Trends in Canada's Energy Future

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Overview

The National Energy Board's (NEB) Energy Futures series explores how possible energy pathways might unfold for Canadians over the long term. Canada's Energy Future 2018: Supply and Demand Projections to 2040 (EF2018) considers four different cases including: a) The Reference Case, based on a current economic outlook, a moderate view of energy prices and technological improvements, and climate and energy policies announced at the time of analysis; and b) The Technology Case, which pushes past the policy and technology boundaries specific to the Reference Case and includes greater global climate policy action and low carbon technology adoption. It provides one potential view of what a faster transition enabled by stronger long-term carbon policy, faster uptake of technologies such as electric vehicles, and lower cost of renewables would mean for Canada's energy future.

This paper will compare the EF2018 Reference and Technology cases for both energy production and energy use across the various sectors of Canada's economy. It will illustrate the key differences between the cases for various fuel types and sectors. It will then identify several fundamental trends that are common to both cases, and provide a framework in analysing potential future Canadian energy system outcomes.

Methods

The EF2018 projections are developed using the NEB's Energy Futures Modeling System. This includes a variety of modules covering various sections of the energy system based on a common set of assumptions. Modules include: Demand and electricity (using the ENERGY2020 energy systems model), crude oil and natural gas production (using NEB developed models), and macroeconomics (provided by Stokes Economics).

The Reference Case assumptions are based on current trends and consensus views of the future for key variables such as crude oil prices, natural gas prices, economics, and technology development. It includes announced policy initiatives for which there is enough detail to include in the modelling.

The Technology Case assumes that countries across the world increasingly adopt new technologies and increase their actions to combat climate change, as outlined in the IEA's World Energy Outlook 2017 "Sustainable Development Scenario." This global shift has implications for energy markets such as crude oil and natural gas. Canadian energy supply and demand trends are influenced by this global context, as well as specific assumptions on cost reductions and adoption for new technologies in Canada.

Results

In the baseline Reference Case projection, energy use grows slowly, and by 2040 is 5% higher than current levels. Canadians use more natural gas and renewables, and less coal and oil refined petroluem products. On the supply side, Canada's green electricity mix becomes even greener and crude oil and natural gas production grow from current levels.

The EF2018 Technology Case explores what a global shift in the implementation of various innovative technologies and related policy assumptions might mean for Canada. Non-emitting sources and energy technologies get cheaper, improvements to equipment and buildings reduce energy requirements, and markets and infrastructure adapt to these changing trends. By 2040, energy efficiency, new technologies, and fuel switching combine to reduce Canadian energy use by nearly 15% from current levels. The fossil fuel portion of the fuel mix that declines even faster, and is nearly 30% lower than current levels by 2040, as the relative share of non-emitting energy grows.

In both the Reference and Technology Cases, gross domestic product (GDP) and population grow faster than energy demand, leading to reductions in energy intensity, measured in terms of total energy use per dollar of GDP and per capita. In the Reference Case, energy use per dollar of GDP is nearly 30% lower than current levels by 2040, while energy use per person is nearly 15% lower than current levels by 2040. This represents a moderate increase in the pace of decoupling compared to historical trends, and is related to a variety of factors including energy efficiency improvements, policies and regulation, and economic structural change. In the Technology Case, these trends depart significantly from history. As the globe shifts towards a lower carbon future and other countries act on climate change in a similar fashion, economic growth in Canada is able to remain comparable to the Reference Case. Because energy use decreases in this case, energy intensity trends decline even further. By 2040, GDP energy intensity is nearly half the current levels, and energy use per capita is reduced by a third.

As emerging forms such as wind and solar increase, traditional forms of energy have limited growth or decline. In the Reference Case, wind capacity doubles and solar capacity nearly triples over the projection period. In the Technology Case, installed capacity of non-hydro renewables reaches over 50 gigawatts (GW) by 2040, 48% higher than the Reference Case. By 2040, the share of non-emitting electricity generation increases to nearly 84% in the Reference Case and 90% in the Technology Case, compared to approximately 80% currently.

Even though domestic use of oil products and natural gas grows slowly or declines, Canada has potential to increase energy production. In the Reference Case, oil and gas prices are sufficient for oil production to increase 58% by 2040, and gas production to increase by 33%. The Technology Case assumes lower global fossil fuel demand, lower prices, and highlights the potential for improved technology to reduce emissions and help production remain competitive in this changing environment.

Conclusions

The EF2018 Reference and Technology Cases offer two very distinct scenarios on how the future of energy in Canada could unfold. The results of these cases show that in a world where the globe shifts towards a low carbon energy system, Canada's energy system will look much different than it currently looks today, and is projected to look in the baseline Reference Case. Despite these different outcomes, the two cases do have some similarities. Specifically, three fundamental trends guide both outlooks. First, both cases show increased diversification of the energy mix with more renewables and less coal and oil product use. Second, both cases highlight Canada's potential for energy production. Finally, both cases show that energy use and economic growth continue their historic trend of decoupling as the economy uses energy more efficiently. All three of these trends exist in both the Reference Case and the Technology Case, with the difference being the pace and magnitude of change.