Emera & NB Power Research Centre for Smart Grid Technologies

Atlantic Region Energy Modelling Workshop Synthesis Report

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Energy Modelling Initiative — Initiative de modélisation énergétique

Bringing the Tools to Support Canada's Energy Transition — Outiller le Canada pour réussir la transition

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1. Introduction

This report synthesizes the results of the Atlantic Region Energy Modelling Workshop held on November 12, 2019, and the one-day Short Course on Modelling of Renewable Power held at the University of New Brunswick (UNB) on November 13, 2019. The events were scheduled together to take advantage of the travel plans of a number of participants from regional electrical power utilities, including Emera, NB Power, NS Power, Maritime Electric and Saint John Energy. There were 59 participants pre-registered for the workshop and 32 for the short course.

The agendas for the workshop and short course and the workshop case study are attached in the appendices. The workshop objectives, agenda and case study were prepared in collaboration with the EMI staff. The objectives of the workshop were as follows:

1. Convene the regional modelling and energy policies communities – modellers and users
2. Lay out policy’s use of and demand for modelling results
3. Explore how to strengthen the community through collaborations and enhanced policy relevance
4. Provide input for a regional report on energy system modelling in Atlantic Canada
5. Identify the essential ingredients for a unified modelling community and expectation from both modellers and policy makers

The objectives of the short course were to provide power system engineers and managers with a structure and optimization methodology for island power systems with renewable sources. The methodology employs a software package developed by Centre personnel to address problems power utilities are facing in understanding the impacts of increasing wind, solar and stored energy in their grids. Short course participants learned how to model and understand this impact. The electric power grid operated by Barbados Light and Power Company was used as the case study for the short course. UNB and Barbados Light and Power Company are collaborating in a five-year research project aimed to develop new tools and technologies in the context of the transition in Barbados from a 100% fossil fuel powered grid to a 100% renewable power grid by 2030.

The workshop and short course were one in a series of events and meetings held between UNB researchers and regional utility and industry stakeholders. The next event is a meeting between UNB, Emera, NS Power, NS Power and Siemens Canada scheduled for December 20, 2019. The meeting agenda includes sessions on modelling of electric power system decarbonization and proprietary data for research and development.

2. Presentations

2.1 Speaker 1: Deep Decarbonization and Electrification in Canada

The first speaker was Dr. Steven Wong, Research Advisor, Renewable Energy Integration, CanmetENERGY, Natural Resources Canada. He spoke on the topic of deep decarbonization and electrification in Canada. Dr. Wong highlighted key needs and solutions required for the Energy Modelling Initiative. He spoke to four federal government departments that provide modelling support, data and analytics:

- Natural Resources Canada (NRCan);
- Environmental and Climate Change Canada (E3C);
- Statistics Canada; and
- Canada Energy Regulator.

Points addressed by Dr. Wong included the following:

- Canada has targeted to reduce greenhouse gas (GHG) emissions 30% by 2030 as per the 2015 Paris Accord. The execution of the Accord led to creation of a framework under the pan-Canadian association to meet the set goals.
- There is a need for decision making to meet the goals within the Paris Accord. The *Green Initiative Program* contains targets for green energy development through energy efficiency and renewable programs. The above federal bodies are determined to cooperate among themselves to achieve the targets of the summit.
- The Energy Modelling Initiative is intended to lead to steps to reduce GHG emissions and modelling to achieve the set goals. For the successful implementation of this initiative, it is important to communicate the policies and government rules and regulations regarding CO2 emissions. The rules and policies set by the federal bodies need to be justified based on proper case studies. This justification must be prepared based on scientific data and experiments analyzed by the researchers. Furthermore, the data must be collected, analyzed and evaluated by specially trained personnel.
- A wide variety of generated resources are available in Canada due to the geographic position and landscape. The province of New Brunswick has its electricity generated from a pool of mixed energy resources. Whereas Quebec is producing its entire electricity from hydro and Alberta is mostly generating power from natural gas. The demand characteristic between the regulators is widely different due to the different provincial structures.

<u>Problems Identified</u>

- Need for better science-based modelling and policy integration.
- Need to build and improve Canadian modelling capacity.

<u>Proposed Solutions/Options</u>

- Consideration should be given to building an open data and modelling platform: It can be achieved through contributions from each stakeholder, bridging gaps between models, and regular model maintenance.

- Establishing a common data source: The solution should bring transparency in the modelling process, to speed up studies and interactions between parties. It should help integrate resources, information, and human skills needed in energy system modelling and policy. It should also provide parties with a common language, i.e. modellers, policy-makers, users, and researchers. This common data source should speed up the process of new modelling initiatives and increase credibility in the models. Everyone involved should have access to the same data.
- EMI actions to date have involved creation of an inventory of models and generation of insights from energy modellers. The goal is to identify electricity infrastructure projects and proposals for an end-use opportunity for decarbonization. Next steps may also involve identifying distributed energy resources and support techno-economic integration.

Question from the Participants

Who can access the stored data?
This is a challenge since the utility providers cannot in some circumstances make data public. Planning needs to be done to decide the type of data that will be open to the public and others with restricted access.

What is the difference between deep decarbonization and regular decarbonization?
Deep decarbonization involves going beyond the reduction of GHG emissions in the electricity sector. It includes all sectors in transportation, processing, commercial and industries.

How safe is the open-access system to prevent a breach of privacy or cyber-attack?
This will require advice from cybersecurity experts. There will be need to be an authentication system for users to access the portal, which will prevent the cyberattack.

2.2 Speaker 2: The Energy Modelling Initiative

EMI Coordinator Dr. Moe Esfahlani and Louis Beaumier, Executive Director of Institut de l’énergie Trottier (IET) provided an overview of The Energy Modelling Initiative.

