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Energy Security and the Road to Net Zero by 2050

by Monica Gattinger

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POLICY PERSPECTIVE

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February's power outage in Texas was a devastating reminder of the importance of energy security. Like the ubiquity of electricity in our lives, we don't realize how pivotal energy security is until we don't have it. We've all had the experience of flipping on light switches during a short blackout, chuckling to ourselves for forgetting the power's out. Longer outages, like the one in Texas, are no laughing matter. The full scale of the impact on human health, the environment and the economy has yet to be determined, but will plainly have been colossal.

In advanced economies like Canada's, we take energy security for granted. Access to reliable, affordable energy is the norm. That we rarely think about it is a testament to the success of energy providers in delivering reliable and affordable fuels and power.

But energy security will be crucial on the road to net zero GHG emissions by 2050. Unfortunately, it is often overlooked in emissions reductions decision-making. This needs to change, or we risk compromising the economy, human health and safety, along with climate action itself.

What is energy security?

Start with a definition. The International Energy Agency (IEA) defines energy security as comprising three key aspects, underlined here: "Ensuring the uninterrupted availability of energy sources at an affordable price." How do each of these relate to net zero, and how will they change in the years ahead?

Take energy sources. In the coming decades, oil and gas will remain key sources, but the proportion of end-use energy accounted for by electricity is slated to grow, and new energy sources like hydrogen and modern biofuels are likely to gain ground.

The IEA's World Energy Outlook for 2020 includes a Sustainable Development Scenario that considers what's needed to meet the Paris climate targets. The scenario sees global primary energy demand in 2040[1] accounted for by 56 per cent fossil fuels (down from 80 per cent in 2019), with the remainder a combination of bioenergy, nuclear, hydro and other renewables (13 per cent, nine per cent, four per cent and 18 per cent, respectively).

Looked at through the lens of end-use energy (i.e., energy use at point of consumption), the Sustainable Development Scenario sees electricity account for 31 per cent of total final consumption in 2040, up from 19 per cent in 2019. The power sector is likely to rely far less on fossil fuels in 2040 (24 per cent of the generation mix, down from 72 per cent in 2019) and far more on nuclear (19 per cent), hydro (10 per cent), bioenergy (11 per cent) and other renewables like wind and solar (36 per cent).

[1] The scenario does not extend to 2050.

The key takeaways here? The almost 25 per cent drop in fossil fuels in global energy demand, the growth of electricity in end-use energy by over 10 per cent and the rise of non-emitting generation sources in the electricity mix.

Similar trends are likely to play out in Canada. Recent modelling by the Canadian Institute for Climate Choices (CICC) proposes a number of different scenarios to meet Canada's net zero by 2050 commitment. All see a growing role for electricity in the economy, lower reliance on oil and gas for end-use energy and the rise of a variety of alternative energy sources, including hydrogen and modern biofuels. This is consistent with previous modelling of Canada's energy future in the context of climate change.

While predicting future energy systems is anything but an exact science, it is a likely bet that the future will see a more diversified energy mix, along with more reliance on electricity in many areas of the economy. These changes will be driven first and foremost by efforts to reduce GHG emissions. It is no accident, then, that decision-makers are alive to the 'sources' component of energy security. But what about availability and affordability? These often get a pass even though they will be crucial underpinnings of a successful energy system transformation.

Take availability. A key issue here is electrification as a major emissions reduction plank. For Canada, a country with one of the lowest emitting electricity systems in the world (82 per cent non-emitting, with a federal commitment to grow that to 90 per cent by 2030), electrification holds tremendous potential to reduce emissions. But the more the economy relies on electricity, the more electricity reliability becomes a pivotal energy security concern. The challenges here are multiple.

Chief among them will be the effects of climate change itself in the form of more frequent extreme weather events like severe flooding, hurricanes and snowstorms, along with wildfires and other natural disasters. All have the potential to knock power systems offline. And the more the economy relies on electricity for transportation, heating and industry, the more devastating the economic and societal impacts will be. This will be far more than just the lights going out.

The power grid is also vulnerable to cyber-security attacks. The North American electricity grid is referred to as the world's largest machine: an interconnected cross-jurisdictional network of generators, transmission lines, distributors and consumers, completely dependent on information and communications technologies to function. The more we depend on it, the more vulnerable we become to cyber-attacks that can bring the whole thing down, whether by hostile foreign powers, terrorists, ransom seekers or disgruntled employees.

Availability will also be shaped by the technical issues of integrating intermittent sources of power into the grid. Having access to firm baseload power or to large-scale storage to supply power when the sun isn't shining or the wind isn't blowing is essential. This crucial point can sometimes get lost in the exuberance surrounding impressive price declines in wind and solar power.

Canada's ability to construct the infrastructure needed to support growing electricity demand will also influence availability. Modelling suggests that Canada will need to double or even triple its

electricity generation capacity by 2050. This means expanding or building new hydro-power projects, wind and solar farms, nuclear capacity and natural gas plants, all at a time when community expectations for engagement in projects and regulatory requirements for impact assessment are at an all-time high. Will we be able to raise sufficient capital for all of these projects? Will new generating capacity, along with the transmission infrastructure needed to bring power to consumers, be built rapidly enough to meet growing demand? If not, we can expect supply interruptions. Or soaring prices, as seen in Texas.

Which brings us to affordability, the third component of energy security. Energy prices are shaped by a complex mix of technological, social, political and economic factors that are difficult to predict even in the short term. Predicting prices in the long term is a mug's game. But one thing is sure: Canadians do not sit idly by when prices spike or price increases seem never-ending. The recent inquiry in British Columbia over high gas prices is a case in point as are the year-over-year electricity rate increases in Ontario that saw the popularity of the Wynne government plummet.

This underscores the need for leaders to pay close attention to affordability on the road to 2050. If not, public pressure could result in calls to roll back commitments to climate change – even if price increases are not directly attributable to climate action. The situation in Texas is a cautionary tale, where the outage is calling into question further integration of renewables into the grid.

None of the above is reason not to act on climate change. Rather, it highlights the importance of ensuring all three aspects of energy security are top of mind when doing so.

This means three key things for decision-makers. First and foremost, availability and affordability must be incorporated into policy thinking and planning to transform energy sources over the next three decades. If not, political backlash may see policy-makers forever taking one step forward and two steps back on the road to 2050. It's unlikely that climate objectives can be met that way.

Second, it means connecting modelling and planning exercises to the real worlds of energy, notably the 21st century realities of electricity reliability; of financing, siting and building energy infrastructure; and of deploying new technologies. We need to bring the modellers and planners together with those doing the heavy lifting on the ground in order to make durable change happen.

Finally, building on the second point above, it means collaboration across the entire energy system – policy-makers, regulators, industry, system operators, consumers, communities, Indigenous organizations and more. Looking at 2050 through the lens of energy security brings systems thinking and integrated approaches into sharp focus. This means collaboration among all players in the system who, collectively, have the information and knowledge to identify the energy source, availability and affordability opportunities, obstacles and issues, and the relationships, power and authority to successfully navigate them.

Canada's net zero by 2050 commitment is ambitious. Energy security will be key to achieving it.

About the Author

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Canadian Global Affairs Institute

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