



Electricity Review Report

Draft – February 18th, 2015



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EXECUTIVE SUMMARY

In fall 2013, the Government of Nova Scotia passed the Electricity Reform (2013) Act. The act committed government to conducting a comprehensive review of the province's electricity system, including a public consultation.

For the first time in over a decade, all aspects of the system were studied, with particular focus on

- emerging technologies
- market trends in supply and demand
- trends in the oversight and delivery (governance and structure) of Nova Scotia's electricity marketplace

The review took place in two phases that included (1) sharing expert findings and (2) consulting with Nova Scotians. Engagement efforts in both phases focused on hearing from experts, stakeholders, and the public.

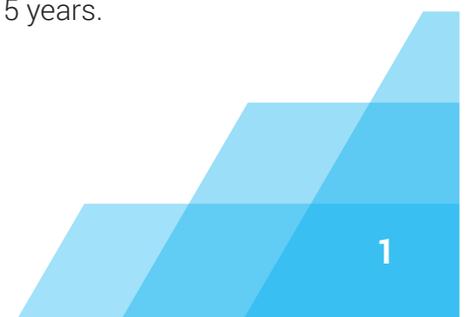
The first phase included gathering and sharing information related to our electricity system, mainly through technical studies and other materials posted on our webpage, novascotia.ca/electricityfuture.

The second phase focused on speaking with Nova Scotians (public and stakeholders) about their views on key elements of our future electricity system. The department received feedback from more than 1300 Nova Scotians through telephone surveys, face-to-face meetings, webcasts, and written submissions.

We learned a lot from experts, stakeholder groups, and the public. While there was not always agreement, there was enough consensus on most topics to provide direction as we move forward with the development of our future electricity plan.

The experts who were contracted to study supply and demand, emerging technologies, and governance set the context. They told us that

- Our electricity needs depend on variable and complex factors. We will need between 8 and 13 gigawatt-hours (GWh) of electricity each year to meet our predicted demand over the next 25 years. We use about 11 GWh per year today.
- An expected small but steady increase in demand (1.2 per cent per year) can likely be mitigated through demand-side management and efficiency.
- We should be able to produce enough energy from current and committed projects to meet our needs and environmental targets for the next 10 to 15 years.



- We need to focus our planning toward 2030, when a number of factors will combine to open up opportunities for new energy projects.
- We likely don't have a large enough market for full-scale market liberalization, but there are opportunities to increase competition, consumer choice, and transparency, and better align the interests of utility shareholders and ratepayers.

Nova Scotians (both stakeholder groups and individual citizens) have told us that they value the environment and generally support investment in renewable energy when it makes financial sense. They recognize the importance of using a diverse mix of fuel sources to protect against price volatility and ensure a secure energy supply.

Overall, they support investment in innovative ideas and technologies that make better use of our existing renewable resources, such as storage and energy management systems. However, they don't necessarily agree on who should finance the investments, and they tend to support pilot projects over widespread adoption of unproven technologies.

Most review participants told us that they want long-term rate stabilization and predictable electricity rates. At the same time, they care about energy affordability for low-income Nova Scotians and for businesses.

We also learned that there is support among Nova Scotians for more focus on small-scale electricity production. A number of Nova Scotians are looking for opportunities to make their homes, businesses, and communities more self-reliant in terms of energy production.

Nova Scotians generally support increased regional solutions. Given our relatively small market, most participants said that increasing our market regionally would benefit our system and give us more import and export opportunities.

Overall, Nova Scotians want to be empowered to be part of good choices and an environmentally sustainable, cost effective path forward that benefit both the rate base and future generations.

Nova Scotians expressed a variety of opinions on how our electricity market should be governed. These range from a fully open market, to evolving into a market where generation is separate from transmission and distribution, to only focusing on the changes that provide the most immediate benefit to Nova Scotians in terms of cost effective and quality service.

Generally, Nova Scotians support a move to a system where Nova Scotia Power Inc.'s (NSPI) performance counts for more when determining their profits. Such a system could include penalties when basic service standards are not met and a sharing of savings if cost targets are exceeded. Review participants generally unsure of how power rates are set, and want to see more accountability and transparency from utilities and the Utility and Review Board.

All input gathered through the review process will be considered as the Department of Energy develops the province's future electricity strategy in 2015.

PROJECT OVERVIEW: ELECTRICITY REFORM (2013) ACT

In fall 2013, the Government of Nova Scotia passed the Electricity Reform (2013) Act. The act has two key components related to our electricity system.

Renewable to Retail Market Opening

The first is the creation of a Renewable to Retail program, which would allow independent power producers (IPP) to sell renewable electricity directly to willing customers. This would allow for more competition in who supplies electricity within the province.

Nova Scotia Power Inc. (NSPI) is leading a stakeholder process to develop a Renewable to Retail Market Opening application for submission to the Utility and Review Board (UARB) by September 1, 2015. More information can be found online.¹ Through the program, individual homes and businesses will be able to contract with eligible renewable electricity producers in Nova Scotia directly to purchase low-impact renewable electricity.

Electricity System Review

The second part of the act committed government to conducting a comprehensive review of the province's electricity system, including a public consultation process. The review was to take no more than one year. For the first time in over a decade, all aspects of the system were to be studied. The legislated review was to focus on three areas:

- emerging technologies
- market trends in supply and demand
- trends in the oversight and delivery (governance and structure) of Nova Scotia's electricity marketplace

¹ <http://www.nspower.ca/en/home/about-us/electricity-rates-and-regulations/regulatory-initiatives/renewable-to-retail.aspx>

Process Overview

The Department of Energy released a scope of work for the Electricity System Review in January 2014. This detailed the work to be completed under the three key areas of study. It explained how the work would be accomplished, and was open to comment from the public and stakeholder groups before being finalized. The scope of work was used to confirm and validate the direction of the activities to be completed.

The review took place in two phases that included: (1) sharing expert findings and (2) consulting with Nova Scotians. Consultation efforts in both phases focused on hearing from experts, stakeholders, and the public. This report includes a summary of what we have heard from each group.

The consultation process was developed based on the International Association of Public Participation (IAP2) planning process. The process selected covered both informational and consultation phases, with the goal that Nova Scotians would provide input that would be considered in planning for our future electricity system.

The first phase included gathering and sharing information related to our electricity system, mainly through technical studies and other materials posted on our webpage, novascotia.ca/electricityfuture.

Number of people who have visited the website:
More than 4,000 people have visited the electricity review page

In spring 2014, the department issued requests for proposals for three technical studies. ICF International was the successful bidder for two studies, emerging technologies and market trends in supply and demand, while London Economics Inc. was selected to complete work relating to the oversight and governance of our electricity system.

In June 2014, the department began releasing the results of these studies for discussion. High-level summaries were prepared outlining key findings. Stakeholders and the public were invited to provide feedback on these documents. Two videos were also released encouraging Nova Scotians to get involved in the review process.

The second phase focused on speaking with Nova Scotians (public and stakeholder groups) about their views on key elements of our future electricity system. The main focus in this phase was to determine the values and priorities that should guide the development of our future electricity policy.

Public input

The department sought the opinions of Nova Scotians through a variety of avenues. Face-to-face public sessions allowed hundreds of people to learn more about the system's future opportunities and challenges, answer a number of opinion-based questions, and become engaged in workshops where they provided focused feedback on key topics.

Throughout the review process, Nova Scotians were invited to submit their comments and feedback to the Electricity System Review process through e-mail, traditional mail, and Twitter. The department requested that these comments be submitted by December 5, 2014. A number of submissions were made both to the electricityreview@gov.ns.ca e-mail address and to the Minister of Energy directly.

In November 2014, a representative public opinion survey asked for views from one thousand Nova Scotians on a variety of issues related to the province's electricity system.

A summary of what we heard from the public can be found in Section 5.0 of this report.

Stakeholder input

In November and December 2014, the department also met with stakeholders representing views relating to the environment, business, energy affordability, and First Nations considerations. They were invited to provide additional feedback through written submissions. These are summarized in Section 6.0 of this report.

Timelines and Deliverables

The department will be accepting feedback on this draft report until March 18, 2015. Comments will be integrated and a final report will be tabled in the Spring 2015 session of the legislature.

SETTING THE CONTEXT

Overview: Nova Scotia's Electricity System

In Nova Scotia, most electricity is supplied by the public utility, Nova Scotia Power Inc. (NSPI). Nova Scotia has a vertically integrated monopoly, meaning that NSPI generates, transmits, and distributes most of our electricity. The utility owns more than 95 per cent of the province's system for the creation and delivery of electricity. It serves about 500,000 residential, commercial, and industrial customers.

NSPI is a publically regulated private corporation. The amount of capital it can invest and the amount of profit it can earn is regulated by the Utility and Review Board (UARB). The UARB regulates the operating costs of the utility, and the province limits the amount of executive salary that can be recovered through power rates.

In addition to NSPI, there are six municipal electric utilities. These utilities buy electricity from NSPI and other sources, generate some of their own, and sell directly to their customers. The municipal utilities are also regulated by the UARB.

Independent power producers (IPP) generate electricity and sell it to NSPI. They supply a significant amount of the province's renewable energy, such as wind and biomass. More than 70 per cent of the large-scale wind turbines generating electricity in Nova Scotia are independently owned by companies other than NSPI.

