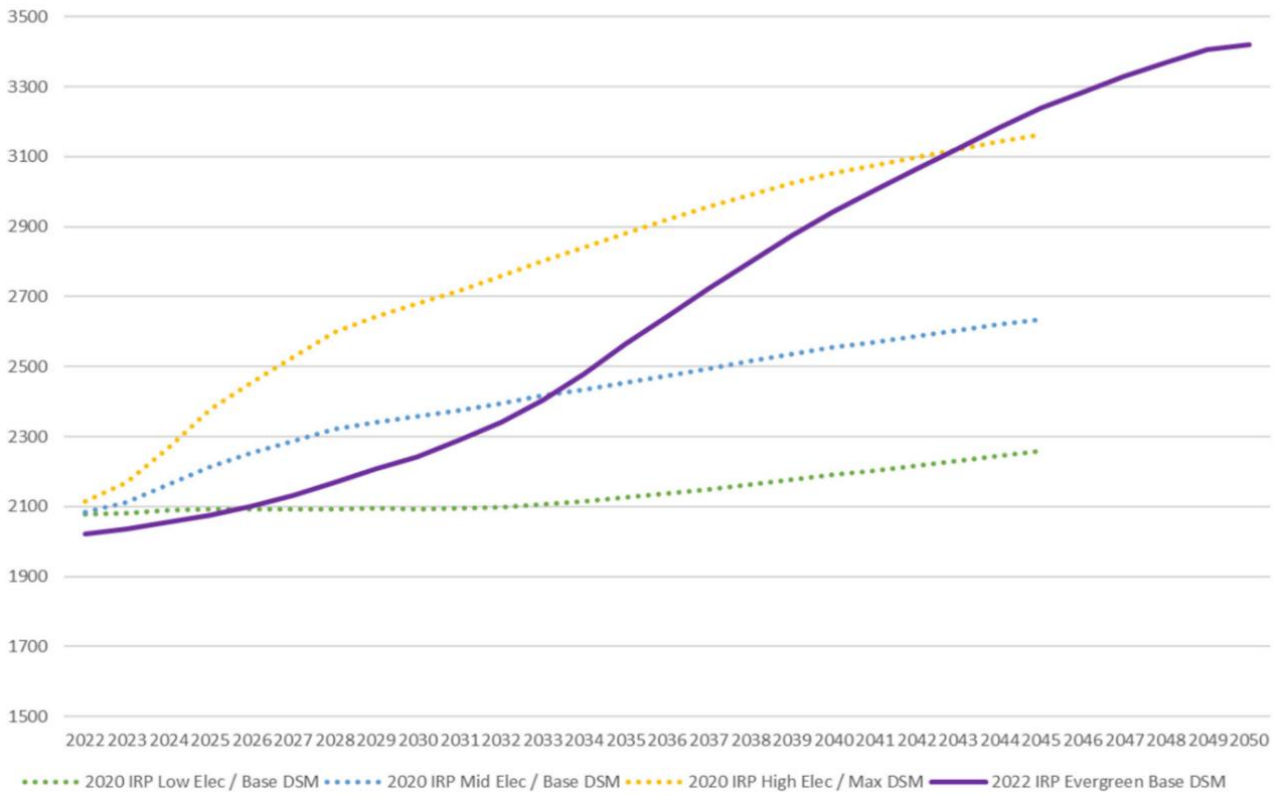
Figures 1 and 2 reveal both peak and annual electricity demand forecasts in the 2022 IRP will increase sharply after 2032 and will go significantly higher than those in the 2020 IRP in 2045 and beyond. It is clear, government policies and consumer behaviour changes within the last two years are influencing the demand for electricity in Nova Scotia. However, the 2022 IRP annual demand forecast remains significantly lower than the NZE Base Scenario generation for 2050. This could, in part, be related to absent considerations for demand-side management in the NZE Base Scenario.

Figure 2: NSP 2022 Evergreen IRP and 2020 IRP annual electricity demand forecasts (GWh)[27]



***Source: Nova Scotia Power, 2022 Evergreen Integrated Resource Plan, Updated Assumptions*[27].**

Figure 3: NSP 2022 Evergreen IRP and 2020 IRP peak electricity demand forecasts (MW)[27]



***Source: Nova Scotia Power, 2022 Evergreen Integrated Resource Plan, Updated Assumptions*[27].**

What do these net-zero policies mean for electricity demand in Atlantic Canada?

Electricity demand will increase across the Atlantic region leading to net-zero emissions in 2050. How much demand will increase though is unclear from the available Energy Future 2021 data, both in terms of annual GWh, but even more in terms of potential increases to peak demand (MW).

There have been many new and rapidly evolving federal and provincial policies, regulations and funding programs are influencing the future demand for electricity. As well, evolving consumer behaviours, both from a growing awareness and motivation to be greener, as well as in response to federal policies such as carbon pricing.

It is evident, as well from the first discussion paper on electricity supply, that Atlantic Canada will need to build new electricity infrastructure to replace outgoing fossil fuel-fired generation. It is also evident that new generation capacity and annual output must be added to meet growing demand from electrification and population growth, among others. Transitioning to electric vehicles, using heat pumps, electrifying industrial processes will all increase peak demand and annual electricity consumption in each of the four Atlantic provinces (See Cases 1 and 2).

