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Illuminating the energy transitions discourse for Canada

A bright ideas article

Energy transition is a growing phenomenon around the world. There are different drivers of change, and energy transition looks different depending on where and why the transformation is taking place. The drivers of change, how they unfold, and who benefits from change depends on a set of interconnected choices. Understanding these variables and their interplay with different energy transition processes can better help us forecast change.

In this series of articles, we'll explore what's happening in the world of energy to help readers separate signal from noise by applying learnings from our experiences and observations in the energy sector.[1]

Future of energy and the Canadian dimension

Energy, and the ways natural resources are used to generate it, is increasingly a subject of great debate as many regions are on the verge of significant transition.[2] Although this is an uncertain environment, some things remain clear: energy transition won't affect every territory in the same way, and the causes of change will vary greatly from region to region. Energy transition processes may share common global characteristics—such as shifting from fossil fuels to renewable sources—but they are not monolithic. One of the most important differences in transition is in speed; swift energy transitions are typically the result of public action relating to a real or perceived threat to safety or the environment, while slower transitions are based heavily upon—and may seek to maintain—existing policies and patterns of investment and consumption.[3]

In a market that's experiencing growing disruption, and with an uncertain future on the horizon, we look to address and alleviate the confusion that energy companies are facing by demystifying the discourse around energy transition.

Core concepts and definitions

Before we begin the conversation, it's helpful to align our understanding of a few foundational definitions and core concepts:

- **Energy pathway:** the method for collecting energy from its source, the transport required to deliver it to users, and any conversions needed to deliver it in its desired output state (e.g., heat.)
- **Energy transition:** the transition from one energy pathway to another.
- **Energy system:** the collection of energy pathways that supplies energy to customers in a region.
- **Forces of change:** forces, such as technological advancement or environmental activism, that act either to reinforce the current region's energy pathway(s) or cause transition.
- **Energy system success criteria:** the definitions of what "good" means for an energy system, including affordability, accessibility, resiliency, sustainability, safety, and economic potential.
- **Energy stakeholders:** the groups involved in the energy system of a region, including customers, pathway operators (utilities), market operators, and regulators.

Throughout human history, energy pathways have mirrored social and economic growth.[4] Each region develops its own energy pathways, based on the resources available and the forces of change being exerted during its development. The choices made are reinforced not only by investment in infrastructure, but also socially, by, for example, economic dependence on the system itself. While these choices are sometimes made nationally, more often they are made regionally, defined by the local geography (available sources) and the needs of local industry. Energy transition takes place when the relative importance of legacy choices is upset, either by a major catastrophe or by the impact of forces of change, such as the drive to decarbonize.

Different types of energy systems and their relative stability

Centralized energy systems, which constitute most of what we use today, are inherently stable and resistant to change. Their continued use has been secured by the need to span large geographies, resulting in the major infrastructure and generating capacity required to transmit energy across thousands of kilometres before reaching local distribution networks for end-user consumption.

The benefits of these centralized energy models are being increasingly challenged by forces of change. Advancing technology seeks to place energy production closer to the end user, eliminating the need for intermediary transmission and its associated costs. Solar photovoltaic is a prime example of a distributed energy technology, as are gas and biofuel-fired combined heating plants (CHPs). While all these have constraints on where and how they can be deployed, their relative affordability is either on track to reach cost parity with existing local energy pathways or has already done so.

Once the benefits of decentralized energy systems are seen to outweigh those of their centralized counterparts, energy transition will start to occur throughout the jurisdiction. These transition processes still face a significant barrier to success: the legacy of existing energy systems and the vested interest in their continued viability may cause resistance to change. This means that more force may be required to bring about transition from centralized to decentralized models.

Forces of change and how they act on energy systems

Energy systems are complex. They reflect a mix of technological, socioeconomic, safety, and environmental concerns, which can be impacted by forces of change. Forces of change can be local, regional, national, or even international in nature.

When considering the future of energy, it's useful to understand how these forces can affect energy systems by geography. It's also important to consider how these forces affect economic viability, customer desirability, and technological feasibility.

Some of the forces that can affect energy systems include:

- **Urbanization**—creates challenges and opportunities for energy pathways and related infrastructure in both urban and rural settings.
- **Environmentalism or decarbonization**—generates pressure to transition to energy pathways that limit emissions and environmental damage.
- **Cybersecurity attacks**—threaten existing and future energy pathways and systems.
- **Climate change and extreme weather events**—threaten the safety and reliability of energy systems.
- **Renewable energy**—sources such as wind and solar are displacing traditional, thermal-based fossil fuels.
- **The potential for circular economy plays**—turning waste into energy and achieving stacked benefits (e.g., reducing carbon footprint while driving new revenue streams.)
- **Customer expectations**—growing demand for two-way participation in energy markets and control over consumption.