What Nova Scotians pay for electricity is determined through several different regulated processes. At the beginning of every year, NSPI estimates the cost of providing electricity, and the projected revenue that will be recovered through their approved rates. If a shortfall in revenue is projected that isn't expected to be recovered through the Fuel Adjustment Mechanism² process, then NSPI will typically file a General Rate Application with the UARB asking for permission to adjust rates going forward.

This application takes into account the return on equity, fuel costs, management and labour, reliability programs, operating, maintenance, and generation costs. The UARB determines whether rates are adjusted, and by how much.

As a private company, Nova Scotia Power Inc. provides capital from lenders and its shareholders. This capital is generally used to invest in long-term assets such as major equipment and system upgrades or new generation. The lenders receive a competitive rate of return based on the assumption that there is only a moderate amount of risk that the debt will go into default. The shareholders receive a return

² The Fuel Adjustment Mechanism ensures that power rates reflect the actual cost of fuel—not just the forecasted cost. These are typically adjusted at the beginning of the calendar year, based on the true expense. This means that they could go up or down if the true cost of fuel was different than the projected cost.

based upon comparisons in the marketplace for similar kinds of investments and risk. Shareholders have a higher degree of risk—if there is a form of loss that is found to be imprudent, they bear that loss first. The current breakdown of capital invested in Nova Scotia Power Inc.'s assets is 37.5 per cent equity and 62.5 per cent debt.

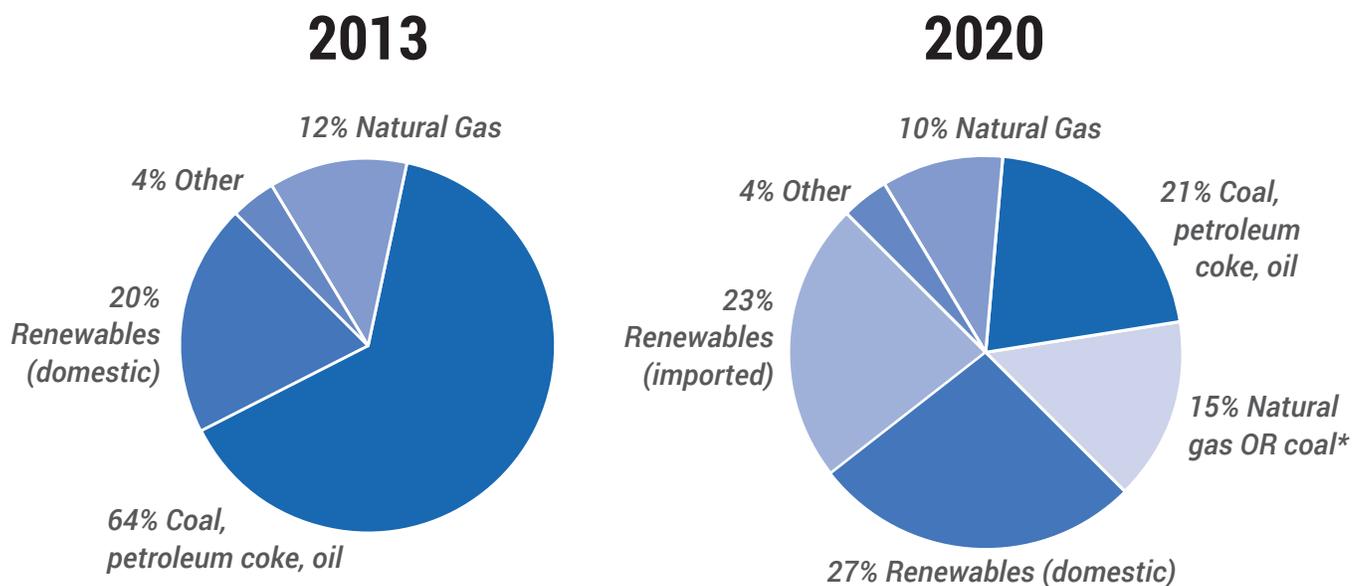
Evolution of Our System

Many of the first electricity customers in Nova Scotia were served by small hydroelectric facilities throughout the province. As demand grew, fossil fuels became the primary source of electricity. By the 1970s, oil was our primary source of electricity generation until the OPEC crisis caused prices to double, and then double again.

In the face of these global price shocks, the province decided to produce electricity from coal, as much of it was mined locally and prices were low. As recently as 2006, coal and related products met more than 80 per cent of the province's electricity needs.

Over the past decade, closure of local coal mines and changes to emissions regulations have meant that a significant amount of our coal is imported from the United States and Colombia. Reliance on imported coal leaves Nova Scotia vulnerable to the volatility of global coal prices. Prices have risen as much as 75 per cent at some points in recent years, but have retreated since recent spikes. Our experiences with fossil fuels have shown the risks of relying too heavily on one fuel source.

Fig.1 Nova Scotia energy sources in 2013 (actual) and 2020 (predicted)



Electricity is generated throughout the province at power plants using coal, petroleum coke, oil, and natural gas, and at plants using renewable sources of energy (wind, hydro, tidal, and biomass). NSPI also imports small quantities of electricity through a transmission line connecting Nova Scotia and New Brunswick, which typically provides 4–6 per cent of our total annual supply.

Together, local generation and imports make up our generation mix. This mix changes from year to year, depending on resource availability (wind), fuel prices (fossil fuels), and environmental regulations.

By 2020, Renewable Electricity Standards (RES) regulations require a minimum of 40 per cent of the province's electricity to come from renewable sources of energy. That legal requirement will be met through existing projects under contract and already committed new construction including the Maritime Link.

Diversifying our electricity sources is important for ensuring electricity security as well as stable and predictable prices. Having too much of our electricity come from one source has proven to be a bad strategy in the past. Moving from oil to 80 per cent dependence on coal and similar fuels seemed like a good idea when it provided economic benefits for Nova Scotia through the use of local coal. Then the mines closed and the world began to be concerned about the impacts on climate change from carbon-intensive fuels such as coal.

Clearly there are risks from becoming overly dependent on a single source. Diversity is a safer choice as it allows for more flexibility in sourcing our electricity (balancing imports, exports, and intermittent and firm sources). It lets us take advantage of low electricity prices for some fuel choices (imported electricity) and provides options to avoid large price increases for some fuels.

Understanding Our Needs

Nova Scotia uses about 11 gigawatt-hours (GWh)³ of electricity every year. Long-term planning studies project that the province could need anywhere between 13 GWh and 8 GWh of electricity a year over the next 25 years.

About 44 per cent of Nova Scotia's electricity use is in the residential sector, 34 per cent in the commercial sector, and 24 per cent in the industrial sector.

Planning for our electricity future must take into account the fact that close to a quarter of our electricity sales are attributed to a handful of large industrial customers. The addition or loss of a large industrial customer could significantly change the overall amount of electricity required to meet demands.

The demand for electricity in the commercial sector is tied to the size of the province's economy as measured by the gross domestic product (GDP). It is currently projected

³ 11 GWh represents the amount of electricity generated, not electricity sales. NSPI's electricity sales are approximately 7 per cent lower due to system losses during transmission and distribution.

to grow at about 1.2 per cent per year. The residential sector is expected to grow by about 0.2 per cent. However, much of this growth can be offset by energy efficiency programs and technologies. Depending on how much support these programs receive and how much growth in demand actually occurs, both the residential and commercial sectors could see a net decline in electricity use over the long term.

Another complicating factor in planning for Nova Scotia's electricity system is the large difference between our winter peak and shoulder seasons. Nova Scotia has a winter-peaking utility, meaning we use most of our electricity (2200 megawatts) during the cold winter months. However, long spring days when there is no air conditioning required we use significantly less (700 megawatts).

This creates a challenge in that we need an electricity system that has the capacity and flexibility to significantly scale up or down, as the season requires. Traditional fossil fuel plants can do that to some degree because they are controlled by the utility, but the availability of new renewable resources such as wind or solar are controlled by nature. They produce electricity when the resource is available—not necessarily when we need it. As a result, we often have more electricity than we need in the summer, so we need to store it, sell it elsewhere, or let it go to waste. Without storage technologies or good transmission connections with our neighbours, today some of it is wasted.

If it goes to waste—a practice referred to as curtailing wind generation or spilling of water at hydro generation sites—this lost opportunity cost is paid for by all customers. Current supply contracts with independent power producers ensure that they are paid for the electricity they produce whether the system can use it or not. If contracts were changed to allow utilities to refuse the power, the cost per unit would likely go up.

Connections With Our Neighbours

Many potential options for sourcing electricity from outside of the province are limited by our poor transmission connections with other systems. We currently have only one major connection to New Brunswick, which only allows for about 300 megawatts (MW) of non-firm capacity. However, the primary purpose of this connection (also referred to as an intertie) is to ensure reliability standards are met, and not necessarily to provide electricity on a daily basis. Nova Scotia's access to the intertie depends on New Brunswick's consumption, so during high demand periods there is effectively no capacity for Nova Scotia.

Firm capacity is electricity that can be guaranteed at any given time (most fossil fuels for example). Non-firm or intermittent capacity cannot be relied upon. They cannot be easily dispatched when they are needed (wind, tidal).