Case 1: Example of potential electricity demand growth (MW) from heat pumps[26,28]

Heat Pumps – Nova Scotia Example

According to Natural Resources Canada, Nova Scotia had 237,000 residential heating systems using medium-efficiency heating oil in 2019. Nova Scotia Power's 2020 Integrated Resource Plan forecasted building electrification (primarily by switching building heating systems to use electric heat pumps) to add significant peak demand to the provincial grid. In the Moderate Electrification Scenario, which modelled 50 per cent of electric heat pump sales by 2030 (replacing fossil fuel systems), in addition to energy-saving building efficiencies. The High Electrification Scenario instead forecasted demand based on 100 per cent of electric heat pump sales by 2030.

The results are significant; the High Electrification Scenario would add between 304 MW and 1080 MW to peak demand, depending on the temperature of the coldest day and the heat pump technologies used. The Moderate Electrification Scenario would generate a smaller added peak impact of between 155 MW and 552 MW.

For example, the High Electrification Scenario forecast for the space heating electrification in Nova Scotia Power's 2020 Integrated Resource Plan sees between 304 MW and 1080 MW added to peak demand, depending on the heat pump technologies being used and the temperature of the coldest day observed[18].

Case 2: Example of potential electricity demand growth (MW) from electric vehicles[29,30,31,32,33]

Electric Vehicles – New Brunswick Example

2022 Telsa Model 3 – RWD
60kW battery
8.5 hours to charge (level 2 charger)
489,507 NB registered vehicles (<4,500kg) travelled 13,242,600,000km (2009)
27,053km travelled per vehicle, on average (2009)
553,244 NB registered vehicles (<4,500kg) (2019)
438km vehicle range
1.2 refills per week, per vehicle

If there were 500,000 electric vehicles in New Brunswick today:

- You would need to fully charge 85,000 vehicles per night for 8.5 hours each (L2 charger)
- This could require **600MW** of additional electricity.

In New Brunswick, using the most efficient electric vehicle available in 2022 as an example, could see an additional 600MW added to daily peak demand depending on when consumers refill their vehicles[29,30,31,32,33]. This 600MW demand for added capacity is roughly equivalent to building an additional Point Lepreau Nuclear Generating Station (660MW as of March 31, 2022)[20].

However, adoption rates also depend on the price and availability of these newer electric technologies. As we are already seeing in some Atlantic provinces and other jurisdictions across the world, electricity prices are increasing with input costs soaring and new investments being made to transition to clean fuels. Recent availability of electric vehicles (or lack thereof) has also been a challenge for some Canadians. It will therefor be important for the provinces, utilities, residents and businesses in Atlantic Canada to do their best to manage demand increases, peak and otherwise, to ensure transition to net zero is as affordable as possible.

"Electricity demand is expected to increase significantly across the region between 2020 and 2050, largely driven by population growth and increased electrification in the transportation, space heating and industrial sectors. Electricity system costs are also expected to increase as greenhouse gas emissions are reduced."

- Clean Power Roadmap for Atlantic Canada: Final Report[14]

Recommendations

The transition to net-zero electricity by 2035 and net-zero emissions by 2050 requires collaborative effort between the Atlantic provinces and federal government. The transition will also require governments to work increasingly with the private sector and communities to manage demand as electrification grows, while ensuring infrastructure is in place to meet that growing demand.

The Atlantica Centre for Energy proposed six recommendations in the first discussion paper in this series. The Centre offers the following additional policy recommendations to help guide governments and utilities in better managing these net-zeros transitions:

PUBLISHING DATA: Federal and provincial governments must improve access to the most current and reliable energy forecasting data used to make policy decisions. Governments can help improve energy literacy and, hopefully, public buy-in for the important energy changes to come.

DATA SUPPORTING DECISIONS MADE: Federal and provincial governments should work provide more data when proposing or implementing policy, regulatory or programming changes that will influence energy supply and demand.

DEMAND-SIDE MANAGEMENT: Consumers should consider the potential benefits from integrating DSM into electrifying homes and transportation. For example, potential future options to allow the utility help to manage when an electric vehicle charges overnight or turn off an electric hot water heater during the weekday could help reduce demand and costs as well.

ENERGY EDUCATION: The federal and provincial governments should further improve access to information to help consumers (residential and business) make informed decisions to help reduce their electricity demand. These efforts should include continued information sharing through utilities, more from governments, as well as classroom learning and partnering with non-profit organizations.

ELECTRICITY ALTERNATIVES: New customers should also consider clean and relatively clean alternatives to heating homes and businesses where available including biomass (e.g., wood pellets), installing solar panels and/or batteries, and natural gas and other clean fuels.

ELECTRICITY DIVERSITY: Ensure electricity supply in provinces and within regions remains diverse and secure. Governments and utilities must weigh the possible opportunities and challenges of increasing reliance on interprovincial trade or deploying one predominant source of electricity such as wind combined with battery storage.

SUPPLY CHAINS: Transitioning to renewable electricity will rely, in part, on batteries. Canada is resource rich, and governments should ensure there is a growing domestic supply chain for raw materials and other technologies to support the transition to cleaner energy.

These recommendations are not comprehensive, and the Atlantica Centre for Energy will share additional policy recommendations in the third electricity discussion paper to follow.