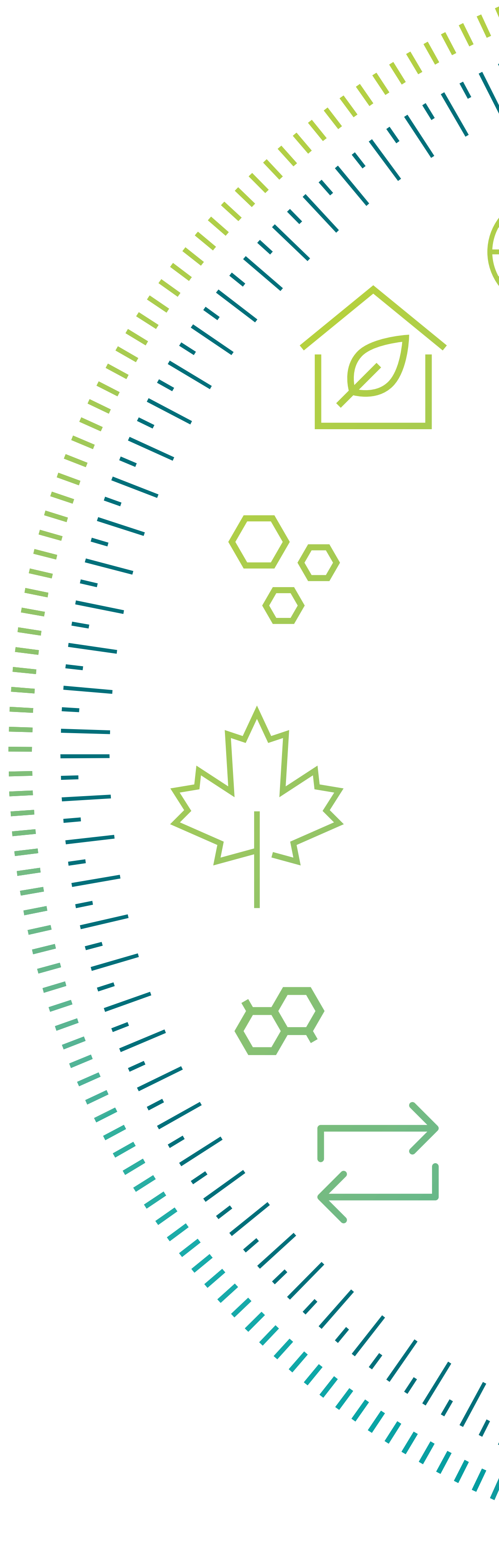
The size of force required to trigger and drive energy transition

The cumulative force required to initiate energy transition is proportional to the "stickiness" of a region's existing energy pathways. Smaller and less expensive pathways (particularly in terms of construction and operations) are more easily changed, while larger and more expensive energy pathways often require considerable force before change is triggered. Transition of this nature is not uncommon: examples from recent history include the adoption of nuclear energy, the adoption of renewable energy, and the ongoing phase-out of coal-fired power.

Energy transition is typically brought about by a combination of forces, and the speed of the transition depends on the number and magnitude of the forces involved. When considering a change that a set of forces is bringing about, it's important to consider these three dimensions:

1. Is it desirable to customers?
2. Is it technically feasible?
3. Is it economically viable?

Where forces of change converge across these dimensions, the move toward adopting an alternative energy pathway is more likely to gain traction.[5] By layering on top of these dimensions consideration of the full set of 'energy system success criteria' (e.g., resiliency, sustainability) described above, you begin to get a full view of the potential transition and its respective choices and trade-offs.



The future of energy in Canada[6]

Based on this understanding of the concept of energy systems, we can now consider the different energy situations in Canada. This is where we can begin to identify the places where energy transition is occurring or may occur in the near and distant future.

Canada's regions and energy pathway archetypes

We've identified three specific regional archetypes that apply broadly in Canada.

Archetype 1: Urban cities, cold climate

The electricity supply mix for most cities in Canada is related to the availability of nearby resources, such as bodies of water that supply hydroelectric power or ample coal (and now gas) supplies. Other types of geographic-agnostic thermal generation (such as nuclear) have augmented these energy mixes where demand has outpaced the regionally available resources. Most Canadian cities benefit from stable electricity and gas distribution at relatively low costs, and most have gas heating as a preferred low-cost pathway despite the presence of electricity.

