



Energy in Canada @150 and Beyond Energy Past ≠ Energy Future

By Colin Andersen, Chair, Energy Council of Canada

One in a series of papers prepared by Canadian energy sector leaders – at the invitation of the Energy Council of Canada – exploring key aspects of our ongoing national energy story on the occasion of the 150th anniversary of Confederation.

Summary: Colin Andersen argues that past will be only limited prologue to our energy future in a time when a “Grand Transition” is underway, driven by digitization, decarbonisation and decentralisation, and characterized by considerable disruption. Electricity in particular is poised for transformation, after a relatively static first 100 years, and regulators will be challenged to move beyond today’s siloed approaches. He closes with a call to ensure that eliminating energy poverty is a component of the change and innovation to come.

The Grand Transition

“What’s past is prologue.”

“The best predictor of the future is the past.”

Notwithstanding Shakespeare’s suggestion that history can teach us lessons, and insight on personal behaviour from the realm of psychology, in 2017 I would venture to say that our energy past does NOT equal our energy future.

Indeed, here in Canada as in the rest of the world – and while we will continue to build on a solid foundation – our energy future, owing to developments within the sector as much as to

external forces, will bear only some resemblance to our energy past.

Some parts of our sector (putting aside whether we can even refer to energy as one sector anymore) remained largely the same for the first 100+ years. Think electricity in particular. Now, however, there probably isn’t a single segment that isn’t undergoing significant transformation of some sort.

To take that one step further, we are in fact going through a “Grand Transition”. So says the World Energy Council (WEC), of whom the Energy Council of Canada was a founding member back in 1923.

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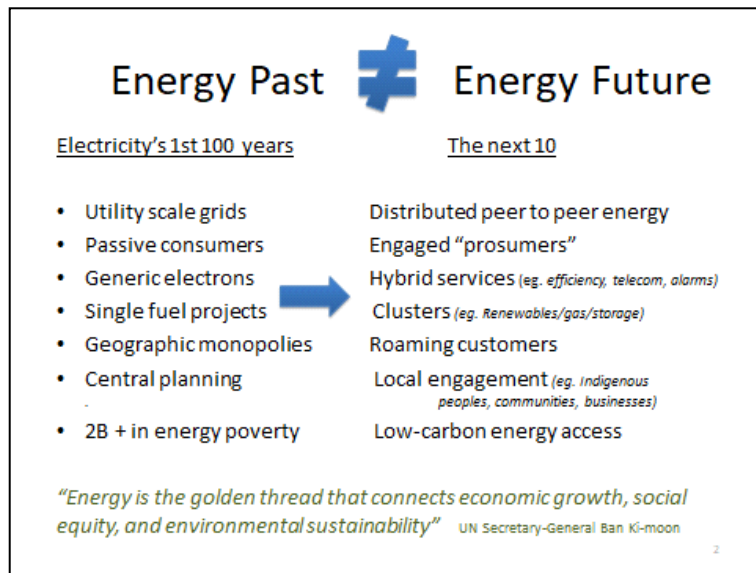
Future chapters of this series of Energy in Canada @150 and Beyond articles will delve into these areas in more detail, but what are some of the forces driving this transformation? Again, let’s start with the WEC, which sees three big trends – digitalization, decarbonisation, and decentralization.

Layer on the emergence of a sharing economy, rapidly changing demand patterns, accelerating



innovation in both energy consumption and supply, increasing convergence with other sectors – all under a sustainability umbrella – and it adds yet another "d" word: disruption. And disruption itself has become a more and more common feature of transformation.

To illustrate some of these concepts, let's start by looking at electricity:



Electricity is a relatively new technology. It has been heralded by many (electrical engineers in particular) as the greatest invention of the 20th century.

For its first 100 years, electricity was characterized by relatively few large generating plants sending electricity in one direction over long distances to load centres. Contrast that with today where we are already seeing peer-to-peer transactions amongst nearby pico- and micro-sized generators and consumers, often bypassing utilities. Indeed, thanks to enabling small-scale technology, some parts of the developing world are skipping the step of a national grid altogether.

Consumers in the first hundred years were largely passive, perhaps not even paying a lot of attention to conservation or where the power came from as long as it was there when they flipped the switch. Today's consumers, if they choose, can be an engaged "prosumer", producing electricity on their rooftop, actively managing consumption with digital assistance ("set and forget"), and even buying and selling electrons over a transactive grid depending on

prevailing prices at different times of day. With asset ownership patterns rapidly changing, "sharesumers" are also rising to the fore.