Closing thoughts and next steps

Given the requirements for cleaner electricity generation over the next 13 years, combined with increasing demand due to electrification and population growth, governments and utilities must work fast to build new electricity infrastructure to power our net zero future.

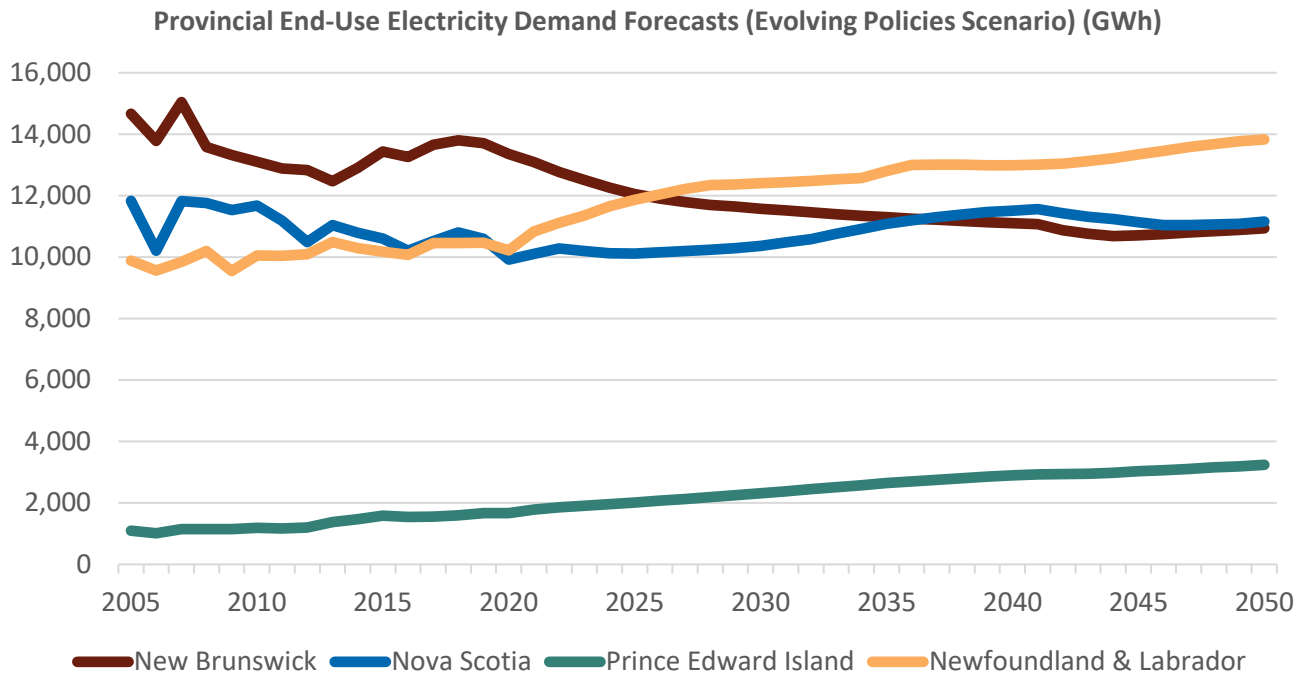
Future electricity demand across Atlantic Canada remains unclear though after dissecting the Energy Future 2021 Evolving Policies and Net-Zero Electricity Base Scenarios. The Evolving Policies Scenario demand forecasts are out-dated given rapidly evolving government policies, regulations, and programs. These forecasts likely underestimate future electricity demand in each of the four provinces.

The Net-Zero Electricity Base Scenario generation forecasts are much higher, possibly too high, and omit important modelling considerations including demand-side management and the potential for an Atlantic Loop. Furthermore, these forecasts exclude import datasets from the public's view including peak demands and interprovincial trade.

Future demand forecasts from Atlantic utilities can likely provide more accurate data to residents and businesses, but not all public forecasts have been updated to reflect important federal regulations such as the incoming Clean Electricity Regulations, or evolving adoption curves for heat pumps.