Starting in 2009, the four Atlantic provinces and the federal government began an extensive research initiative aimed at enhancing the co-operation of government and regional power utilities in Atlantic Canada for a cleaner energy future. The project, known as the Atlantic Energy Gateway (AEG), included eight modeling and research studies around power system planning, operations modeling, clean energy (industrial), and economic development. Two major implications for Nova Scotia emerged from this work.

Part of the AEG work was based on the assumption that a new electrical connection between Nova Scotia and Newfoundland known as the Maritime Link would be built. It was approved by the Nova Scotia Utility and Review Board in 2013 and is scheduled for completion in 2017.

Under the 35-year contract with Nalcor, NSPI will pay the cost of building the electrical connection, and in return will receive a fixed amount of electricity (153 MW). In addition to the long-term contract, up to 198 MW of non-firm capacity will be available for purchase if it is required and cost effective. This additional electricity is guaranteed to be at market price, which has generally been lower than current energy costs in Nova Scotia.

If market prices for additional hydro-electricity from the Maritime Link are cost effective, more than 50 per cent of Nova Scotia's electricity could come from renewable sources in the 2020s and 30s.

The Maritime Link also creates a new Atlantic energy loop that strengthens Nova Scotia's interconnection to the North American grid. Being part of a new energy loop will allow the province to import new supplies of clean energy such as from Quebec and New Brunswick, use renewable imports to balance our locally produced intermittent generation, and potentially export surplus renewable energy in the future. This connection also provides a strategic advantage for Nova Scotia by putting us first in line for access to energy from Muskrat Falls and also from Upper Churchill after it reverts back to Newfoundland in 2041.

The Atlantic Energy Gateway work also supports opportunities to enhance connections with other provinces by upgrading our existing intertie and share reliability responsibilities with New Brunswick. The creation of the Maritime Link is expected to encourage increased connections with New Brunswick and the broader northeast region, to enable other markets to access Maritime Link surplus electricity, and possibly surplus renewable electricity from Nova Scotia as well.

Environmental Considerations

How we source electricity now and in the future is also influenced by the province's commitment to improving environmental outcomes to benefit citizens. Nova Scotia has committed to reducing greenhouse gas (GHG) emissions by approximately 25 per cent in the electricity sector by 2020 to meet a provincially regulated cap of 7.5 million tonnes, and 55 percent by 2030 to meet a cap of 4.5 million tonnes.

Nova Scotia is committed to improving air quality and protecting the health of our citizens in a way that achieves good environmental outcomes while balancing economic impact to rate payers. Starting in January, new and amended legislative requirements will reduce pollution from our electricity system over the next 15 years. New air pollution requirements move from an annual to a multi year cap system that allows more freedom to make economic choices on fuel sources while still maintaining compliance and achieving the same environmental outcomes. For the first time ever, the requirements also include annual sulfur dioxide emissions limits in communities with generating stations. By 2030, sulfur dioxide from electricity generation will reduce by 86 per cent and mercury by 89 per cent from 2001 levels. Nitrogen oxides will be reduced by 69 per cent from 2000 levels.

These new requirements will help the province reach an agreement on national air pollution targets with the federal government. On a fleet level, they will bring us closer to other jurisdictions while allowing the utility to meet declining caps in whatever way the is most cost effective without requiring capital intensive and expensive pollution control equipment such as scrubbers. The federal government is committed to developing air pollution standards for the electricity sector (BLIERS), and while we don't know what the federal regulations will look like, our new 2030 targets put us in a better position to reach an agreement with the federal government similar to what was achieved on the GHG-side for coal-fired electrical plants.

Overall our air quality requirements are part of our strategy to transform the electricity sector to be cleaner burning and more renewables focused, with lower greenhouse gas emissions.

The Environmental Goals and Sustainable Prosperity Act was passed in 2007 and outlines 21 goals and 2 overarching objectives that recognize the importance of integrating environmental sustainability and economic prosperity.⁴ The act was amended in 2012, following a mandated five-year review, and 4 more goals were added for a total of 25. The amended act sets two main objectives for the year 2020: (1) to demonstrate international leadership by having one of the cleanest and most

⁴<http://www.novascotia.ca/nse/egspa/docs/EGSPA.2012.Annual.Report.pdf>

sustainable environments in the world, and (2) to provide certainty to all sectors of the economy while improving the province's environmental performance to a level at or above the Canadian average. The 21 goals relate to improving performance around key environmental areas such as air quality, greenhouse gases, renewable energy, and energy efficiency buildings, among others.

In support of the initiative, the Department of Energy amended the Electricity Act and changed the Renewable Electricity Regulations. Under the regulations, the government outlined rules to meet the legislated minimum targets for renewable energy of 25 per cent by 2015, and 40 per cent by 2020. We are currently on track to exceed both of these regulatory requirements.

Using Less Electricity

A large part of Nova Scotia's electricity future relates to increasing energy efficiency. One of the best ways to manage future electricity supply costs is to use less electricity. In 2014, the Government of Nova Scotia restructured Efficiency Nova Scotia under the Electricity Efficiency and Conservation Restructuring (2014) Act.

This essentially requires Efficiency Nova Scotia (ENS) to compete directly with NSPI's cost of generation going forward. If efficiency measures provide the lowest cost, then NSPI will have the obligation to purchase all cost-effective energy efficiency. A set amount (\$39 million) was approved for 2015 as a transition year, and for 2016 onwards, ENS and NSPI will have to negotiate three-year agreements for the appropriate amount of demand-side management programs.

Efficiency Nova Scotia's 2015 plan estimated that they will save ratepayers 121 million kilowatt-hours of electricity in 2015—enough to power 12,000 homes. These saved kilowatt-hours have an average cost of \$0.025 compared to the conservatively estimated cost of electricity production of \$0.04, resulting in around \$180 million in electricity cost savings over the next 10 years.⁵

⁵ <http://www.efficiencyns.ca/who-we-are/energy-and-efficiency-plan-for-2013-2015/>

KEY CHALLENGES AND OPPORTUNITIES

Reports and Studies

Throughout the review process, the Department of Energy has sought feedback from a variety of informed sources to help identify the key opportunities, challenges, and realities we can expect to face in planning for our electricity future. During the first phase of the review, the department contracted with ICF International to complete work related to technical components of the system and London Economics Inc. for a review of our electricity marketplace. A number of other sources and studies have also been reviewed, as outlined below.

Integrated Resource Assessment

In addition to ICF International's technical study on future electricity supply and demand in Nova Scotia, the review also takes into account a similar process by electricity system stakeholders and the Utility and Review Board called the Integrated Resource Planning process (IRP). Through the IRP, the UARB required NSPI to develop multiple scenarios for our electricity, considering current requirements. The IRP process included significant input from stakeholders.

Nova Scotia Power filed its final IRP report with the Utility and Review Board in October 2014. The UARB subsequently directed NSPI to file its preferred resource plan and avoided cost on December 10, 2014.

The 2014 IRP looked at system requirements out to 2040. Thus, the IRP looked at both supply and demand for the utility over a 25-year horizon. The information provided through the IRP was integrated into the first two review studies (emerging technologies and market trends in supply and demand).

Energy Management Working Group

As a result of the ICF studies, the department brought together a group of stakeholders to discuss issues around energy management systems. This working group developed a report⁶ that discusses some of the key challenges facing the changing electricity environment, including the development of smarter community energy systems. Some of the key issues discussed include

- integration of renewables
- management of system peak demand

⁶ The Energy Management Working Group Report can be found online at <http://energy.novascotia.ca/electricity/electricity-system-review/electricity-review-phase-i/energy-management-working-group>

- metering
- billing
- data
- competition and new business opportunities
- planning
- access to capital

Other Expertise

The review also takes into account expertise from a number of other studies and reports, including the following:

- technology reports by Natural Resources Canada (Clean Electricity and Renewables Portfolio – Portfolio Strategic Plan, August 2014 Draft for Consultation)
- the Tidal Value Chain Study funded by Atlantic Canada Opportunities Agency and Offshore Energy Research Association
- the Report of the Energy Management Systems Working Group
- information from the Carbon Capture and Storage Consortium of Nova Scotia
- the Ecology Action Centre report on Solar Photovoltaics in Nova Scotia: Report on Costs and Measured Electrical Productivity

This collection of work is currently being used to inform next steps from the Electricity System Review.

Key Findings

Our Electricity Demand (Now and in the Future)

Both the ICF study on supply and demand and the recent IRP found that we will be able to meet our most likely demand scenarios (slow growth of electricity use) with our existing and committed generation, and increases to electricity efficiency and demand-side management.

Some new generation may be required to replace existing sources near the 2030 time frame, but the capacity we have today may be all the capacity we need well into the end of the next decade. Significant new, large-scale generation before 2030 would

only be needed if we see a massive increase in demand, such as major developments in our offshore sector.

Growth in electricity demand depends on a number of factors. Energy efficiency improvements, increased focus on demand-side management, and uptake in technologies that better manage our home electricity use all help us use less electricity and mitigate electricity demand growth.

