GENERATION ENERGY
The Conversation Continues

THE PATHWAYS, FORECASTING AND ENERGY DATA EXPERTS WORKSHOP

Ottawa - September 12, 2017

On Sept 12th, 2017, the Ivey Foundation and Natural Resources Canada jointly hosted a workshop of roughly 30 experts to discuss how energy data and modeling is used to inform decision-makers in both governments and industry and how Canada's energy data and modeling landscape can be improved. Lorne Johnson, senior policy advisor at the Ivey Foundation, facilitated the workshop.

WORKSHOP OVERVIEW

The workshop started with three presentations by energy data and modeling experts to illustrate what energy models are currently saying about Canada's energy future, the range and limitations of energy modeling in Canada, the current state of energy data in Canada, and the future challenges of energy data and modeling.

Following these presentation, the workshop explored the following topics and issue statements:

1) **What the various energy-economy models are telling us**
    - There is a consensus around the key pathways to deep decarbonization (e.g. energy efficiency, electrification, decarbonizing electricity supply, low-carbon fuels, alternative fuels); and
    - Anticipated bottlenecks to achieving a low carbon future depend on the different potential pathways (e.g. some decarbonization pathways that are less technologically advanced, such as biofuels, low-carbon long-haul freight, alternative aviation fuel, or energy storage).

2) **Key shortcomings and gaps with data collection and energy models and their use in Canada**
    - Modeling challenges exist when predicting disruptive change and the impact of innovation
    - Modeling faces challenges with communicating the assumptions that are made when developing future scenarios;
    - There is limited capacity to undertake extensive modeling exercises or to collect and curate comprehensive energy data for Canada; and
    - Canadian energy data, even if all sources could be combined, is incomplete, is of varying quality, lacks consistency, and is not widely or easily accessible, even to the federal government.
3) **The most promising ways to address gaps and shortcomings**
    - How to improve the availability of, and access to, Canadian energy data, information and analysis?
    - How to create effective, open, transparent modelling capacity in Canada and how can modelling capacity be effectively integrated into evidence-based policy?
    - How can the short-comings of energy-economy and econometric models be supplemented to better understand and work towards plausible pathways to a low carbon future?

KEY INSIGHTS

UNDERSTANDING WHAT THE MODELS ARE TELLING US

- **Energy models are in high demand** both in Canada and globally, due to their ability to provide insights and advice, including on future low carbon and energy demand scenarios. With added use comes additional scrutiny to get it right.
- Models are increasingly used in government, to advise decision-makers and review the performance of policies and programs.
- It is clear that **no single model can accomplish every task**. The challenge is to use multiple models and make sure to use each model based on its particular strengths. In addition, when using a model it is important to not focus on specific outputs (e.g., numbers) but to look at broader trends and commonalities that are consistent across different models and assumptions.
- **Energy models show a series of critical pathways to support deep emissions reductions** across the economy.
    - Canada's 2030 emissions reduction targets, as well as it's longer term targets, look achievable. There is growing **resiliency and technological certainty** around a number of key pathways, including:
        - **Electricity decarbonisation**;

    - **Energy efficiency**;
    - **Electrification** (with a focus on the use of oil); and,
    - **Reducing non-energy greenhouse gas emissions.**
  - There is also significant **technological and structural uncertainty** around other pathways, including:
    - **Transportation** (second generation biofuels, electric-powered freight);
    - **Carbon capture and storage** (many models assume a heavy reliance on CCS for oil and gas production, emissions-intensive electricity generation, and some industrial emitters);
    - **Alternative fuels** (like transportation, many models assume a dependence on the next generation of zero or near zero emissions fuels but weak market signals make the development of these fuels a challenge); and,
    - **Battery technology** (the required energy density of batteries for long-distance travel, including freight, marine, and air transport, has yet to be achieved).
- Models **could be significantly underestimating future potential emissions from structural changes to the economy**, including urbanization, dietary shifts, movement to service and knowledge-based economies. More work is needed to better understand the potential impact of these changes.

<u>SHORTCOMINGS AND GAPS WITH ENERGY SYSTEMS MODELS AND THEIR USE IN CANADA</u>

- **Energy modellers use a range of 'top-down' and 'bottom-up' models in use in Canada, each with their own strengths and weaknesses.**
- A number of international jurisdictions have stronger, more integrated modelling efforts and better coordinated energy data collection and validation. For example, the Committee on Climate Change in the United Kingdom, the Swedish Energy Agency, and the United States Energy Information Agency have detailed modelling approaches. Countries often utilize universities to build modeling expertise and maintain a variety of models to do analysis.
  - Certain international jurisdictions use models to make recommendations on energy targets and emissions mitigation strategies and enhance energy literacy and public engagement.
- **There are a number of inherent challenges with energy model use in Canada**. Models are better at working with incremental change and are often not well designed to factor in innovation and disruptive technologies. Models are also frequently unable to monitor for bigger systemic changes impacting the economy and greenhouse gas emissions. In addition, many models we have in Canada were developed decades ago under significantly different economic, social, and policy contexts. While there have been attempts to maintain and update these models, the investment climate has not been as supportive as necessary.