The following objectives were highlighted by the speaker:

- To seek people in Canada who have relevant data to contribute to our goal.
- To establish a modelling inventory of Canadian modelling expertise.
- To convene the modelling community in order to expedite collaboration in model development. This involves bringing people together, organizing more workshops and initiating more exchanges of information.
- To organize energy hubs to access data and policy recommendations such as the Canadian Centre of Energy Information and the Canadian Institute of Climate Choices.

- To design modelling applications.
- To develop a business case for long-term projects
- To identify the data needed and terms for sharing and access by energy modellers.
- To plan for sustainable policy and modelling initiative over the next 10 years.

The speaker emphasized the importance of identifying groups in the Atlantic region who have completed related studies and acquiring relevant data to contribute to the modelling process. Canada is in the early stages of creating the required models based on the forecast. The goal is to find a permanent and effective solution to reduce GHGs emissions.

3. Panels

3.1 Panel 1: Meeting Climate Action Goals: The View from Policy Makers

The questions are in bold and responses from the panelists follow. For information on panelists please see the workshop agenda in the appendices.

There is a perception that there is a disconnect between public policy and modelling communities, for instance in the sharing of information. This perception is one of reasons we have assembled here today. Is there a disconnect, and if there is, how could the public policy and modelling communities change the ways they interact with each other?

- There is a gap in communication between researchers and modellers. The big challenge for researchers is to come up with a package of information in a way that is useful for policymakers.
- There are disconnections between database modellers and users. Therefore, there is a need to create a modelling inventory platform for all parties to share results on transition solutions and to achieve climate goals that will boost synergy among all stakeholders.
- There is a dependency on Statistics Canada (StatCan) data. They have been effective in providing a substantial amount of useful data for modellers as well as researchers.
- There is no specific reason for the disconnection between researchers and policymakers. A forum is needed with participation from a variety of experts.
- An example of where significant challenges exist for policy development and modelling, in a carbon constrained future is electric vehicles (EV). Where the road tax is paid for by gasoline tax revenues, new taxation policies need to be developed, e.g. tires could be taxed higher, or vehicle registrations fees could increase. So more broadly the multi-disciplinary nature of new policies will lead to more complexities.

What new problems and challenges should energy system modellers address in contributing to policy making for climate action?

- There are challenges with data. Federally collected data for New Brunswick did not capture the interconnections of NB with New England, Maine, Nova Scotia, PEI, Hydro Quebec. The electrification models NRCan uses in New Brunswick are old and the results do not come out with the right projections. The reason could be that New Brunswick power transmission and distribution system have the highest number of interconnections with other provinces. To overcome this problem, we need more co-operation from the utility companies for data sharing.

- It's important to know what the strengths and limitations are for a given model. In other words, what comes out of that model, what do the results mean, and what should and shouldn't the results be used for.
- Regarding steps and approaches, it's rational to approach it from a variety of ways, through an iterative process. Recognizing that you will have to define some criteria for any given model to function, but that defined criteria should be flexible and allowed to change depending on the outcomes.
- It's equally important to leave room for different approaches as time goes on, and that we not get too committed to a particular set of results. When setting near term goals and targets, the challenge is setting ambitious enough targets to achieve meaningful emissions reductions, but recognizing that there is a limit as to what the rate payer and tax payer can afford to pay.
- New policies are multi-disciplinary in nature. Cost of stable and reliable energy will increase for consumers as a result of increasing stringency of emissions targets. This will likely drive a need for enhanced social policy and programming to offset increased costs for those that cannot afford to pay more.
- Modelling tools for policy development are important, but at the end of the day, the modelling involves uncertainties, and where there exists uncertainty there's the potential for unintended consequences. Models are useful to give a view to the future of a potential outcome based on a set of assumptions. Making policy based of the output of a single model, with a single set of assumptions would lead to a limited view of the potential future, and greater risk of unintended consequences.
- Sticky policy would be policy that involves changes to multiple pieces of legislation, and regulations. The policy would have to be flexible enough to allow for unintended consequences to be addressed in a timely fashion. For instance, if the build out of large wind generation were to require new builds of natural gas generation, and/or due to locations of new generation sites put protected species at risk.

In the pre-call to this panel, we talked about how we have existing energy modelling tools and we want to get the most of out them in our new modelling challenges. What are some of the ways in which models are useful in the policymaking or regulatory process? How can we get the most of our existing modelling tools?

- In integrated resource planning, electric power utilities are modelled based on their lifecycle expectations and the least cost method of attaining those goals. The electricity sector has more flexibility in meeting carbon reduction goals than any other sector. Thus, it is easier to set a target and plan strategies to reach those goals on a cost-benefit basis in this sector.

It seems that the federal government sees the need for transformation of the economy and industrial base to meet Canada's climate goals. One of the questions in modelling changes to energy systems in this transformation is about

the process or sequence of steps. What should be done first? For instance, thinking of the case we will discuss after lunch, in achieving a 40% reduction of GHGs by 2030 and 80% reduction by 2050 in a provincial territory, is the first step to articulate specific GHG emission reduction targets for each sector of the economy? Alternatively, do you begin with modelling interprovincial energy storage options with jurisdictions like Quebec and Newfoundland that have significant hydroelectric capacity. There are presumably many other starting points. From either a public policy perspective or an energy system modelling perspective, what is the sequence of steps or process to begin modelling this transition within Canada?

- Policymakers need to know the goals for GHG reduction and financing available for the system transformation. But policy makers should not impose too many details.
- Policy makers should set the target and let modellers design the models.
- Policymakers shouldn't pick one solution. Approval in more than one solution can provide more options for applicability and give the researchers as well as policymakers more options to think. Policymakers and researchers are aiming for the same objective: Reduction of carbon emission. The ideal solution should be for policymakers to set the goals and modellers to choose the way to get there.