Archetype 2: Rural towns, cold climate

Gas heating is common, although typically in the form of delivered propane. Biomass (wood) is another common energy pathway. Power outages are more common than in cities, due to the vast distribution networks and a higher probability of failure due to damage caused by weather events.

Archetype 3: Remote communities, cold climate

The per-capita energy demand in these communities is high, making the accessibility and resiliency of energy pathways extremely important. Most rely on local distribution networks with electricity generated by diesel, and use either biomass, heating fuel oil, or propane for heat.

The potential for energy transitions in the regional archetypes

Note:

Near term = less than 5 years

Mid term = 5-10 years

Long term = more than 10 years

Archetype 1: Urban cities

In the near term, the likelihood of fast-moving energy transition in Canadian cities appears unlikely, based on the current-day economics of potential alternative solutions (e.g., solar plus storage) that could provide the same performance as the existing grid. A slow energy transition is in progress in many of these regions in terms of the supplied electricity mix, through the addition of more utility-scale renewable power. This slow transition will be more likely to occur in places with good renewable energy resources, such as sunlight or high wind. The potential for end-user energy transitions does exist, and will occur increasingly in the mid-term for a small subset of customers who hold the requisite upfront capital or access to financing and who are keen to reduce their costs and carbon footprint below that of the grid. This transition may involve a small number of users relative to the size of the overall system, but it will still have an impact and be a threat to the current model, because of the reduction in overall demand and the decrease in number of remaining customers who will bear the cost of the system.

Archetype 2: Rural towns

The prospect of fast-moving energy transition in the near term appears unlikely in rural Canadian towns. In the medium term, there is a growing potential for an impactful contingent of rural energy users to transition to distributed energy resources to either reduce or eliminate their reliance on grid power or gas heat. With high delivery charges, and extreme weather events causing power interruptions becoming more frequent, rural customers will undertake these energy transitions (including backup systems) not just for cost but also for reliability, resilience, and sustainability improvements. The opportunities posed by circular economy plays for large energy users, turning waste into energy (e.g., in animal raising) may trigger some transitions earlier.

Archetype 3: Remote communities

Energy transitions are already underway in many remote communities, with numerous pilot projects active in Canada.[7] Costly and non-environmentally friendly diesel-generated electricity is being relegated to a backup power source, replaced by alternative Distributed Energy Resources (DERs) pathways including solar photovoltaic, micro wind, micro hydro turbine, and storage, all of which are cleaner, safer, and typically cheaper. Indications from these pilot projects suggest that the costs of these systems are already below parity with legacy diesel systems. Access to upfront financing is an important hurdle to the rapid adoption of energy transitions in these communities.

The path toward a connected series

This series of articles will explore the issues facing stakeholders in the energy ecosystem, the options available to them, and case examples of what others are doing. Topics for our ***Bright ideas: New perspectives on the future of Canada's power sector series*** include assessing strategic risk and making choices to win in the future of energy; energy transition through innovation and digital transformation; the impact of the evolving customer lens; energy transition and operational implications; and the cyber risk implications of energy transition.

We hope that you will join us in the conversation.

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Acknowledgement

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1. Deloitte Canada, "Price forecast: Oil, gas & chemicals," June 30, 2020; and Government of Canada, "Canada's Energy Future 2019: Energy Supply and Demand Projections to 2040."
2. Stanley Porter and Kate Hardin, *Navigating the energy transition from disruption to growth: Energy and industrial companies are positioned for a lower-carbon future*, Deloitte Insights, May 27, 2020; and Government of Canada, Canada Energy Regulator, "Canada's Energy Transition: Historical and Future Changes to Energy Systems—Update—An Energy Market Assessment," June 24, 2020.
3. World Economic Forum, *The Speed of the Energy Transition: Gradual or Rapid Change?* September 2019.
4. Nico Bauer et al., "Shared Socio-Economic Pathways of the Energy Sector – Quantifying the Narratives," *Global Environmental Change* 42 (January 2017), 316-330.
5. *ESI Africa*, "Report: transition from coal to clean energy is within reach," July 9, 2020; and *The Daily Times,* "Adopt renewable energy to solve power sector failure, Don urges FG," July 10, 2020.
6. https://www2.deloitte.com/ca/en/pages/energy-and-resources/articles/future-of-energy.html
7. For example, Government of Canada, Green Infrastructure Programs, "Clean Energy for Rural and Remote Communities: Capacity Building Stream," June 12, 2019.

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