- There are also specific **challenges associated with the use of energy models in policy making**. There is a lack of consistent use of models, with no cohesive plan or framework in place linking modelling to energy and climate policy. There can be a tendency to focus too much on specific numbers and to seek definitive answers rather than looking at the broader trends that models can reveal. Inconvenient truths and politically controversial assumptions can potentially be left out of models, leading to greater inaccuracy with results. Models also have the potential to be used to justify decisions after the fact, rather than to support the rationale for the decision in the first place.
- A **barrier to access and transparency lies in the ownership of energy models**. Most, if not all, Canadian energy models are either privately or government owned, creating restricted access, a lack of transparency in assumptions, and limited understanding outside of these groups in terms of how the models work (e.g., assumptions, strengths, weaknesses).
- **Capacity challenges relate to a lack of investment and support for energy models that can be expensive to maintain**. Greater investment and support (public and/or private) could foster a robust modelling network that builds skills and ensures training. Funding that does exist is often short-term and competitive (2-4 years in length). Despite this challenge, Canada still has a world class core modelling capacity and talent.

RECOMMENDATIONS: IMPROVING MODELS AND THEIR USE

- Consider establishing some form of national 'experts panel' (similar to the UK Committee on Climate Change) that could provide unbiased modeling advice to decision-makers across the country;
- Avoid focussing on specific numbers when using models to inform decision-making. Look at trends and resilient learnings and apply lessons to support different choices, rather than the definitive answer;
- Use multiple models to identify common trends and support the use of scenario approaches to identify alternative desirable futures;
- Run models continuously under different assumptions to build confidence in their outputs, while making incremental adjustments as necessary;
- Look for sensitive linkages across energy systems where one adjustment to the model could lead to a step change in other systems;
- Make co-benefits or ancillary benefits (health, jobs, etc.) from the energy sector a greater emphasis in modeling, rather than focussing solely on emissions;
- Support basic education and greater communication between decision-makers and modelers (including a focus on uncertainty of projections);
- Consider adopting a standardized template that would be used to characterize the different models we are using and their strengths, weaknesses, and applications;
- Use energy models to stress test energy systems data and provide quality assurance; and,
- Challenge core assumptions of many of our models regarding energy demand, GDP and population growth and support exploratory modeling to explore the global factors driving our energy systems, potentially through a fund or prize for creative model exploration.

RECOMMENDATIONS: STRENGTHENING MODELING CAPACITY

- Our goal should be a robust community of modelers and model systems that are being continuously being tested, challenged and improved;
- This will require funding for open independent modeling (including research and development and model improvement) – maybe consider an Natural Sciences and Engineering Research Council-type approach;
- If established, a national 'experts panel' could commission support for different modeling centres and a wide range of approaches;
- Hosting an annual modeling forum that convenes model users, policy-makers, researchers, and industry could support discussions on best practices and common objectives;

RECOMMENDATIONS: IMPROVING MODEL TRANSPARENCY AND ACCESS

- Ideally, scenario type models (stocks, flows, linkages across energy systems) would be open-source and open-access models with a user-friendly user interface;
- A national experts panel and a central coordinating organization could help improve transparency and access;
- We could develop incentives for modelers to post their results publicly and to provide details on core assumptions; and,
- Governments could add conditions to contracts requiring transparency of data and results, use of only publicly accessible (& ideally single set of) data.

KEY CHALLENGES WITH ENERGY SYSTEMS DATA IN CANADA

- A **lack of available energy data** is a key challenge Canada. In one case, a participant voiced that only 38% of 189 potential energy indicators are currently collected by governments. The trouble lies in figuring out what data points we are not collecting but should collect, as we cannot collect it all.
  - Examples of areas where we lack sufficient energy data include new energy technologies, co-generation, the impact of new energy sources, energy infrastructure, renewable energy, and energy storage.
- There is also a challenge around the collection and dissemination of **incoherent energy data**. Different definitions, collection and dissemination methodologies, time periods, and regions make data points difficult to compare and communicate. For example, there are more than 10 different definitions of 'sector-based' greenhouse gas emissions, there is a lack of clarity around final energy consumption versus end-use energy consumption, and there are questions around the differences between energy balance and energy accounts.
- **Inconsistent data** comes from sources with competing facts. Errors can also stem from data changing between primary and secondary sources and from different collection methods

between sources. One participant highlighted that out of 26 indicators from different sources, 42% differed in value by more than 10%.

- **Canadians lack confidence in energy data**. Interviews with key data users reveal limited confidence in the data we have.
- **Canadian energy data is often dated and not timely.** Of data assessed and used in 2016, 61% was from the same year, 9% was from 2015, and 30% was from 2014 or earlier. This stems from the fact that most data is only available on an annual basis.
- **Confidentiality needs can create problems with ensuring energy data is open and transparent to the public.**

KEY RECOMMENDATION: ESTABLISHING AN ENERGY INFORMATION-TYPE ORGANIZATION

Participants expressed general support for improving energy data in Canada by establishing a national-level Canadian Energy Information-type initiative. The discussion steered towards a number of core characteristics and potential functions of such an organization.

Characteristics:

- Ensure that the **scope captures the entire energy system** (e.g., national, regional, local, supply and demand, all types of energy, all sectors with demand);
- Develop an independent board or governance structure to ensure that the organization is **non-biased** and not controlled by any one stakeholder;
- Grow **broad support** for the initiative through the buy-in of all levels of government, industry, and other key stakeholders (e.g., academia, civil society);
- Support a **strong legislative mandate** and **stable, long-term funding** (e.g., 3-5 year cycles);
- **Collaborate** with data gatherers through agreements and other mechanisms;
- Create **transparency** in operations and governance;
- Build **accessibility** through user friendly analytical tools and publically available data sets;

Functions:

- Use advanced approaches to data management;
- Support a broad range of economic, environmental, and social research and analysis;
- Maintain strong relationships with data providers;
- Create marketing and communications strategies to tailor data for decision makers in Indigenous communities, businesses, government, academia, and civil society; and,
- Work with data providers to improve the quality of energy data and to close data gaps.