How do we optimize the use of energy resources in different regions in Canada for interchangeable benefits between regions?

- There should be an increase in trans-regional (east-west line) transmission capacity.

Do modellers consider social and behavioural changes with other modelling parameters?

- Modellers need to put into consideration social factors to have a holistic view and to get the best optimal outcomes.

What level of historical load data is available to researchers?

- NB power provides periodical data. They don't have access to every 5 minutes because of the lack of a database for storage. Recently, the regulatory body asked access to these hourly data, which are now available on their website.

Are researchers working on how to bring transmission lines to remote places?

- Yes, research has been done in this field. But it depends more on the utility providers in the province. Policymakers are the moderators to decide whether they want integration between provinces.

3.2 Panel 2: An Overview of Energy Models

The questions are in bold and responses from the panelists follow. For information on panelists please see the workshop agenda on the appendices.

What energy modelling tools are available? What type of energy models have been created so far and what is the experience in the field?

- Examples of modelling tools include:

PSS/E: It allows engineers to simulate reliability in energy dispatch.
STRATEGIST: It models load dispatch.
GENUPS: It models up to 7 days of economic dispatch.
PLEXOS: It is a tool for modelling long-term through short-term across electric power, water and gas systems.

- The models simulate different scenarios and interpret the grid response to a certain level of changes or disturbances.
- On the academic side, one challenge is to adapt academic modelling to the practical system either in industry or utilities.
- In utilities, modelling is done using a variety of software to simulate load flow, load demand, methods to meet energy targets, economic and financial dispatch.
- The tools are advantageous, but the ones that depend on forecast are not accurate. The weather and load behaviour can have unexpected data results. Dealing with such data is chaotic. For 2-3 years of forecast, an average is used. It might not be accurate.
- Economic dispatch models have been created using software such as PROMOD, Plexos and Zenus. Modelling is done on a different time frames for different regions. Zenus has a cascaded hydro model that deals with changes in water flow. These models are not perfect, but they are consistent.

Do modellers engage with policymakers?

- When policy maker makes a change, they focus on the financial and social aspect of the implications.
- A good cross-border contract between policymakers and modellers will be beneficial for everyone.
- Researchers typically do not make recommendations on policy implementation. Instead, they typically provide solutions and advice when being asked by the policymakers.
- Policymakers are the architects and the modellers build the interface.
- Economic studies often accompany technical modelling.
- Policymakers dictate the constraint in their system to energy modellers. Modellers request from policymakers what the model interface and architecture need to look like.
- There is a need for modellers to include the impact of carbon in some of the tools used.
- Capital costs are most times ignored during modelling, which affects the results.

How can we have models without knowing the load/client behaviour?

- Modelling and data availability will differ by province.
- Consumers wouldn't want to have their own usage data accessed by everyone.
- Certain data requires privacy and needs protection against cyberattacks. Improvements and investment in cybersecurity will be valuable to protect data.
- The contribution of technology with smart meters will help the process of gathering more precise data. Smart meters will elevate the value of information.
- Other observations from this session include the need for modellers to add the impact of carbon in some of the tools used. Capital costs are often ignored in modelling.

3.3 Panel 3: New Policy Needs and Models

How should modellers and policy makers work together?

- There is not a single process. Relationships are most important. Policymakers and modellers need to build trust and relationships, work together from the beginning to end of the modelling and policy making processes.

Was there engagement with policymakers in the past regional workshops?

- The Central Workshop that took place in Ottawa was attended by more government representatives and the Victoria workshop had more academic representatives. Most modellers use their own frameworks for modelling, with little reference to policy in the modelling assumptions. The EMI initiative has a responsibility to map out landscaping in energy modelling. The initiative will allow people to converge and communicate inside out. The initiative creates a standard protocol to store data and connect to other concerned initiatives in order to mobilize the network to solve policy problems.

How do you connect policy effects into modelling? How do you measure the implications of policy in the model? Is EMI considering this?

- It is necessary to evaluate the policy effects in a model and to know the areas of improvement in it. An open data source can help users to know the type of data used to build these models.
- In electric power utilities, the demand side management (DSM) program has a measurement and verification strategy to check & balance the models for continuous improvements. Non-intuitive results are difficult to explain. Therefore, utility modellers can generate accurate results with this approach.

What's the balance between policy simplicity and technical complexity in the communication aspect?

- To achieve climate goals the steps to adopt renewables or carbon captures processes is not main objective. Rather, the main objective is to achieve carbon reduction goals. It's the duty of the modeller to choose the right model to achieve those objectives.

What determines what to prioritize in policy goals?

- It depends on the objectives to be achieved but building an early relationship between modellers and policymakers is very essential in other to make good priorities.

4. Case study: Round table discussion

Dr. David Foord presented the case study. Tables were given the option to use either NB goals for GHG emission reductions of 40% by 2030 and 80% by 2050, or 1-2 tonnes per person by 2030 and net zero by 2050.

Attendees were divided into groups, each composed of a diversity of stakeholders (modellers, policy makers, academics, etc.). Each group has a designated moderator (UNB professors Kush Bubbar (1), Chris Diduch (2), David Foord (3), Mary Kaye (4) and Julian Meng (5), and one student note taker per group: Alpha Behera (1), Millena

Guedes-Blanch (2), Bhavin Mangukiya (3), Rillwan Shokunbi (4) and Riashad Siddique (5). Each table had assignments of 11 to 12 participants.

The following presents the notes taken at each table.