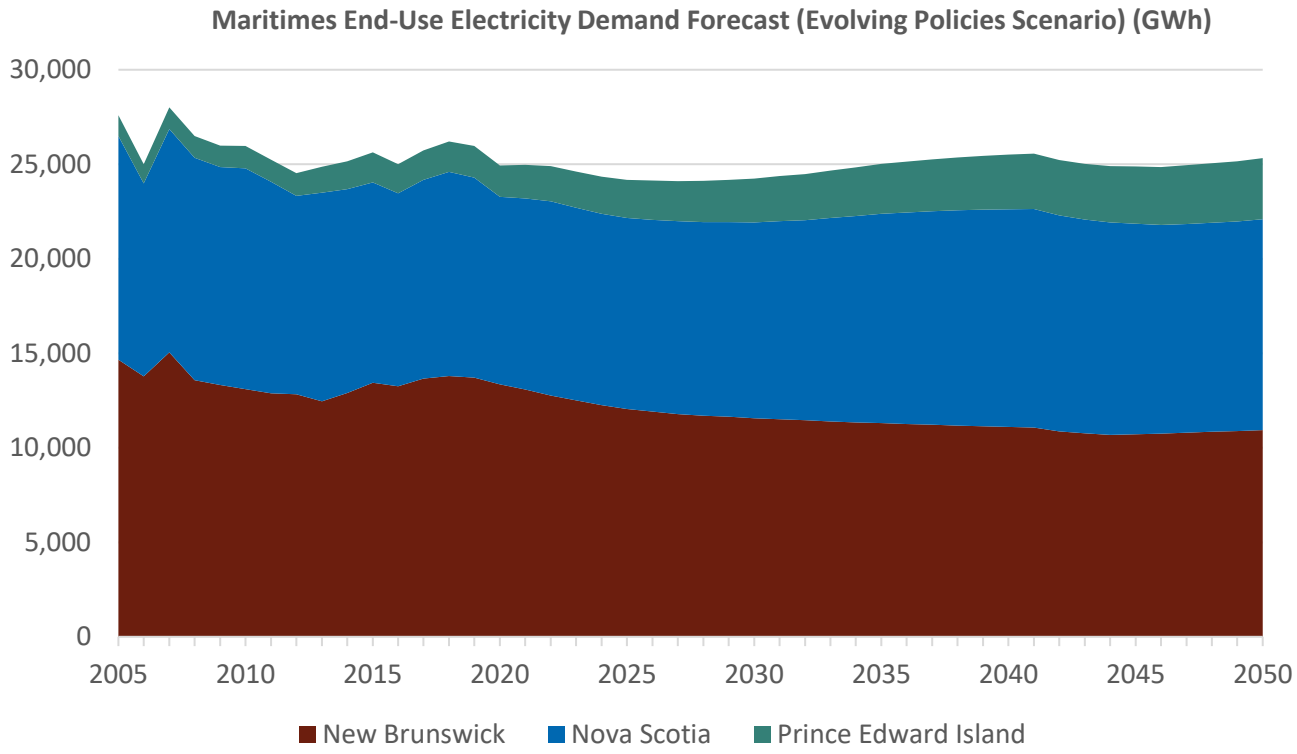
Next, we must better understand cost to bridge the gaps between the current supply of clean electricity in Atlantic Canada with future demand. The Atlantica Centre for Energy's next electricity discussion paper will focus on forecasting future electricity pricing across the four provinces to help residents, businesses and leaders to better prepare for this transformational change.

Appendix 1.1: Atlantic Canada electricity demand forecasts (EPS), by province



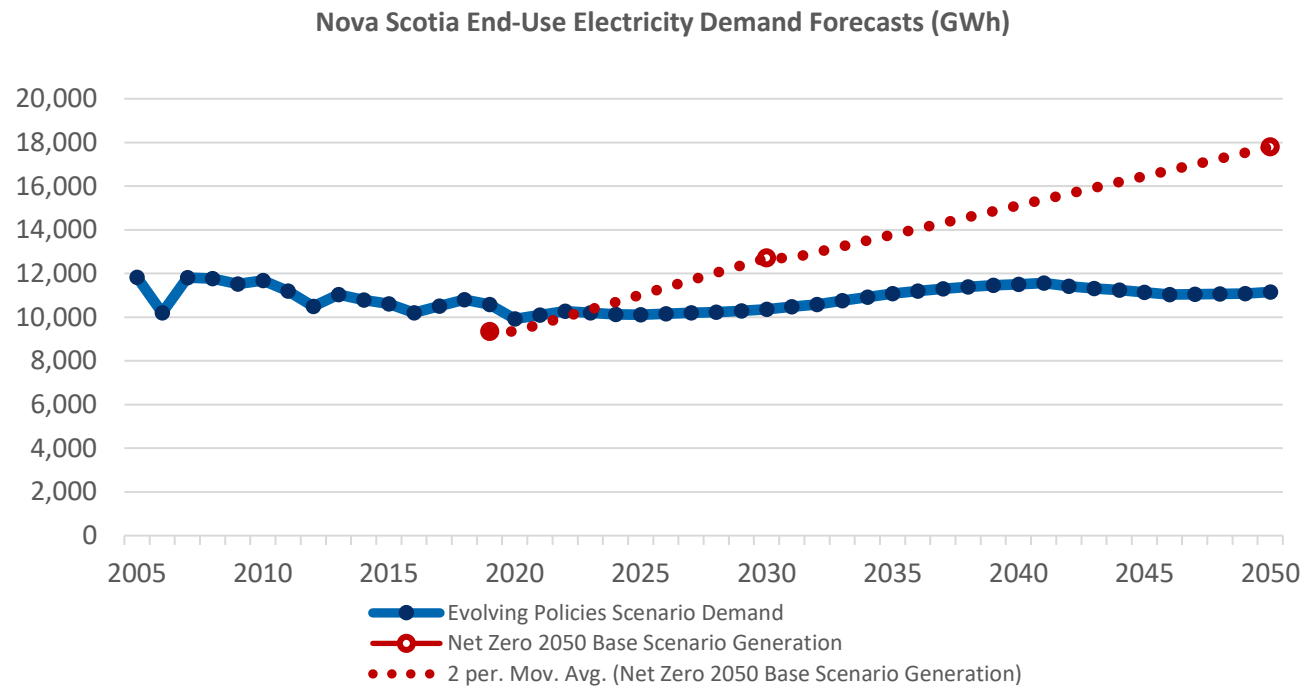
Source: Canada Energy Regulator, Canada's Energy Future 2021, Evolving Policies Scenario.