However, technologies such as electric air source heat pump systems (whole-house ducted systems and split systems) are growing in popularity and have the potential to increase electricity demand during peak times (cold winter days). Improvements to electric transportation technologies (electric vehicles) could also increase our electricity consumption.

Planning for our future electricity system needs to start now. Major electricity projects have long lead times. The studies suggest that we should use the next 5 to 15 years to plan for 2030 and beyond. At the same time, we should investigate potential energy solutions and manage demand growth through investments in grid modernization, energy efficiency, storage strategies, and other generation technologies.

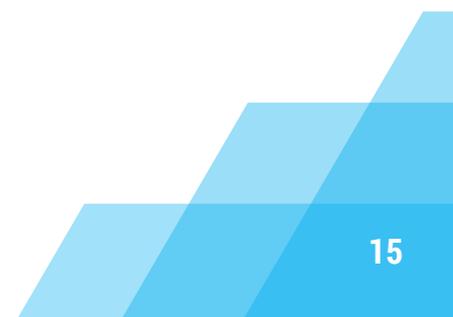
Today's Energy Supply (now to 2020)

As mentioned in the previous section, Nova Scotia likely has enough existing and committed generation to meet our electricity needs toward 2030. In the short term, our key challenges are making the most of our existing renewables and improving our ability to integrate intermittent sources of electricity into our system.

To date, there are commitments for wind projects totaling approximately 550 MW. However, the growing use of wind presents a challenge, as the amount of electricity produced by a wind turbine is tied directly to wind speed. A wind turbine might produce at its full capacity, at a portion of its capacity, or not at all. The output can change very quickly depending on the availability of wind—from no production to full production with a gust. With experience and improvements in weather modeling, the ability to predict the hourly, day-ahead wind production output is increasing.

Still, there remains a need to back-up intermittent sources of electricity. This can be done through firm sources of electricity like fossil fuels and natural gas, through power from the Maritime Link, or through new technologies such as storage.

Once the Maritime Link is in-service, it will provide both a firm, reliable source of renewable electricity and additional competitively priced non-firm market energy. It should also provide incentives to improve our connections with surrounding markets.



In the short term, it will be important to gain a better understanding of the role that the Maritime Link can play in our electricity system and the future opportunities it may create.

Coal continues to play a big role in our energy mix. Through the equivalency agreement negotiated with the federal government, the federally prescribed timeline to shut down coal plants will not apply to Nova Scotia; instead, the electricity sector will continue to reduce coal to meet declining GHG emission caps laid out in provincial regulation from 2010 to 2030. Outside of coal plant closures to free up transmission for the Maritime Link, all other existing coal units will likely stay open well into the next decade and will be used when it is economic (within our emissions caps) or necessary to meet peak demands. There is the potential that some of the Tuft's Cove thermal units in Dartmouth may need to be replaced; however, it is not anticipated that a large number of coal plants will come off-line in the next decade. It is more likely that they will be used less frequently.

An additional issue facing our system planning is the role of distributed (locally produced) energy. There is a possibility to integrate more locally generated electricity as the costs of some technologies start to come down over the next few years. For example, the study completed by Natural Resources Canada looked at when a number of technologies can expect to reach grid parity (when the cost to produce the electricity matches the cost to residential retail consumers). The study found that solar photovoltaic (PV) may reach full retail cost grid parity somewhere around 2020 in some Canadian markets.

The implication is that by 2020 it may become economically viable for residential homeowners in some parts of Canada to get their electricity from a solar PV system installed on their roof through a net-metering arrangement with their electricity distribution company. There are, however, additional costs to the utility, as net metering is inherently subsidized by non-net metered utility customers. Residents who generate electricity are not required to pay fees associated with transmitting their electricity to other customers or fees for exiting the system. They have access to on-demand electricity when they need it, but are no longer paying some of the embedded costs of the larger rate base.

Our Future Supply (2020 and beyond)

As we near 2030, there will be opportunities to replace a significant amount of our electricity generation.

Many wind farms in the province operate under power purchase agreements (PPA), which are 15 to 20 year contracts for electricity. The first PPA for wind was signed

in 2006, with the majority of Community-Feed-In-Tariff wind projects awarded in 2012. This means that between 2026 and 2035, many of our current contracts for renewable electricity (550 MW) will expire.

The current GHG regulation includes emissions caps only to 2030. It is uncertain how the province and federal government will proceed, but it is likely that requirements to reduce greenhouse gas emissions will become more stringent and may require the retirement of some of our coal plants after 2030. Future climate change policies at home and globally may also result in financial penalties for carbon emissions.

There will likely be more opportunities to access new electricity markets with improved transmission connections for Nova Scotia.

In May 2012 the Province of Nova Scotia released the Marine Renewable Energy Strategy, which laid out a plan that would see the province take a phased and progressive approach to the development of Marine Renewable Energy. A longer-term goal of producing 300 MW of power from in-stream tidal energy projects was also established with the assumption that significant lessons will be learned from the initial arrays deployed in the next five years in Nova Scotia resulting in continued broad community support and lower costs.

The OERA Value Proposition Report (to be released later this spring) looks at economic impacts from development to meet our needs and exports. It assumes cost reductions will come from experience and innovation. This results in the provincial goal of 300 MW being achieved by 2028, serving incremental renewable electricity needs throughout the 2020s and beyond. It also recognizes that an accelerated development of our tidal resources improves our competitive position to export tidal goods and services into other jurisdictions, which represents a unique renewable energy economic development opportunity for Nova Scotia.

Beyond 2028, further tidal development at any significant scale in the province will require additional markets within Nova Scotia, access to export markets, or both.

Electricity Prices

A number of complex and constantly changing factors impact Nova Scotia's cost of electricity. Our historic dependence on one fuel source (first oil, then coal) made us susceptible to fluctuations in global market prices. We still get the majority of our energy from fossil fuels, including natural gas, so we are subjects to volatility in terms of price and availability. For example, there were days in the winter of 2014, where NSPI could not buy all of the fuel it needed due to increased demand in New England. As a result, the utility had to interrupt some of its industrial customers.

Over the past 10 years, the province has taken significant strides to diversify our fuel sources. Integrating more renewables, though more costly today, provides long-term price stability. The price we pay for wind today is the price we will pay in 20 years due to long-term, fixed-price contracts. For example, when the Pubnico Wind Farm was first built, costs for the electricity it generated were comparatively high. Over time, the price stayed stable while other fuel prices rose, making it on par today with some of our less expensive fuel choices.

Innovation and Technology

Renewable Energy Sources

ICF International completed a review of new and emerging technologies that might make sense for generating electricity in Nova Scotia in the near and longer term. They pointed out that the cost of many technologies would come down over time, but at different rates and times. To enable a comparison between each one, they levelized the costs.

A levelized cost takes into account the capital cost of the technology and projected long-term fuel costs, as well as availability of the fuel source and other resources within the province. For example, the cost of a generation technology may decrease significantly, but if the province doesn't have enough of the energy input when we need it—or a system that can store it in a cost-effective manner—then the overall cost of the electricity from that source will stay fairly high.

The emerging technology study found that given Nova Scotia's cost of electricity, many new technologies cannot be considered cost effective for large-scale integration today. However, a combination of more cost effective technologies and higher electricity rates in the future might support increased uptake over time.

It may be necessary to introduce some of these technologies on a smaller scale to understand how they will perform within our system. Pilot projects would allow us to study and redesign new technologies to suit our system, while only having a small impact on rates.

Technology could impact our future electricity system by changing the way we generate electricity, manage electricity, or both. New technologies can help us both store electricity from intermittent sources (solar, wind, and tidal) to use it when we need it, or shift out electricity demand so that we are using electricity as it is being produced.

Renewable energy technologies become more attractive when we can find cost-effective ways to store surplus electricity until the system needs it. A battery is a commonly thought of form of storage for electricity, but other technologies such

as thermal storage (including ice, chilled water, hot water, phase-change materials, ceramic bricks, earth energy storage), compressed air, flywheels, and hydrogen are also emerging as options.

These technologies can also help smooth some of our peak-load demand scenarios. For example, some heat pump technologies allow for electrical energy to be stored as thermal energy, which could be accessed when system demand is high. Instead of a heat pump system adding to our peak demand, the stored thermal energy could be drawn on during high demand times instead of electricity. This type of system could also allow us to maximize our renewable resources by storing energy when they are producing and could alleviate some of the peak demand pressure on the system.

Some Renewable technologies may be expensive today, but if storage costs can be significantly reduced, new lower-cost options will emerge. This is why we need to design a system of generation, transmission, and use of electricity that is flexible and can accommodate a range of new technology options.

The Natural Resources Canada and ICF International studies agree that the increased use of renewables will be constrained by the grid's ability to accept these variable sources of electricity. The studies note that an inability to manage variable generation will hold us back from taking full advantage of the current state-of-the-art capabilities of renewable energy generators. We will require more intelligent electricity infrastructure (distribution and automation) to fully take advantage of renewable technologies.