4.1 Group 1

Moderator: Kush Bubbar
Note taker: Alpha Behera

1. Electricity Generation
Factors involved in the GHGs emission in the power generation sector in New Brunswick:

Sources	**Power ratings**	**Number of units**	**Retire year**
Coal generation	450MW	1	2042
Natural gas	225MW	1	2027
Heavy fuel oil	1GW	3	2010

The coal and oil units produce the highest GHG emissions in the electricity generation sector, which is approximately 900 tonnes per gigawatt of consumption. All of those power units are expected to be replaced by natural gas and some renewable sources. The approximate capacity is 2 gigawatts depending on the availability of natural gas. The emission of carbon dioxide can be reduced to 340 tonnes/ gigawatt with the use of natural gas in power production units instead of coal/petroleum oil. Questions were raised during the discussion as follows:

1. Where do most of the carbon emissions originate, especially in the industry sector?
2. What is the relationship between sectors in terms of both energy consumption and GHGs emission?
3. How to reduce 80% of GHGs emissions by 2050?
4. What is the utilization quantity of natural gas needed to meet the required goal

2. Assumptions
In New Brunswick, the building sectors need to:
- Build solar domestic hot water or photovoltaics
- Reduce electric heating
- Reduce heat pumps
- Increase building insulation

These steps may lead to a net decrease in electric power demand.

3. Transportation
This sector contributes to 25% of the total GHGs emission in New Brunswick. Freight is the major cause that contributes 35% of the total emission in the transportation sector. It includes diesel and rail/ trucking.

Domestic transportation is another cause of GHG emissions, which includes high EV penetration and contributes to 30% of the emission in this sector.

For the solution, a suggestion was made to develop a project to reduce demand response and to reduce commercial and residential demand. It can lead to a net increase in electrical power demand.

4. Waste and Agriculture
During the discussion, this sector is considered not very influential. The reason for emission includes non-combustion-based metrics. It has the least influence on other sectors. It can be used in the biogas generation. Ultimately, waste and agricultural management has minimal dependency.

5. Industry
Fossil fuel production units are the major contributors. They released 2.3 million tonnes of GHGs in 2012. The non-combustion industrial process emits 1 million tonnes of GHGs in the atmosphere. It has an influence on the transportation sectors. Carbon capture storage can be introduced to reduce the emission in this sector.

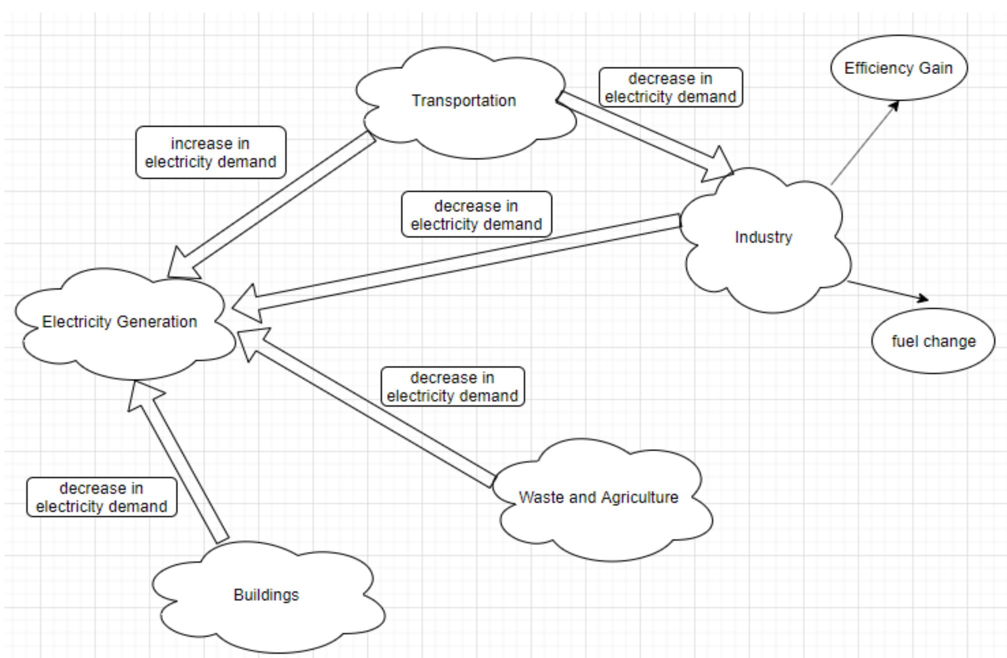


Figure 1: A diagram drawn during a discussion to understand the relationship between the sectors

The questions raised during the discussion were as follows:

1. What are the alternative ways to generate electricity?
2. What will happen to the economic demand / value of resources?
3. How to optimize and balance the relationship of loss and gain between sectors?

A possible solution could involve:
- Add or increase carbon charges.
- Check technology rather than individuals.
- All sectors' losses are supposed to be eliminated to get GHGs emissions by 2050.
- All these changes eventually influence policymakers.

Types of models may include:
- Bottom-up optimization models are important.
- Each sector has complex details.
- "Electricity generation" sectors are the most influential and interconnected to other sectors.
- Economic behaviour in each sector affects and influences the complete system. e.g. social values, personal need, cost, GDP.
- In the optimization model of GHGs emissions and energy, electricity is a variable.
- Each sector is independent in terms of GHGs emissions.
- Economic consideration at the macro-level (e.g. jobs, GDP) is not considered in the initial optimization, but the cost is required for sub-models in each sector.
- Modellers should execute various scenarios to explore different feasible pathways.
- For each method, feasible pathways can perform uncertainty analysis.
- AIS (Automated Identification System) is a new approach to create new ways of modelling.
- Data is very important. Experts interpret data for modelling.
- GIS software and analytic platform to analyze energy data.