Appendix 1.2: Maritime region electricity demand forecasts (EPS), cumulative

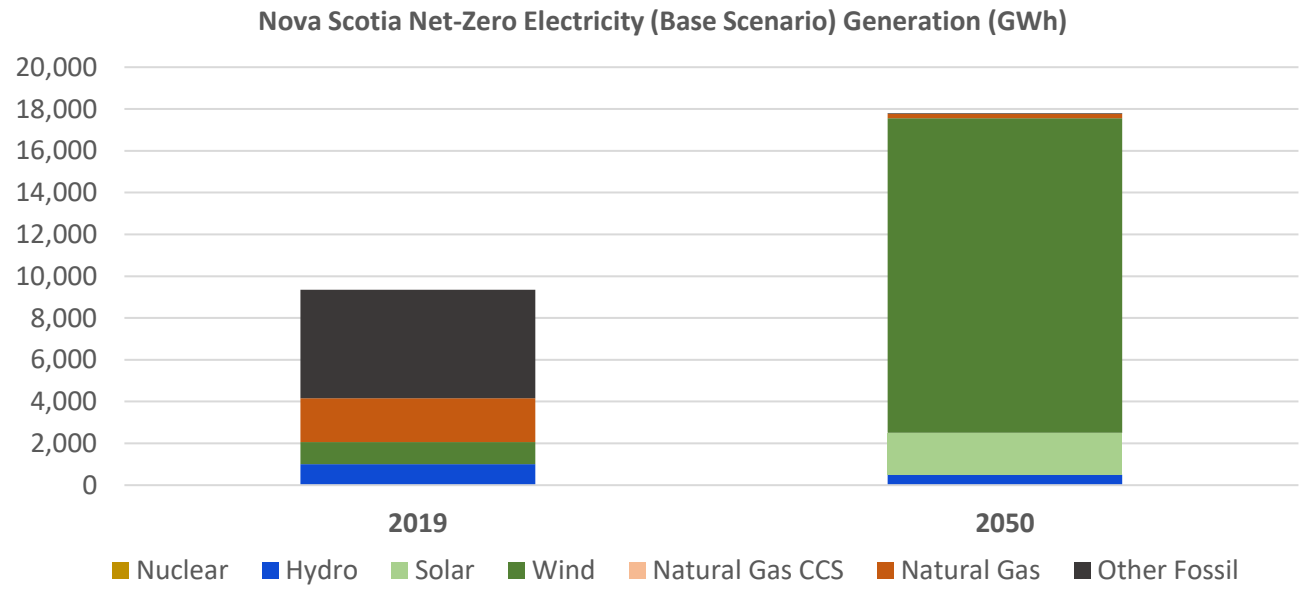


Source: Canada Energy Regulator, Canada's Energy Future 2021, Evolving Policies Scenario.