The following list of technologies was identified in the ICF International study as relevant to Nova Scotia:

Solar to generate electricity (photovoltaic or PV): Nova Scotia has a good solar regime, so solar use for hot water heating can be effective and make economic sense. However, timing is an issue when solar is used for generating electricity. ICF noted that the best days for generating solar energy in the province are unfortunately during periods when our electricity demand is the lowest. This presents a challenge in having any large-scale adoption of solar in Nova Scotia without the availability of affordable storage solutions. Solar must also be considered in the context of existing investments in other intermittent renewable energy resources. We have reached the limit at which we can integrate further sources of intermittent electricity cost effectively without new storage technology, and sources such as wind are currently more effective.

Biomass: Biomass is currently used in a number of projects in Nova Scotia. However, even at commercial scale, the cost is relatively high (13 to 17 cents per kWh). New fuel stocks and research may provide an opportunity for innovation within the province.

Geothermal for electricity: Specific geology and geography is needed for geothermal temperatures to be hot enough to create steam to drive a turbine. There is no such resource available in Nova Scotia, although there are a number of locations where the temperature differential is sufficient to drive heat pumps for space heating.

District energy systems: Community-scale district energy systems for combined heat and power represent a potential opportunity for the province, but they are based on site-specific efficiencies and economies of scale, such as taking advantage of multiple infrastructure replacement (water, sewer, and power lines).

Tidal: Development of hydrokinetic energy, particularly in the Bay of Fundy, offers great opportunity to Nova Scotia as a clean, renewable source of power with major economic benefits. Note that tidal is not included in the chart below because the expected cost-reduction time frame is only beginning to become clear.

Carbon capture and storage (being explored but unlikely): Based upon what was known at the time of their study, ICF suggested that there were no significant opportunities for carbon capture and storage within the province. However, research by the Carbon Capture and Storage Consortium is exploring whether there is enough capacity to store the CO₂ output of a coal plant the size of Point Aconi in Cape Breton. Drilling results are expected early in 2015. If the results are positive for storage, then technology to capture CO₂ could be considered for use when it becomes more cost effective. If the results are negative, then this technology could be ruled out as an option.

More information can be found in the ICF technical report⁷ and the summary report posted on the Electricity System Review website.

Energy Management Technologies

The introduction of management systems that can shift, store, and release energy represents a significant opportunity for improvement. Today's electricity system functions through a series of reactive one-way relationships. For decades, the equation was simple: customers increase the amount of electricity they need and the utility increases the amount of electricity generated. However, as we add renewable intermittent sources of electricity, the equation is more complicated. Electricity is now generated independent of customer demand. Now the utility has to manage other generation sources as intermittent resources come online.

Advances in technology can allow a more dynamic relationship between electricity users (ratepayers), the utility (Nova Scotia Power Inc. or municipal utilities), and power producers (the utility or independent power producers) to maximize our existing resources.

⁷ The ICF International technical study and summary report can be found at <http://energy.novascotia.ca/electricity/electricity-system-review>

Ideally, our future electricity system will be able to respond to an increase in demand from one sector by reducing demand in another with no noticeable impact to the consumer. It will respond to a drop in supply from one intermittent source of electricity by drawing power out of storage or making minor adjustments to demand. We will only be able to do this through increasingly complex control systems.

There are opportunities today to incorporate emerging technologies, and more in the next two decades as the province replaces older central station coal and natural gas plants.

Our Future Electricity Marketplace

London Economics Inc. completed a detailed assessment of our electricity system marketplace and governance structure. It considered ways to improve the system through increased competition, accountability, and changes in the regulatory framework.

Increasing Competition

Liberalization of our electricity system means more competition for the generation of electricity, and potentially more choice in who will supply electricity. Liberalization does not mean the elimination of regulations; it means reshaping the way we regulate utilities.

There are advantages to the current model. For example, accountabilities are clear. Nova Scotia Power Inc. (or a municipal electric utility) can be held directly responsible for service issues and safety. They are also obligated to serve any customer who requests service.

A fully liberalized system that depends on market decisions spreads responsibility for these matters among the many players. Experience has shown that in a completely liberalized system, an Integrated System Operator (ISO) or a TransCO (transmission company) is needed to ensure the coordination of services required to meet a reliable supply of electricity. However, ISOs and TransCOs do not own, operate, or build any generation assets.

It is also important to note that neither a fully liberalized system nor increased competition will guarantee lower power rates. Over the long term, competition has the potential to increase efficiency and cost effectiveness, which can mitigate increases. However, experience in a number of jurisdictions has shown that full liberalization can also lead to sharp increases in the beginning since new players have new costs while existing players still have costs from the previous system. It is also likely that electricity costs will always be linked to some degree with inflation.

Increasing Accountability

It was suggested that a broader, performance-based approach (PBR) could help better align the utility's interest with consumer interests. A PBR approach would change the way that the utility earns its rate of return. Under the cost of service model, the rate of return is based primarily on capital investment. A PBR approach could introduce incentives for the utility to focus on factors such as customer service, cost effectiveness, and efficiency.

It has been suggested that PBR (once properly established) may reduce the number, length, cost, and complexity of regulatory hearings and that there could be stronger incentives for the utility to minimize costs and rate increases. However, depending on the complexity of the PBR approach, there could be an increase in hearings in the short term related to setting the PBR structure.

Performance-based Regulation

Performance-based regulation should be viewed as a spectrum. Through a stakeholder engagement process, tools and objectives are selected to create a PBR regime. They can be relatively straightforward, such as incentives and penalties, or increasingly complex taking into account a number of factors. The system works best in addressing matters that are largely within the control of the utility and when compliance can be achieved through good management and execution. This could include benchmarking of power outages, including the return of service when an outage occurs. The complexity comes from determining which events would be reasonably within the utility's control and how much weight should be assigned to each factor.

In more complex forms, PBR covers the entire spectrum and does not just enforce penalties or incentives, but ties this performance to the utility's return on investment. It becomes part of a complicated weighting system that together creates the structure of how a utility will earn its return.

Globally, many jurisdictions are moving from a traditional cost-of-service model to PBR, but not all experiences have been positive. In particular, there are lessons to be learned from Ontario's recent experience implementing PBR. Productivity and technical and allocative efficiency has declined, electricity rates have increased, and reliability has decreased. If PBR is to be successful in Nova Scotia, it is important that there are clear objectives and limited interference in the process.

Along the PBR spectrum, there is the option of a blended model. There are situations where the cost of service and PBR approaches are blended and the rate-of-return structure accounts for both the utility's cost of delivering service, and performance

benchmarks such as reliability, outages, and communication. NSPI's performance in keeping rates in line with or below the rate of inflation could also be considered. This would allow for flexibility to accommodate years where there are large-scale capital investments (post 2030) and years when the focus would be more on performance.

WHAT WE HEARD FROM NOVA SCOTIANS

Digby: September 11

Yarmouth: September 12

Mahone Bay: September 18

Antigonish: September 21

Sydney: September 22

Port Hawkesbury: September 23

Middleton: September 27

Amherst: September 29

Dartmouth: September 30

Truro: October 1

Halifax: October 15

In September 2014, the department began a series of public consultation sessions across the province. The Minister of Energy hosted 11 sessions, with more than 300 people in attendance. Sessions began in Digby on September 10th, and concluded in Halifax on October 15th.

Attendance varied by region, with 20 to 30 participants at most sessions. The final session in Halifax had more than 70 participants. It was also webcast in both English and French, with 54 viewers in total. These webcasts are available on the Electricity System Review website.

As of January 15th, 127 people have viewed the webcast posted on the electricity review website (12 in French)

A presentation by the Minister of Energy explained some of the key concepts and findings from the consultant studies. The presentation also provided people with an opportunity to give feedback on questions relating to our electricity future. Through electronic polling, people at the sessions were asked about their thoughts on how we

should generate electricity (choosing between energy sources such as wind, tidal, and solar), and other issues relating to our electricity system.

- After the presentation, people participated in group discussions on key topics, including
- how much electricity we need (demand)
- where we should get it from in the future (supply)
- what we should plan for in the way of technology or new policy approaches (innovation)
- how we can offer more choice and improve accountability within a regulated system (governance)

The public meetings concluded with a question-and-answer session with the Minister of Energy, and an opportunity to provide any additional feedback that was not covered in the workshop itself. Feedback from the workshops was collected, and a summary was provided online.

In November, the department completed a public opinion survey (through Thinkwell Research) of 1000 Nova Scotians. The survey also asked for the views and priorities of Nova Scotians as it relates to the province's electricity system. The survey was structured to be representative, meaning that it is a statistically valid representation of what Nova Scotians think. The results of the survey are integrated into this report and available on the Electricity System Review website.

About Our Energy Sources

With 2030 emerging as the next critical planning point for large-scale electricity production, it was important that the review consider where Nova Scotians feel we should be getting our electricity. This relates both to our electricity sources and whether Nova Scotians feel it is more important to secure lowest cost electricity regardless of where it comes from (local or imported).

During the public consultation sessions, a small number of session participants felt that we should be focusing on local electricity production (within Nova Scotia), while a small proportion indicated that it doesn't matter where our electricity comes from as long as it is the lowest cost source. Most session participants felt that (where possible) we should use Nova Scotia energy sources first, but that Atlantic Canadian approaches should also be considered where it makes more sense in terms of cost. In general, there was support for increasing our connection and ties with other Atlantic Canadian provinces for sourcing electricity.

Moreover, Nova Scotians highly value the environment and want to ensure that environmental considerations are a key part of our electricity planning.