4.2 Group 2

Moderator: Chris Diduch
Note taker: Millena Guedes-Blanch

The steps to achieve the emission target of 80%, the cost involved, the impact of policy implementation, power rates, social impact are important topics for the discussion. Capturing data is difficult but it's important. Consumers are insecure about letting the utility control their home devices such as their water heaters. A clear vision of the policy is needed. A better understanding of acquired data requires efforts but it will save time in the long run. Policies for utilities across the country differ. The questions raised during the discussion were as follows:

1. What are we trying to minimize and consider in each province?
2. Carbon is a constraint, so we need to replace it (for example, fossil to renewable) but what are the material changes?

3. How much do we have to reduce for 80% target?
4. When we increase EV, will energy consumption increase as well?
5. How to measure the targets and be sure we are on the track on achieving the target?

Incentives for consumers are important to consider. By increasing reliability for smart grid implementation, it will be easier since there is no need to convince consumers. Do the existing tools have a way to capture the target on Electric Vehicles (EV)?

What impacts need to be considered in policy development, in addition to rates and GHG emissions? Questions are in bold and responses follows:

What impacts on energy system infrastructure should be modelled?
Penetration of PV and distributed energy resources should be modelled.

How can we model changes in consumption in gas and electricity?
We can model the trade-offs of carbon footprints and electrification of transport. This generates a challenge for electric power utilities once there is a target of a 20% decrease in energy consumption.

How can we model increases in self-generation and prosumers?
Does baseload and demand-side impact of increased EVs need data hourly or monthly data? The improvement cycle requires design, implementation, measurement, analysis and input into further improvement. This comparison can help to see if the policy is good and its impact. There is a lack of data from the provinces, such as the number of licensed EVs. It is worth considering different models and policies for each region, industry and sector.

How should we consider a decrease in capacity to pay of lower income consumers?
NB Power has the highest poverty levels in the country. Lower income consumers should be modelled with lower power rates, incentives, or other programs. We should also model EV diffusion assuming various incentive programs to learn from other jurisdictions whether policy can move the needle on uptake.

4.3 Group 3

Moderator: David Foord
Note taker: Bhavin Mangukiya

An aggressive target was set at the beginning of the case-study session, 1-2 tonnes per person by 2030 and net-zero by 2050. Net-zero was defined as zero carbon emissions.

To achieve net-zero by 2050, low carbon or zero carbon energy can be offset for carbon-producing sources. An electric vehicle transition is part of this pathway to 2050.

Modelling and policy considerations for a transition to EVs by 2050 include the following:

- Total 750,000 vehicles at present.
- Each battery will take an average of 3 kW for charging.
- Total load added to the grid: 3 x 750000 = 150 MW.
- 150 MW is a high number and it will add significantly to the system load.
- The solution is to charge car batteries at night or during working hours.

Vehicle-to-grid option:

- Should we model car batteries being used to discharge to the grid during peak period?
- For EV manufacturers, the life cycle is the biggest concern.
- Grid-scale storage can mitigate storage problems.

What is the cost of the net zero transition?

- Modeling should be able to determine the amount of investments needed and how it can be spent most efficiently.
- Wind and solar with the storage provide good energy efficiency and costs.

Should we focus on energy efficiency in our modelling?
Energy efficiency does not get us to the goal of 100% reduction of carbon generation. Although it is the low hanging fruit in terms of cost per kilowatt hour, a strong investment in energy efficiency in the early 2020s may mean less investment for wind, solar and others systems that are needed to get us to our goals. How should this be modelled?

There are reliability issues to achieve 100% renewable integration**:**

- In the future, the requirement of grid-security may be replaced by the individual taking over their own security. In that case, power grid might not be interconnected. Should we model changes in cultural assumptions about what grid reliability is acceptable?
- This might involve building neighbourhoods with their own wind, solar and storage in a cost-effective way, with reciprocating generator as a backup.
- In the scenario of neighbours selling energy to their neighbours: (a stand-alone system), the wealthy will be able to protect themselves from blackouts, but the poor communities may not be able to protect themselves. That’s why utilities will come into the picture, to help who can’t help themselves. This concept is similar to the microgrid. Should these scenarios be modelled?

It is possible for NB Power to achieve 100% decarbonization generation from wind turbines, solar, hydro, geo-thermal, small modular reactors and retiring all thermal units?
Yes, but in this scenario, it may be difficult to synchronize with Quebec, inertia wise. (Asynchronous grid).

To reduce carbon emission by 80% by 2030**:**

- We should model a high renewable case, with peaking from natural gas. Natural gas has lower emission than fossil fuel and with thermal storage.

- For the industry to reduce carbon emission by 80% by 2030, electrification in the industry is not easy. The industry needs an intensive energy management system.
- The refinery in Saint John is mainly exporting. Should we model a switch from chemicals to hydrogen?
- With closure of the Belledune plant, NB will be close to the 2030 target for power production. For the 2030 target, modelling needs will rely on current technologies. For the 2050 target, modelling relies on the technology that hasn't been invented yet?

4.4 Group 4

Moderator: Mary Kaye
Note takers: Rillwan Shokunbi

The questions raised during the discussion were as follows:

1. What are the prospects of new modelling approaches for political decision-making?
2. How should modelling results be presented for political decision-making? By whom? How often?

New models should be developed by working groups comprising stakeholders from all sectors (electricity, transportation, processing and industrial), government, municipals, policymakers, and modellers.

An integrated model for the all sectors should run on one platform. A U.K model was cited. The modelling results should be presented continuously over the lifespan of the entire project, or until the goals are achieved.

How should the results of modelling be presented for public presentation?

- Results should be presented through regular workshops, with participants from different sectors.
- Teamwork amongst all levels of government and the utility companies is crucial.
- The presentation should be done in a flexible and comprehensive manner.

What processes of consultation should modellers undertake to prepare reports for political decision making?

- Modellers should build simple and user-friendly models to ease communication for policymakers.
- They should use a common language that all stakeholders can understand.
- They must determine each of the sector's specific outputs.
- They need to use transparent and trustable data.