Appendix 1.3: Nova Scotia forecasts

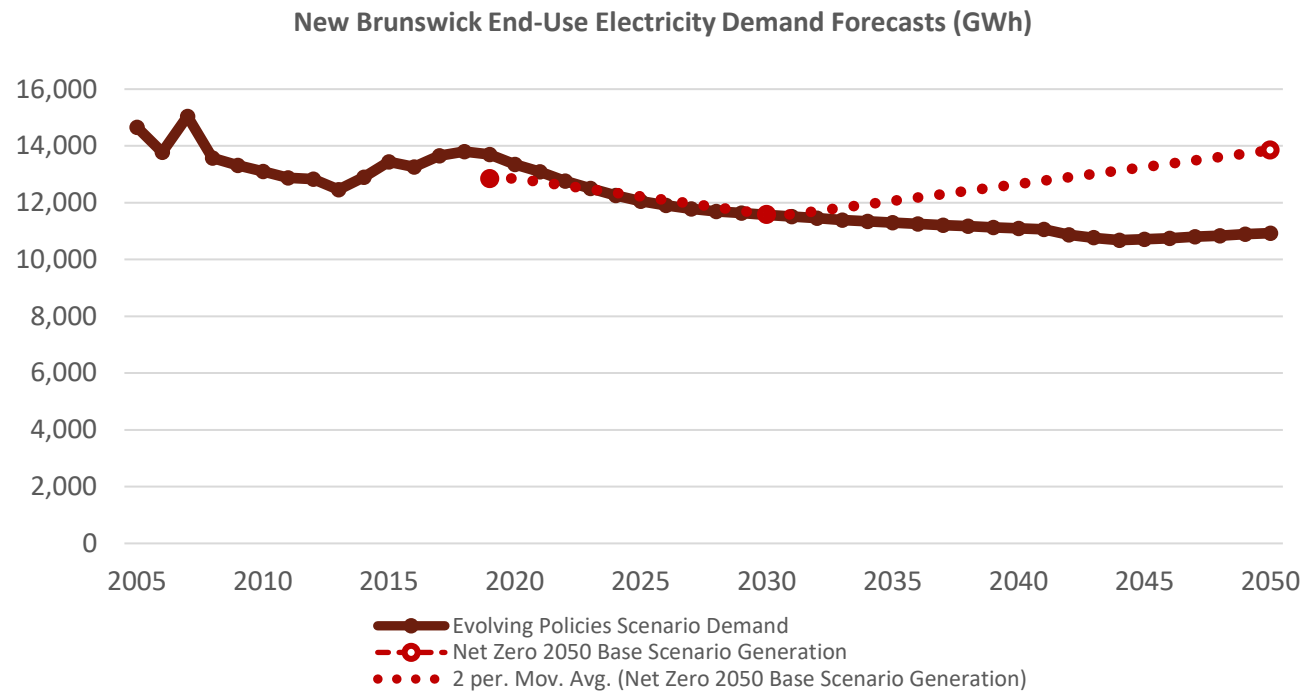


Source: Canada Energy Regulator, Canada's Energy Future 2021, Evolving Policies Scenario.
Canada Energy Regulator, Canada's Energy Future 2021, Net-Zero Electricity Base Scenario.

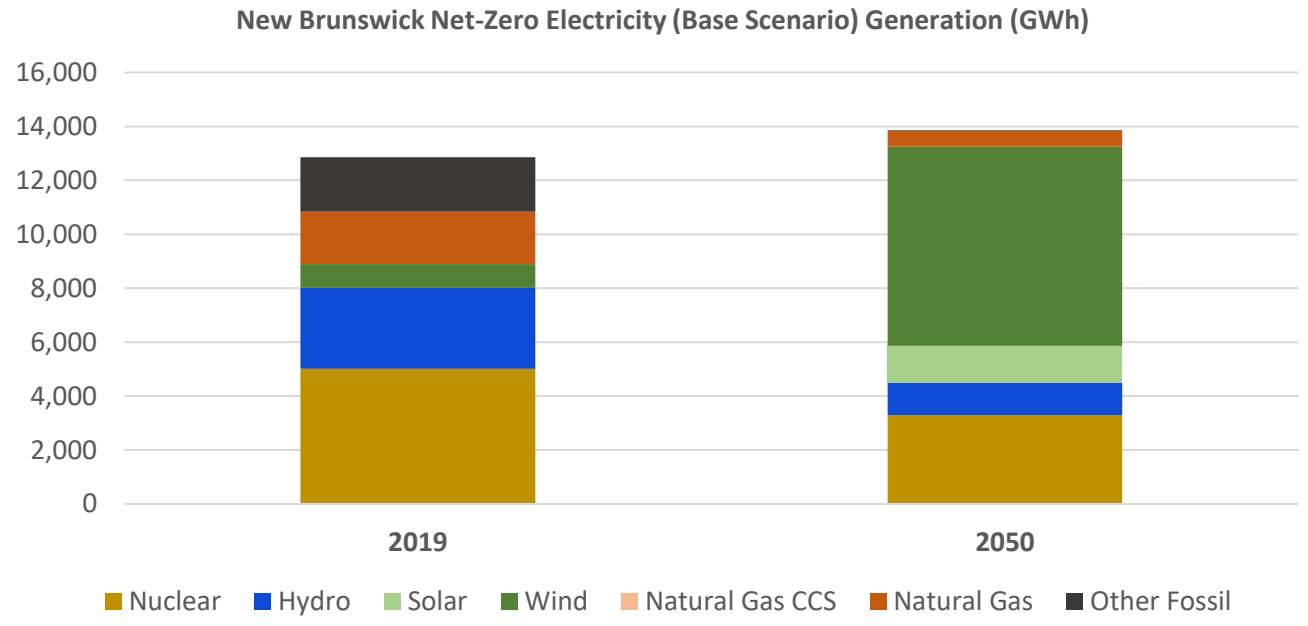


Source: Canada Energy Regulator, Canada's Energy Future 2021, Net-Zero Electricity Base Scenario.