Through the public opinion survey, Nova Scotians were asked to identify which option was most important: electricity coming from Nova Scotia, from Atlantic Canada, or from wherever offers the lowest cost. Fifty-four per cent of respondents were not concerned with where their electricity came from as long as it was the lowest cost possible. Twenty-three per cent want their electricity to be sourced from somewhere in our region. Nineteen per cent of respondents felt it was most important to have Nova Scotia-sourced electricity.

The majority of public session participants felt that if we are going to pay more for electricity, it should come from within the province, and support local jobs and economies. They suggested that we should only be sourcing our electricity from outside the province if it can be acquired at a lower cost than locally produced sources. Many participants stated that tidal energy development in the province is a good example of how electricity sources can be more expensive, but still be supported for their economic development potential.

There was also widespread support by session participants for diversification of electricity sources. Most participants indicated that we should be getting our electricity from a variety of energy sources. A number of session participants specifically commented that we “shouldn’t put all of our eggs in one basket” so that we don’t expose ourselves to significant price volatility.

The public opinion survey asked respondents to rank on a scale of one to five how important they considered various sources of electricity production. The majority of respondents felt that wind was the most important source of electricity, followed by solar and natural gas.

In some sessions, participants suggested that individuals should be encouraged and supported to produce their own electricity, with a need to focus on small-scale, individual energy production versus larger-scale commercial projects for the transmission system.

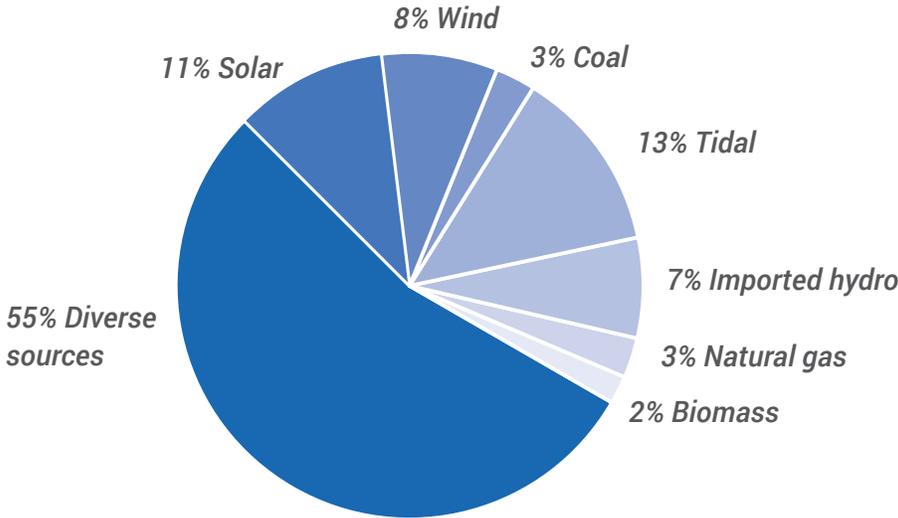
About Investing in Renewables

One of the key considerations of the electricity review has been our electricity mix, including how we should source our electricity. Fundamental to this is how aggressive we should be in adding new sources of renewable electricity. During the public consultation sessions, opinions varied on whether we should continue to add renewables to our electricity mix beyond our legislated requirement.

On one end of the spectrum, a small number of session attendees wanted to reverse the legislated requirements for renewables. They stated that they believe investment in renewables is responsible for the rising cost of electricity, making the province less competitive, and causing us to lose business to other markets. Some also indicated that industrial customers should have lower rates.

On the other end of the spectrum, an equal portion of participants indicated that we should be pursuing 100 per cent renewables, or as much as we can possibly acquire. It was stated that the increased cost was not as important as environmental impacts, and that higher costs today would pay off because fossil fuel prices will continue to rise. It was also felt that higher prices in the short-run would create an incentive for efficiency and innovation.

Fig.2 Session Participants
Q. Where do you think most of our electricity should come from?



Neither of these positions represented the majority.

The majority of session participants said that the province should be focused on positive environmental outcomes, and that increasing renewables was a good thing. However, given that we are on track to meet our renewable energy targets, it was felt that any significant increase in renewable electricity sources should only come if they are cost effective and do not negatively impact rates.

This view was also reflected in the public opinion survey results. Respondents were asked whether they felt that we should obtain more environmentally friendly power production regardless of cost, or if renewables should be added as they become

more cost effective. Sixty-eight per cent of respondents felt that we should wait for renewables to become cost effective before we add them to our electricity mix.

Respondents were also asked if they would be willing to pay more (above the normal rate of inflation) for renewable energy. Fifty-eight percent indicated they would be willing to pay somewhat more (between 2 per cent and 50 per cent more), while 24 percent indicated that they would not be willing to pay anything additional for renewable electricity.

There was an additional observation by some participants that there should be a life-cycle approach to costing where not just capital costs, but also fuel, environmental, and healthcare costs are considered when selecting our electricity sources. Others felt that the cost of backing up renewables or hot-idling coal plants should also be included when we consider the cost-effectiveness of adding renewables.

About Using Less Electricity

Many workshop participants strongly suggested that we continue a focus on energy efficiency to reduce future demand. Using less electricity rather than generating more was the preferred choice. Other related discussions focused on a need for better education on home electricity management and time-of-day rates, and a need for updated building codes and standards to help the province reduce overall electricity use.

The public opinion survey asked Nova Scotians whether they thought we should focus on using less electricity versus new sources of generation. Thirty-eight percent of Nova Scotians indicated that they somewhat or strongly agreed, with 32 percent indicating they were neutral.

About Investing in New Technologies

Overall, there was support in public sessions for the province to continue research and development relating to new and emerging technologies for the electricity system. There was a general opinion, however, that investment in innovation by taxpayers or ratepayers should solve a Nova Scotia problem (such as storage). A number of session participants also supported limited research and development investments that advanced economic development by accessing global markets for the technology (for example, tidal energy).

There was much discussion by participants around who should pay for investment in new technologies, with a wide variety of opinions and no overall agreement to this issue. Some suggested options for investors included the private sector, taxpayers (government-funded), and ratepayers (through power rates). It was also suggested that a portion of rates could be earmarked for innovation.

When asked if they supported government investments in innovative technologies if they benefit Nova Scotians, almost 87 per cent of telephone survey respondents somewhat or strongly agreed.

There was also significant support by participants for tidal development. While many believed the cost would be too expensive to supply Nova Scotia in the short term, it was overwhelmingly supported as an economic development and export opportunity. It was often mentioned as an example of how we should be focusing on maximizing our own energy resources.

About Investing in Energy Management Technologies

There was also a lot of support for investing in electricity storage so long as research could be applied to the Nova Scotia system. Storage was generally viewed as a tool to allow us to maximize our existing resources instead of having to focus on new generation opportunities.

Many participants supported increasing the use of technologies that would allow us to better manage our system in terms of communication. There was much discussion around the cost of these technologies, and issues such as privacy, safety, and an increase or decrease in control over our individual electricity use.

When asked if they would like more control over how electricity is managed in their home, over 65 per cent of telephone respondents strongly or somewhat agreed.

About Innovating and Taking Risks

Session participants frequently expressed the view that we should manage the risks associated with new technologies by investigating best practices and considering lessons learned from mistakes and successes in other jurisdictions.

A small number of participants felt that Nova Scotia is already behind in terms of research and development and should be more aggressive in pursuing new ideas and technologies, while a similar number of participants expressed the opinion that due to our size and economic situation, we should leave the risk to others. Most workshop participants sought a balance between the two options, with support to innovate where it makes sense.

A few participants believed that there should be more investment in building relationships with academic institutions and building on our academic infrastructure, while others thought that there should be more regional co-operation in supporting and implementing technologies on a larger scale due to our small market.

About Regulating Utilities

One of the main themes of discussion throughout the workshops was the role of the Utility and Review Board in regulating our utility. A large number of participants felt that the process is unclear and not generally understood by Nova Scotians. The lack of understanding is likely the driver for the perception that the process is not ensuring the best interest of ratepayers and is not effective enough in holding the utility accountable.

A number of participants felt that the information needed on rates and how they are set is not available. The department notes that in many cases the information is public; however, it is not easily accessible or able to be understood by those not heavily involved in the regulatory process. The lack of knowledge expressed by the workshop participants was also reflected in the public opinion survey results.

When asked if they felt that they understood how electricity rates are set in the province, only 24 per cent of public opinion survey respondents strongly or somewhat agreed. Twenty-five per cent were neutral, while 39 per cent disagreed with the statement. Overall, 64 per cent of respondents were not confident that they understood how electricity rates are set in Nova Scotia.

Furthermore, when asked if they felt the regulation of electricity rates results in a fair and balanced price for electricity, 50 per cent of respondents did not agree. An additional 24 per cent of Nova Scotians were not confident that regulation of rates results in fair electricity prices. Only 20 per cent of respondents agreed with this statement.

A few public consultation session participants suggested that the Board process has become too adversarial. It was noted that the process has become more about “beating up on Nova Scotia Power” than holding the utility accountable for spending decisions and rate increases. It was also noted by some that Nova Scotia Power gets more undue media attention than most utilities.