4.5 Group 5

Moderator: Dr. Julian Meng
Note taker: Riashad Siddique

The questions raised during the discussion were as follows:

1. How can we increase synergies between modelling and policy-making?
2. Where can and should modellers be engaging in the policy-making process?
3. What do modellers need to know about a policy maker's job? What do policy makers need to know about a modeller's job?
4. Where have modellers, or projects that leverage modelling gone wrong such that modelling work hasn't been useful in the policy-making process?
5. What examples come to mind where this synergy has been particularly successful? Or unsuccessful? What made these examples successful or unsuccessful?

- Sociological analysis is the key to determining the solution in the long run. To get the data recorded is quite difficult for the time being. This is due to the use of analog meters in consumer homes. Also, some consumers are hesitant to release their consumption data due to fears it may target them for possible robbery or cyber attacks. Some also have the phobia about the utility trying to control the home of consumers.
- A wide-scale review of the policy is needed.
- Utilities should not have the same policy throughout the country. Their policies should differ by region. The policy should be based on how the cost of achieving our target goal.
- The federal and the provincial bodies must be on the same page. Modellers need to be incorporated by federal and provincial governments from the early stages. Continuous cooperation between the policymakers and the modellers is crucial.
- Modelling and policies need to be industry specific.
- The demographic factor is a key issue since remote areas do not have access to enough sunlight and may be hesitant to switch to photovoltaics and may lack the necessary infrastructure to initiate the switch.
- Modelling more east-west transmission systems should be a priority.
- The carbon footprint has a high probability to shift its status for the ongoing rise in demand for electric vehicles. High penetration of electric vehicles will have an impact on an electrical generation so the offset demand needs to be dealt with so that there is no extra emission due to this rise in electric vehicles. Need to model the impact of the increase in electric vehicles. This modelling will enable us to compare whether the implementing policy is good for society and how is it impacting the economy. However, there exists insufficient data for such modelling to take place since the number of electric vehicles in a province is hard to predict. Need some federal interrupting for such a model to take place.

5. Appendices

The appendices consist of the following documents.

1. Workshop Agenda
2. Workshop Case Study
3. UNB Renewable Power Short Course Agenda
4. Case Study Presentation

Appendix 1 - Workshop Agenda

University of New Brunswick
Emera and NB Power Research Centre for Smart Grid Technologies

Energy Modelling Initiative - Initiative de modélisation énergétique
Bringing the Tools to Support Canada's Energy Transition - Outiller le Canada pour réussir la transition

Atlantic Region Energy Modelling Workshop

November 12, 2019
University of New Brunswick (UNB), Wu Conference Centre
6 Duffie Drive, Fredericton, NB E3B 0R6

Natural Resources Canada (NRCan) sponsored a Workshop on the Development of an Open Modelling Platform for Electrification and Deep Decarbonization Studies in Montreal on February 21 and 22, 2019. The resulting Energy Modelling Initiative is supporting, in collaboration with local researchers, three regional workshops in Victoria, Ottawa and Fredericton. These workshops are bringing together local energy policy makers, energy modellers and users to expand the inventory of modelling tools, identify region-specific needs, and to develop new collaborations as Canada moves towards a clean electric future. The next steps include a national workshop to be held in Montreal on December 17 and 18, 2019.

Workshop Objectives

1. Convene the regional modelling and energy policies communities – modellers and users
2. Lay out policy's use of and demand for modelling results
3. Explore how to strengthen the community through collaborations and enhanced policy relevance
4. Provide input for a regional report on energy system modelling in Atlantic Canada
5. Identify the essential ingredients for a unified modelling community and expectation from both modellers and policy makers

Agenda

8:00 – 8:30 Arrival and Breakfast (supplied)

8:30 – 9:00 Welcome and Introductions

- Dr. David Foord, Assistant Professor, Technology Management and Entrepreneurship Centre (TME) and Emera & NB Power Research Centre for Smart Grid Technologies (ENBRC), UNB
- Dr. Dave MaGee, UNB Vice President (Research)
- Dr. Chris Diduch, Dean of Engineering and Director of ENBRC

- Introductions by participants (15 min)

9:00 – 9:30 Setting the Table: Context and Visions

- Dr. Wong, Research Advisor, Renewable Energy Integration, CanmetENERGY, Natural Resources Canada - Deep decarbonization and electrification in Canada (20 min)
- Dr. Moe Esfahlani, EMI Coordinator / Louis Beaumier, IET - Polytechnique Montreal, The Energy Modelling Initiative (10 min)

9:30 – 10:45 Panel: Meeting Climate Action Goals - The View from Policy Makers

- Moderator: Dr. David Foord, UNB
- Dr. Ganesh Doluweera, Director, Research, Canadian Energy Research Institute
- Brad Little, Renewable and Electrical Energy Division, Natural Resources Canada
- Dave Sollows, Senior Advisor, Energy (Division), Natural Resources and Energy Development, Government of New Brunswick
- W. K. (Bill) Marshall, President, WKM Energy Consultants Inc.

10:45 – 11:00 Break

11:00 – 12:15 Panel: An Overview of Energy Models

- Moderator: Dr. Kush Bubbar, Assistant Professor, TME, UNB
- Dr. Bo Cao, Research Associate, Electrical and Computer Engineering, UNB
- Craig Church, NB Power, Senior Corporate Modeller
- Ann Evans, Senior Engineer, Power Systems, WSP
- Matthew McCarville, McCarville Research

12:15 – 1:00 Lunch (supplied)

1:00 – 3:00 Case Study Roundtable Discussion

- Presentation of case study, Dr. David Foord, UNB
- Attendees will be divided into groups, each composed of a diversity of stakeholders (modellers, policy makers, academics, etc.).
- Each group has a designated moderator (UNB professors Kush Bubbar, Chris Diduch, David Foord, Mary Kaye, Julian Meng) and one student note taker per group.