Appendix 1.4: New Brunswick forecasts

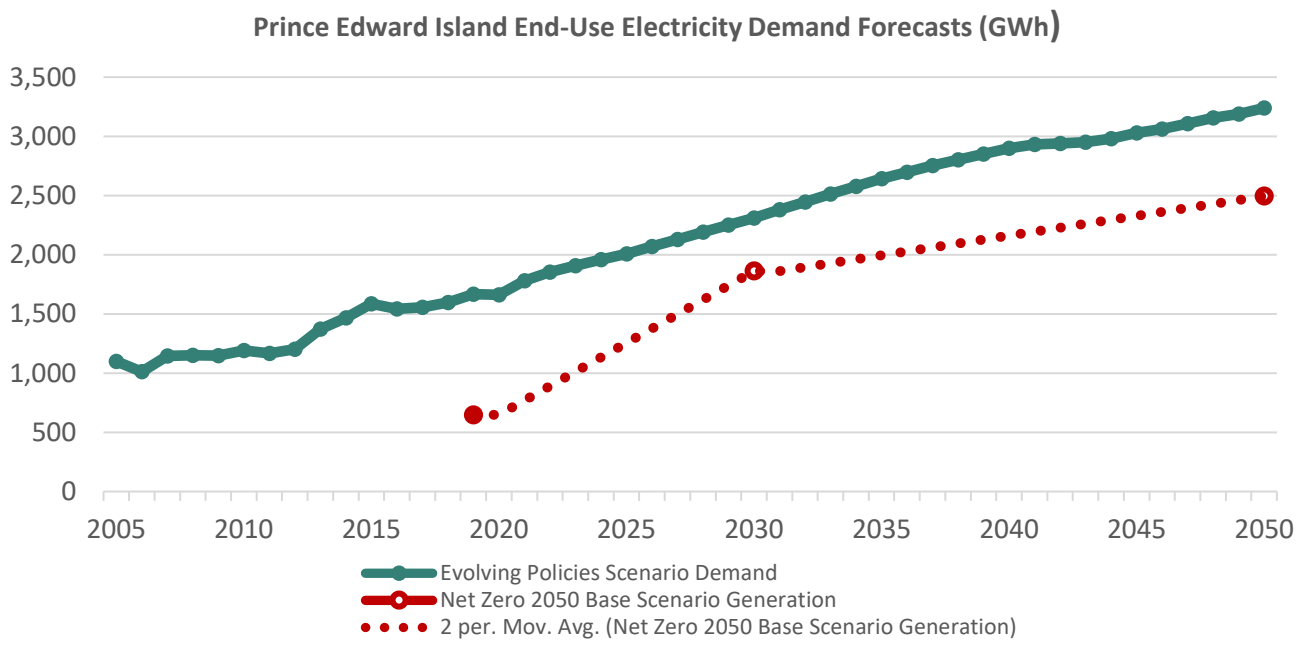


Source: Canada Energy Regulator, Canada's Energy Future 2021, Evolving Policies Scenario.
Canada Energy Regulator, Canada's Energy Future 2021, Net-Zero Electricity Base Scenario.

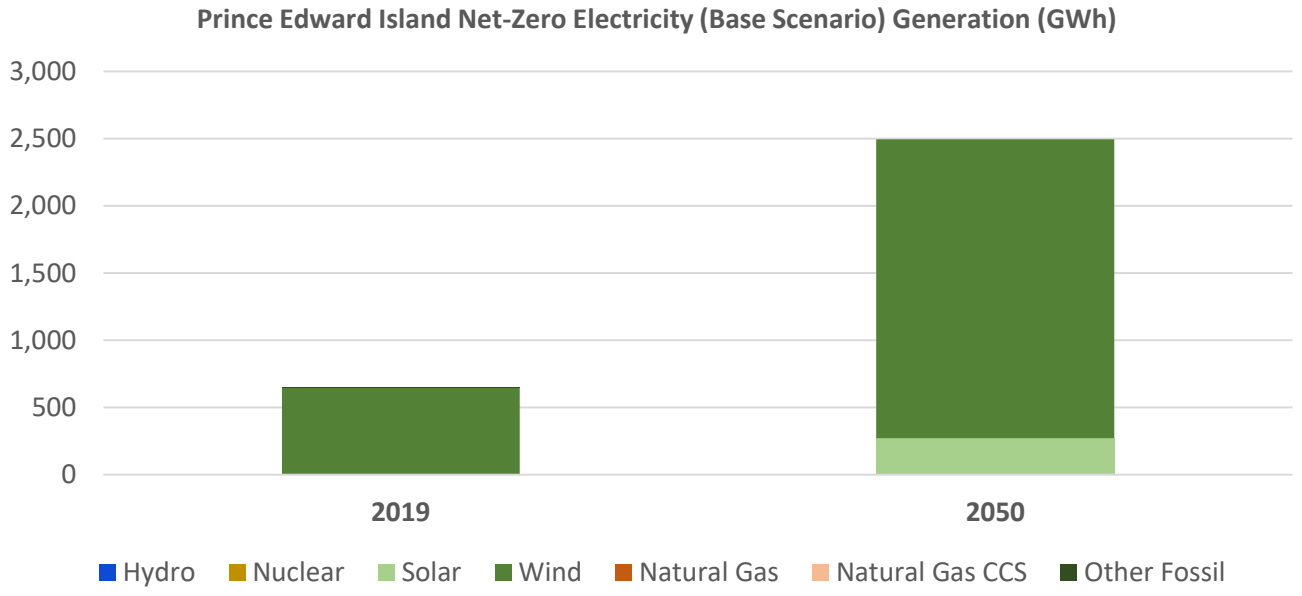


Source: Canada Energy Regulator, Canada's Energy Future 2021, Net-Zero Electricity Base Scenario.