Other participants felt that under the current model, Nova Scotia Power is only concerned about Emera shareholders, and that the board is not providing enough oversight to protect rate payers.

In general, most participants felt that increased competition would have a positive effect on our electricity system. They stated that competition would create more incentives for efficiency and is generally seen as what keeps businesses innovative and cost effective.

At the same time, most participants were not clear on what competition would look like in our system or how specifically they would benefit. Some participants felt that

because our market is too small for real competition, we should focus on a regional solution and maximize our connections with other markets.

A few participants felt that there should be a separation of transmission and generation assets. They stated specifically that Nova Scotia Power should no longer be in the business of generating electricity, and should only provide the service to customers. However, other participants were focused on getting the most cost effective service and were not concerned with how it is delivered.

Overall, workshop participants were in favor of performance standards for the utility. In terms of possible standards, many people commented that safety considerations and environmental standards are legislated and should be a given. Outage frequency and duration were the standards most often identified as priorities.

This is consistent with the results of the public opinion survey: 59 per cent of public opinion survey respondents felt that Nova Scotia Power should spend more money to decrease the frequency of power outages, while 33 per cent felt that Nova Scotia Power should spend as little as possible in order to keep power rates down.

It was fairly clear that a number of public session participants were not satisfied with the utility's response to a major storm earlier this year that caused major outages. Some suggested that there should be a system in place to either compensate people affected by significant power outages or a way to hold the utility accountable when they do not meet basic performance standards.

While outages were identified in workshops and on the survey as an important priority, 40 per cent of survey respondents felt that the top priority for Nova Scotia Power Inc. should be cost management. Managing costs is also related to achieving long-term rate stability which the overwhelming majority of people questioned wished to see. This is a goal that could also be linked into a performance-based management system.

Survey respondents were asked directly if they felt the Government of Nova Scotia should introduce a report card of performance standards to increase accountability when the UARB makes decisions regarding how much NSPI should earn on their investment—77 per cent of survey respondents strongly or generally supported the introduction of a performance standards report card. Only 13 per cent were not in favour.

WHAT WE HEARD FROM STAKEHOLDERS

The Department of Energy invited key stakeholders to attend informal round table meetings, and provide formal submissions for public release. The department asked that submissions be made by December 5th to ensure that the Electricity System Review report met legislated timelines. The following provides a summary of the feedback received. Not all stakeholder groups that attended sessions provided written submissions. Full submissions can be found on the Electricity System Review website.

Affordable Energy Coalition

As part of the electricity system review, the coalition recommended that a model of electricity regulation be considered that ensures all households have access to an affordable, minimum amount of electricity. Energy poverty in Nova Scotia occurs when people have unsustainable energy burdens and their access to energy is undermined. The coalition believes inadequate income is the primary reason for disconnection of electrical service. Low-income families are forced to use food banks or to stop buying medicine to pay electricity bills.

In the context of addressing the issue of affordability, the Affordable Energy Coalition (AEC) recommends the introduction of a universal service program (USP) that could be either ratepayer, or taxpayer funded. This would be a four-part program that would protect and promote low-income households' access to electricity through

- rate affordability – matching their electricity costs to their limited incomes (USP would reduce low-income electricity costs to 8 per cent of income of electrically heated homes and 4 per cent for base load electricity)
- arrears management – dealing with arrears in an affordable, predictable way (USP could forgive arrears over three years for those who consistently pay their affordable electricity bill)
- emergency relief – providing relief to deal with all genuine emergencies (low-income families facing job loss, illness, etc., so they would still have access to electricity)
- energy efficiency upgrades – upgrading tenant homes to reduce energy use, while continuing to upgrade homes owned by low-income households

Efficiency Nova Scotia

Efficiency now accounts for more than 5 per cent of the province's electricity supply. Nova Scotians are avoiding \$78 million on electricity costs in 2014 alone due to Efficiency Nova Scotia activities to date, and the production of more than 550,000 tonnes of carbon dioxide is avoided annually. There is additional potential for cost savings within the Nova Scotia market.

Performance-based regulation offers the potential to utilize incentives that reward utilities for achieving energy efficiency goals. Efficiency strongly encourages an examination of PBR where investment in efficiency is rewarded or incentivized. Efficiency Nova Scotia can play a role in the implementation of smart meter technology by ensuring that ratepayers receive the objective information required to benefit from this technology at home and at work. Efficiency and conservation currently makes a substantial contribution to reliability, competitiveness, affordability, and efficiency of Nova Scotia's electricity system.

Electricity Mobility Canada

Increased adoption of Electric Vehicles (EVs) is important to achieving greenhouse gas (GHG) emissions. Transportation is one of the biggest contributors to GHG emissions and the introduction of a new "electric fuel" will enable Nova Scotians to choose a cleaner and more affordable fuel source.

Electrification of the transport system would also create a steady increase in demand for electricity that could be met with off-peak capacity. With various advances in smart grid and other energy management technologies, EVs can become instrumental for load management and energy storage as a distributed battery to help balance the grid and deliver electricity during outages.

Municipal Electric Utilities

Nova Scotia needs to determine which assets in the electricity system should be public and which are best served in private hands. It is submitted that the transmission system should be a public asset. Electricity system infrastructure is paid for and amortized through the rates. Generation assets however are different in that there is more business risk and, therefore, it is fair that those who take on the risk should reap the rewards.

NSPI may function better as a Crown corporation where a better borrowing rate and no income taxes could see up to a 10 per cent rate reduction. In the event that nationalization is unlikely, PBR may allow for better alignment between electricity

ratepayers and utility shareholders. It would allow policy makers to delineate society's goals and structure the regulatory regime to accomplish them.

It should be a goal of the province to sponsor a more robust and available interconnection to the rest of the northeastern power pool.

Municipality of the County of Colchester – Municipal Solid Waste

The County of Colchester through its Solid Waste Department remains committed to responsible waste management; however, there remains a question of what to do with post-recycled municipal solid waste—how do we recover this material for beneficial use rather than disposal by burying?

Every tonne of municipal solid waste (MSW) processed at a waste-to-energy facility offsets one tonne of GHG emissions. The production of energy in the form of electricity, heat, or a combination of both reduces consumption of fossil fuels. Waste-to-energy facilities offer a firm (more than 90 per cent capacity) source of electricity.

The Solid Waste Department of the Municipality of the County of Colchester strongly recommends the classification of post-recycled municipal solid waste as a renewable source of energy.

Solar Nova Scotia

The growth rate in solar PV installed capacity in Nova Scotia has averaged 80 per cent per year over the past five years. It is projected that with a modest 30 per cent annual growth solar PV could reach 32MW of capacity by 2030.

An independent study of the grid integration needs for distributed solar PV has not been done in Nova Scotia, and should be done within the next few years in anticipation of continued growth in solar PV installations.

In addition to solar PV, other forms of solar energy along with smart grid technology have the potential to reduce electricity demand (such as solar hot water heating and passive solar housing) Solar Nova Scotia estimates that the installation cost of solar PV systems (in 2014) is \$3.00–\$3.62 per installed Watt.

More support is encouraged for the development of community solar gardens (collectively owned solar arrays). This would not fit into either the renewable-to-retail or net metering model. Increased access to the net metering program is needed. Solar Nova Scotia members are reporting unnecessary delays in getting interconnection agreements processed, etc. There should be a simplified and standardized approval process.

Ecology Action Centre

While Nova Scotia is a leader in setting targets for—and achieving— greenhouse gas emissions reductions from the electricity sector, the electricity system still relies heavily on GHG-emitting fuels. This makes our province particularly vulnerable to likely future scenarios in which federal climate change policy will regulate the electricity sector for deep emissions reductions.

Stationary emissions, especially electrical power generation facilities, present the second largest opportunity for easy reductions today when compared to the difficulty associated with reducing emissions from transportation or oil and gas extraction. Further, existing and potential future mercury emissions standards will make coal-fired electricity generation increasingly impractical.

The EAC believes that the following commitments are crucial to achieving fossil free by 2035.

- Pursue all energy efficiency that is cost effective and achievable.
- Make provincial energy security a top priority
- Develop a non-cost criteria for selecting energy sources

It is time to stop tackling issues one-by-one and start giving citizens the ability to feed in to large-scale, long-term energy planning on an ongoing basis. It is essential that next steps focus on how to consistently engage Nova Scotians on energy decision-making. The EAC suggests that the concept of an Energy Planning Authority for Nova Scotia be created

Port Hawkesbury Paper (PHP)

PHP believes that the province should encourage the development of all potential energy storage initiatives by including support for the introduction of pilot projects and/or competitive solicitations for energy storage alternatives.

PHP supports a performance based regulation goal that would provide the utility with incentives to increase its performance while keeping costs as low as possible. The focus on cost containment should be a key element if components of PBR are to be successful in Nova Scotia. The province should also focus on increasing inter-regional co-operation and ensure NSP has the proper incentives to enter into inter-utility arrangements with will benefit all electricity customers.

PHP also believes that the department should continue to emphasize the important role of energy efficiency in helping Nova Scotia meet its future electricity needs at the

lowest possible long term cost. The Government should seek to develop mechanisms and provide support for significant projects that assist in achieving measurable and verifiable demand and energy savings that will provide the electricity system with flexibility and growth in demand through economics development.