3:00 – 3:15 Break

3:15 – 3:45 Case Study Roundtable Discussion Reports

- Note takers will prepare summaries of the table discussions and post them in the room.
- Table moderators will present to tall participants on the results of the table discussions.

3:45 – 4:30 Panel: New Policy Needs and Models

- Moderator: Dr. Chris Diduch, UNB
- Steven Wong, Natural Resources Canada
- Darren Clark, Senior System Planning Engineer, NB Power
- Dr. Moe Esfahlani, EMI Coordinator / Louis Beaumier, IET - Polytechnique Montreal

4:30 – 4:35   Wrap-up

- Dr. Chris Diduch, UNB

End of Program

Participants are invited to join us at the Crowne Plaza Lord Beaverbrook Hotel for a reception at the James Joyce Pub starting at 5:00 pm, followed by a self-funded dinner at 6:30 pm in the Maverick Room.

Appendix 2 - Workshop Case Study

Energy Modelling Initiative - Initiative de modélisation énergétique
Bringing the Tools to Support Canada's Energy Transition - Outiller le Canada pour réussir la transition

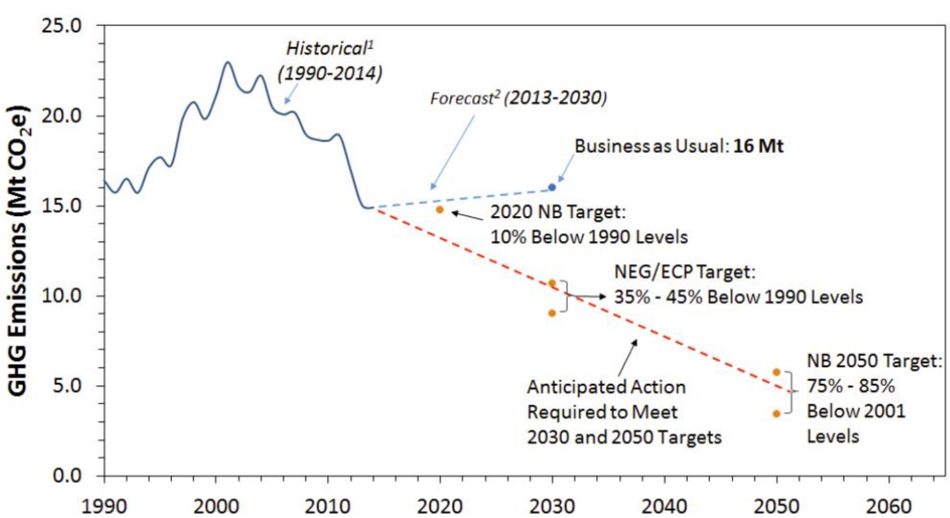
Atlantic Region Energy Modelling Case Study
“Electrification and Decarbonization in New Brunswick”
November 12, 2019

Introduction

In this case study you are asked to identify modelling tasks, gaps and issues in a New Brunswick electrification and decarbonization scenario. You are not obligated to use information outside of this case, but you are permitted to do. The case study questions are presented on the following page.

Background

New Brunswick’s plan is to achieve greenhouse gas (GHG) reduction targets of 10 per cent below 1990 levels by 2020, and 75 to 85 per cent below 2001 levels by 2050, equal to about 5 million tonnes. The plan is illustrated in Figure 1. According to data from Canada’s Energy Regulator[1], New Brunswick’s GHG emissions in 2016 were 15.3 megatonnes (MT) of carbon dioxide equivalent (CO2e). This amounts to 20 tonnes CO2e per capita, just above the Canadian per capita average of 19.4 tonnes.



The largest GHG generating sectors in the province are electricity generation at 32% of emissions (4.9 MT), transportation at 28%, and oil and gas at 17% (primarily petroleum refining at 2.5 MT, with 0.1 MT attributable to production, processing, and transmission).

[1] Link: https://www.cer-rec.gc.ca/nrg/ntgrtd/mrkt/nrgsstmprfls/nb-eng.html?=undefined&wbdisable=true

Figure 1: GHG emission trend for New Brunswick[2]

According to NB Power's 2017 Integrated Resource Plan, NB Power's projections for GHG emissions are relatively flat at about 4 million tonnes per year during the period from 2017 to 2039, and then decrease to below 2 million tonnes per year by 2041 as Belledune (coal fired) and Coleson Cove (oil fired) generation stations are retired and new natural gas combined cycle turns are commissioned. NB Power's forecast of future provincial electricity requirements to 2042 are also relatively flat, remaining at just under 15,000 GWh with an Energy Smart NB Program, and rising to about 17,000 GHh without the Energy Smart NB Program.

New Brunswick's greenhouse and gas (GHG) emissions by sector in 2014 are presented in Figure 2. For the modelling exercise, presume New Brunswick has GHG emission reduction
objectives of:

- 40% zero-emission personal automobile usage by 2040 and 80% by 2050;
- 80% net-zero energy buildings by 2050;
- 40% reduction in GHG emissions in waste, agricultural and industry sectors by 2030 and 80% reduction by 2050; and
- 80% reduction of GHG emissions in electricity generation by 2050.