Appendix 1.5: Prince Edward Island forecasts

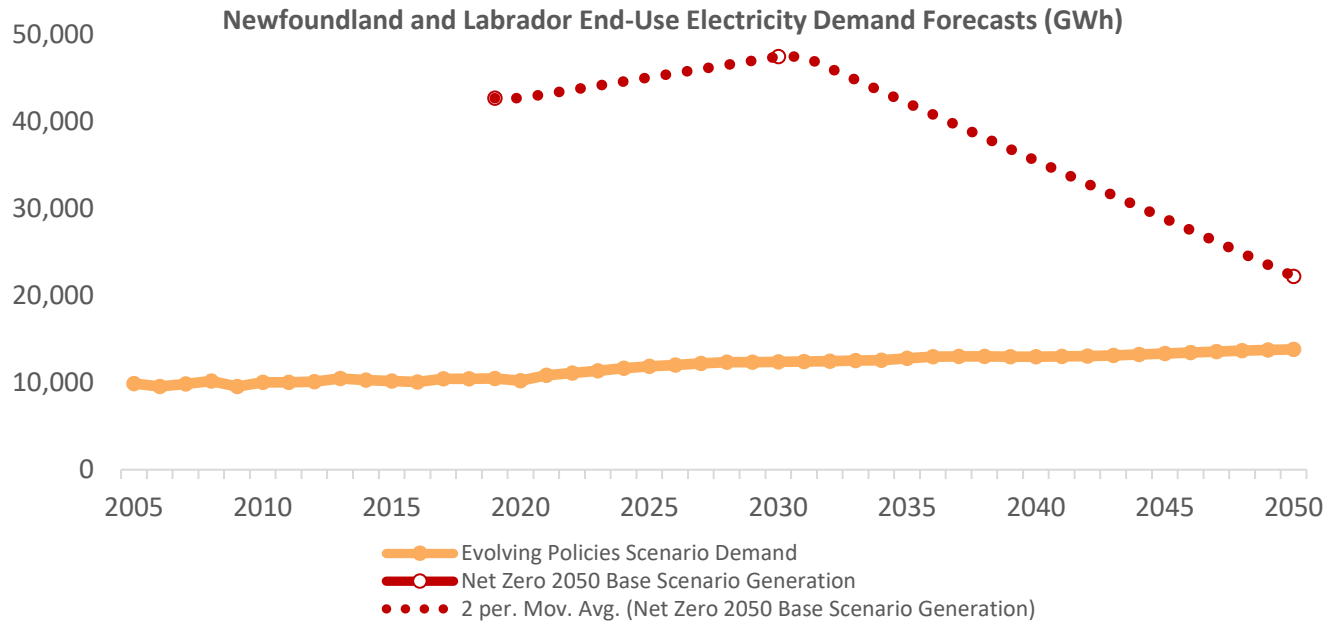


Source: Canada Energy Regulator, Canada's Energy Future 2021, Evolving Policies Scenario.
Canada Energy Regulator, Canada's Energy Future 2021, Net-Zero Electricity Base Scenario.



Source: Canada Energy Regulator, Canada's Energy Future 2021, Net-Zero Electricity Base Scenario.

Appendix 1.6: Newfoundland and Labrador forecasts



Source: Canada Energy Regulator, Canada's Energy Future 2021, Evolving Policies Scenario.
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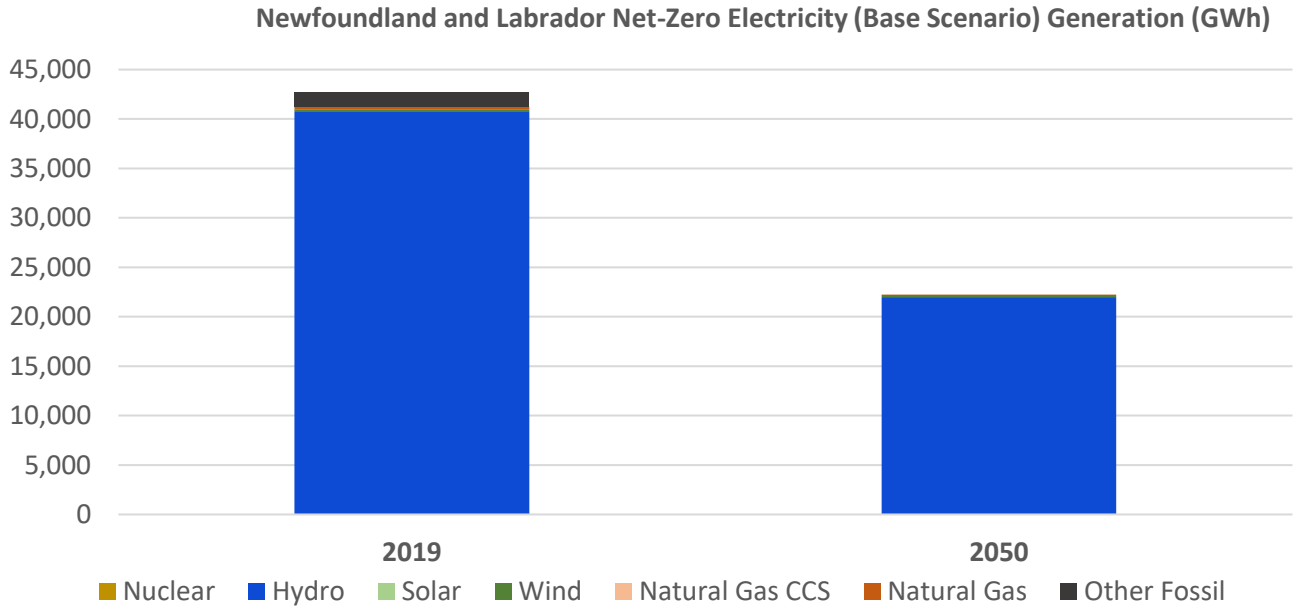

Source: Canada Energy Regulator, Canada's Energy Future 2021, Net-Zero Electricity Base Scenario.

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This discussion paper was produced by the Atlantica Centre for Energy.

The Centre provides a unique forum for government, the education and research sectors, industry, and the community at large to foster partnerships and proactively engage in energy-related issues in Atlantic Canada. Energy education is an important priority.

More information about the Centre is available at www.atlanticaenergy.org.

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