ELECTRICITY & AFFORDABILITY

The cost of electricity is an ongoing concern for Nova Scotians due largely to our reliance on fossil fuels as our primary source of electricity. We have seen significant increases in electricity rates over the past ten years. While shifting to more diverse sources of electricity will help mitigate some of that in the long term and bring more predictability to rates, electricity affordability continues to be a concern for Nova Scotians today.

As part of the Electricity System Review, London Economics Inc. completed a high-level cross-jurisdictional analysis of how other areas address electricity affordability. The Affordable Energy Coalition has also suggested that the province create a universal service program.

Universal service programs essentially ensure that all customers have access to electricity regardless of their ability to pay. In Maryland, eligible customers receive assistance via payments for a portion of their current electric bill. Anyone whose income is below 150 per cent of the federal poverty line is eligible. This is a ratepayer-funded program, where a small charge is added to all electric customers' bills. Maryland also has a program that installs energy conservation materials in the homes of low-income ratepayers at no charge.

Ontario also has a low-income energy assistance program that provides emergency financial assistance to low-income customers (up to \$500) for electricity bills in arrears, and energy efficient upgrades. The province also has specialized rules for qualified low-income customers such as equalized billing and disconnection grace periods. Beginning in 2016, the Ontario government will also give low-income residents discounted electricity through direct on-bill support.

The Department of Energy is currently focusing on energy efficiency upgrades for low-income homes as a way to address electricity affordability. By lowering overall consumption, we not only decrease power bills today, but also reduce the impact of future price increases. Nova Scotia Power shareholders have committed to

contributing 37 million dollars for in low-income efficiency home upgrades with the aim of having all upgrades completed in the next ten years.

In addition to the Electricity System Review, the province has undertaken a review of the province's taxation system. Many of the tax review suggestions have implications for addressing poverty in general, and any policy decision by the province on electricity affordability will need to be integrated with actions on taxation.

It should also be noted that the issue of affordability is not limited to those on low incomes. All Nova Scotians and businesses have faced pressure from the rise in fossil fuel prices - particularly for coal and natural gas. The fall of 2014 saw a significant drop in oil prices, but regional and environmental factors as well as purchasing plan decisions all mean there is no immediate and automatic link between a fall in oil prices and the cost of fuel for electricity. Accordingly, for most Nova Scotians, the objective remains more stable long-term prices, at or below the general rise in the cost of living.

WHAT WE HAVE LEARNED

About Our Need for Electricity

The province is expected to have access to enough electricity from current and committed energy sources to meet our likely electricity needs for the foreseeable future. Overall electricity demand is not expected to significantly increase without major drivers such as growth in our offshore sector. We can likely balance steady and predictable demand increases (from factors such as increased use of electronics) through demand-side management and efficiency.

However, as time passes and current generation sources reach the end of their contracts or the end of their useful life, they will need to be replaced.

The electricity system will also have to be flexible enough to respond to the unforeseen. Significant changes in the demand for electricity, such as the loss of large industrial customers, or sharp increases in population growth due to economic growth (an offshore oil discovery, for example) have not been factored into the ranges used in the model that predicts our future demand. With so much unknown, system designs that can respond quickly to unforeseen changes would have significant value for our future electricity system.

Public support for managing growth through efficiency is strong, but the public is mindful of cost. Investments in efficiency measures, policies and rate designs, and technologies that support efficiency and the shifting of demand can all potentially drive down long-term costs for electricity. Still, they all have a cost today in return for future benefits. The public is looking for a balance and many are asking that affordability be taken into account.

About Our Electricity Sources

The studies completed by ICF International show that as we approach 2030 we reach the next critical point for our electricity planning. The gradual phase out of coal-fired power plants and potential retirements of renewable power purchase agreements will open up opportunities for new electricity projects. However, the nature of these opportunities will be shaped by our ability to increase interconnection with other electricity markets such as New Brunswick, and increase regional collaboration on electricity issues.

Our electricity future will be shaped by both a provincial desire to improve our environmental performance and federal requirements to lower greenhouse gas emissions. Federal regulations around coal and air emissions will be a driving force in how Nova Scotia sources its electricity in the future.

While this provides an impetus to continue improving our environmental performance, it also limits how and where we source our electricity. There is also renewed focus globally on climate change. If this continues, we can expect further external pressures such as carbon pricing or more aggressive requirements to create a low-carbon future.

Nova Scotians have told us that they value the environment. They want the province to continue making improvements (as technologies become cost effective) in how we source and manage our electricity to positively impact the environment.

We must now balance external pressures to decrease carbon, our own desire to improve environmental performance, and the desire of Nova Scotians to keep electricity costs stable. This speaks to a need to plan for a low carbon future today, so that price increases can be mitigated or offset through careful planning and integration.

Through the public consultation sessions, we learned that there is some support among Nova Scotians for more focus on small-scale electricity production. There are a number of Nova Scotians looking for opportunities to make their homes, businesses and communities more self-reliant in terms of energy production. This desire for individual opportunities will have to be balanced by the interests of all ratepayers as Nova Scotians look for long-term rate stabilization and predictable electricity rates.

Diversity in our electricity supply has been a goal for the province over the past 15 years. This means moving away from fossil fuels such as coal as our primary energy source. However, this does not mean elimination of fossil fuels. Overreliance on any once source of electricity, even renewables, places us at risk in terms of price and resource availability.

Through the public consultation process, we have reaffirmed our commitment to diversity. Experts, stakeholders, and the public feel that we should be ensuring our electricity security, both in terms of price and availability, by ensuring a mix of electricity sources.

We've also learned that Nova Scotians generally support increased regional solutions. Given that the market is relatively small, most participants feel that increasing our market regionally would benefit our system and give us more import and export opportunities.

About Innovation and Emerging Technologies

The studies completed by ICF International show that many of the innovative, emerging technologies available today are not currently cost effective for large-scale deployment within the province. As the cost of electricity increases and the cost of energy technologies come down, there may be more opportunities for their use in our system. Despite the general observation about new technology still being costly, there are specific cases where the cost-benefit business case can be made today. One such case is in the area of energy management systems.

Nova Scotia's electricity system has undergone significant transformation in the past few years. From a fairly simple model of electricity production ramps up or down to meet changes in need to a complex model that needs to take into account not just changes in customer needs but also one that must balance electricity that comes on when the winds blow or the tidal current ebb and flow. New technologies around system management could help us get maximum value out of renewable resources; shift demand for electricity off peak; and give us a much better understanding of our electricity use and how to manage it.

New technologies that provide a platform for meters and home and office energy management systems are the foundation of preparing Nova Scotia for an electricity future that offers more options in rates and billings and more choice and a reduction in electricity use. They also become critical in managing storage systems and in fact are already in place for electric thermal storage.

Overall, Nova Scotians support pursuing innovative ideas and technologies that will benefit our system. However, we must invest strategically. Investment in new technologies should solve Nova Scotian issues (such as energy management or storage) or bring significant economic benefits to the province (such as tidal energy). Nova Scotians also strongly believe that we should learn from the mistakes and build on the successes of others.

Review participants generally felt that Nova Scotia should focus on small-scale pilots to start testing some of the more expensive technologies today, in order to gain a better understanding of how they work within our system. The discussion around who should pay for innovation has identified a need for a more systematic approach to developing new technologies.

There were a number of options identified in terms of who should pay for investments in new technologies (tax payers, rate payers, or the private sector, for instance). Additional work is needed to identify specific funding streams for electricity innovation.

About Setting Rates and Regulating Utilities

Experts have shown that Nova Scotia likely does not have a large enough market (500,000 electricity customers) for full-scale market liberalization. However, there are opportunities to increase competition and transparency, and better align the interests of shareholders and ratepayers.

There are a wide variety of opinions regarding how our electricity market should be run. They range from a fully open market to breaking Nova Scotia Power into transmission and generation assets to only focusing on what gives the most benefit to Nova Scotians in terms of cost effective and quality service. However, a few key themes that have emerged.

Our current model (cost of service) is becoming less common as utilities move from large capital-intensive investments to models with increased economic and customer performance. Full-scale performance-based regulation would be a lengthy, complex, stakeholder-driven, intensive process with results that may not meet expectations of some stakeholders. However, there are ways to blend our existing cost-of-service model with regulation that has more of a focus on performance and outcomes without immediately going into a full performance-based model.

Through this process, it has become apparent that the rate-setting process is viewed as complex, and not easily understood or accessed by non-experts. Many review participants believe that there is not enough transparency or accountability in the system. Some participants have stated that the UARB process has become too adversarial and information is not readily available or easily accessible. The rate-setting process is layered and complicated, and more work needs to be done in communicating how these components work. Results need to be shared in a way that is easily accessed by the public. In a number of cases, participants complained that basic information is not publically available, when in reality it is available, but difficult to find.

CONCLUSION

The Electricity System Review process has provided valuable feedback on many aspects of the province's electricity system. All input will be considered by the Department of Energy in the development the province's future electricity plan in 2015.

To view detailed expert reports, stakeholder submissions, and summaries of public input from public sessions and telephone surveys, visit the Electricity System Review website at novascotia.ca/electricityfuture