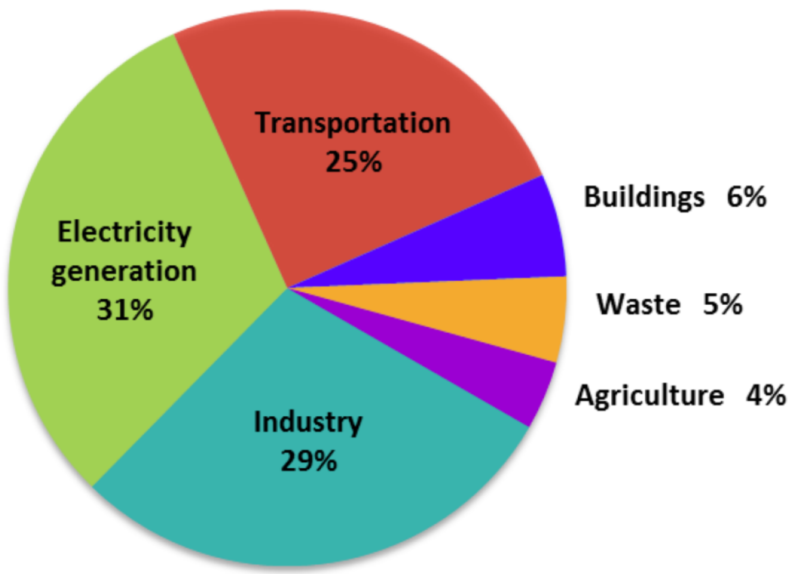


Figure 2: 2014 New Brunswick GHG emissions[3]

Case Study Questions

Electrification spans a breadth of decision-making jurisdictions (municipal, provincial, federal, international) and systems (gas, electricity, water). Individuals operating devices behind the meter, provincial planners developing load forecasts and infrastructure expansions, and federal negotiators making climate commitments all have different needs and information requirements. Representing these requirements in energy

[2] Link to Final Report of the Select Committee on Climate Change: https://www1.gnb.ca/legis/committees/archive/58/climate-e.asp
[3] Link to Final Report of the Select Committee on Climate Change: https://www1.gnb.ca/legis/committees/archive/58/climate-e.asp

system modelling calls for a range of models with different frameworks, spatial-temporal scales, objectives and so on.

Your task is to identify modelling tasks, gaps and issues in the above New Brunswick electrification and decarbonization scenario. Questions to consider include the following.

1. How can modelling be applied to reach our decarbonization objectives?
   (a) The morning's modelling overview panel reviewed several model categories and their appropriateness in addressing different issues. Which of the models discussed in the panel session are appropriate and useful in the context of the case study topic?
   (b) Hypothetically, if a project applied the models discussed by the panel to address the case study topic, where would there still be gaps in the analysis?
   (c) Outside of the quality of the analysis, what other considerations are important? For example, is model transparency (i.e. open-source data and code) important for increasing public trust in good governance and appropriate policy?
   (d) What additional capabilities would have to be developed/applied to address the gaps?
   (e) What new data is required the modelling activities?

2. In pursuit of those **objectives**, what **impacts** need to be considered in policy development, in addition to rates and GHG emissions?
   (a) What impacts on energy system infrastructure should be modelled?
   (b) How can we model changes in consumption in gas and electricity?
   (c) How can we model increases in self generation and prosumers?
   (d) How should we consider a decrease in capacity to pay of lower income consumers?
   (e) What are the impacts for federal-provincial cooperation in energy system electrification and decarbonization?

3. How can multiple **objectives** be addressed simultaneously? How can they be integrated with a higher, systemic objective?
   (a) How can municipal, provincial, federal, international models cooperate?
   (b) How may new modelling problems be identified for research and development within academia?
   (c) What organization will model gas, electricity, transportation systems simultaneously? What organizations will support this modelling work?

4. What are the prospects of **new modelling approaches** for political decision making?
   (a) How should the results of modelling be presented for political decision making? By whom? How often?
   (b) How should the results of modelling be presented for public presentation?
   (c) What processes of consultation should modellers undertake to prepare reports for political decision making?

There is a natural fit between modellers and policy-makers: modellers often develop insights that could be useful to policy-makers; policy-makers often seek evidence to support decisions and policy. However, despite this natural fit, we are here today in part because we don’t always witness or partake in projects where this natural fit manifests.

5. How can we increase synergies between modelling and policy making?
   (a) Where can and should modellers be engaging in the policy-making process?
   (b) What do modellers need to know about a policy maker’s job? What do policy makers need to know about a modeller’s job?
   (c) Where have modellers, or projects that leverage modelling gone wrong such that modelling work hasn’t been useful in the policy-making process?
   (d) What examples come to mind where this synergy has been particularly successful? Or unsuccessful? What made these examples successful or unsuccessful?

Appendix 3 - UNB Renewable Power Short Course Agenda

University of New Brunswick
Emera and NB Power Research Centre for Smart Grid Technologies

Short Course on "Optimization Models for Island Power Systems with Renewable Sources"

Course Instructor: Dr. Eugene Hill
Course Date and Location: November 13, 2019, Wu Conference Centre, UNB

This one day short course will provide engineers and managers with a structure and optimization methodology for island power systems with renewable sources. The methodology is based on two different criteria: (i) minimization of residuals arising from normal loads and intermittent renewable sources; and (ii) minimization based on the capital cost of renewable resources.

The methodology employs a software package developed by Centre personnel to address problems power utilities are facing in understanding the impacts of increasing wind, solar and stored energy in their grids. In this one-day short course power system personnel will learn how to model and understand this impact.

Agenda

08:00 – 08:30	Arrival and Breakfast (supplied)
08:30 – 08:45	Welcome and Introductions
08:45 – 10:15	Context and Introduction to the optimization methodology
10:15 – 10:30	Break
10:30 – 12:00	Results based on the Barbados Light & Power system
12:00 – 13:00	Lunch (supplied)
13:00 – 14:30	More on the methodology and software
14:30 – 14:45	Break
14:45 – 16:15	Operational reserves and storage
16:15 – 16:30	Wrap-up

Appendix 4 - Case Study Presentation

The case study presentations slides are attached in a PDF file.