Utilities and system operators initially bought generic electrons, sometimes favouring a particular generation source (nuclear, hydro, or natural gas) or characteristic (baseload, intermediate, or peaking). Not so much anymore. In the eyes of planners and developers these days, not all electrons are necessarily created equal. Clustered offerings, with their

ability to provide more targeted value to the system – including power where and when it is needed, voltage support, frequency stabilization, and other ancillary services – mean that procurements and markets will rely on supply "bundles", such as renewables, storage, and gas all intertwined together.

From a consumer perspective, electricity services have always been the focus – will the lights come on? Moving forward, the days of separately pricing a kilowatt hour may come to a close as customers look to have their cars optimally charged, their homes secured, their carbon managed, and their wifi provided all on one bill. What this means for the utility of the future, and the corresponding but currently



disparate regulatory authorities now responsible for each component, remains to be seen. But "partner or perish" comes to mind.

Aside from having a more varied collection of items in the same shopping basket, tomorrow's electricity consumers won't just stick close to home. They will expect to roam with their EV as much as with their cell phone – with their road trip electrons showing up on their bill back at the ranch. And thanks to the blockchain, they may feel less constrained by geography and borders when considering buy/sell transactions with peers.

It follows naturally from this that local empowerment will be more of a defining feature. Actions and influence of individuals, host communities, indigenous peoples, municipalities, and local businesses are taking more precedence than before. Central planning and policy making will continue to focus on market failure, consumer protection, and security but conceivably more of these benefits will be paid for by the taxpayer if there are fewer ratepayers left attached to the grid to pick up the tab.

The First Three "D's"

Now, let's more specifically tie back to the WEC's three "D's" of digitalization, decarbonisation, and decentralization, and the transforming forces leading to my fourth "D" of disruption.

Digitalization is an enabler of much of what I have just described – smart grids and meters are going beyond dispatch and meter reading to smart appliances, pole sensors, set and forget conservation products, and EV charging. Blockchain means borders are less important

and facilitates peer to peer trading of energy. And the digitalization of work is having profound impact already in the energy sector. Talent Management is a perennial Top 10 concern of Canadian energy leaders in the WEC's annual Energy Issues Monitor. Workforce management in a sector with looming retirements and where tasks will be automated but not professions will be profoundly different. As machine learning drives into even more professions than now, and with its predictive, diagnostic, and judgement/sentiment elements, we can expect some fundamental shakeup in exploration, operations, and delivery. Automated work, blockchain, internet of things, big data, cyber hygiene – it's not particularly surprising to see why digitalization is now seen for the first time by energy leaders as the number one uncertainty in the most recent Energy Issues Monitor.

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We are likely now in a 20- to 40-year transition to a *decarbonized* future, where "evolution is more likely than revolution" as highlighted at the ECC's kickoff workshop for the Generation Energy consultation process led by Natural Resources Canada. Solar and wind costs have come down faster than expected; with microgrids and storage poised to follow the same route. Zero marginal cost resources (such as wind and solar) are changing the way we dispatch power. Electrification could triple demand. These developments are having an impact now on prices paid. decarbonisation will have differential costs and benefits, varying by job class, by region, and by sector. And as we



have seen with the Paris Accord and the US election, national and international approaches to climate change policy can shift quickly. However, as we have also seen, subnational governments at the provincial, state, and municipal level have played and will continue to play a significant role in driving momentum. Still, actions to date do not meet our collective Paris ambitions, neither in Canada nor globally.

Consumers trust their utilities but are no longer wedded to them.

Decentralization in the form of distributed generation will enable better access to energy. Depending on what form it takes, decentralization can be both good for the environment, such as renewables, or more problematic, such as diesel. Likewise, decentralization can both add to *as well as* reduce system costs. The nature of the energy business is that assets are long-lived, and historically centralized, so this part of the transformation isn't going to happen overnight.

Consumers may trust their utilities, but are no longer wedded to them. Utilities will need to transform, moving from selling unidirectional electrons to selling a variety of attractive, personalized services as noted earlier. Capital-driven revenue strategies will need to shift. Stranded assets and the communities that host them will have to be considered. Innovative thermal grid solutions could further drive customers, developers, and asset owners to as yet largely unregulated behind-the-meter solutions.

And will there be less socialization of costs in a future where you pay only for your own use/share of energy, capacity, and transmission? Will this lead to more democratization of our system (yet another "D" word)?

Disruptive Forces

Elyse Allan, President and CEO of GE Canada, and the Energy Council's 2016 Canadian Energy Person of the Year, says in her *Energy in Canada @150 and Beyond* article: "I'm speaking of course of the technology race that we all find ourselves in. Call it the IT Revolution, the Digital Revolution, the Internet of Things... whatever we call it, we are all faced with the reality that technology today is disruptive, and these disruptions are occurring at an accelerating pace. Technology is reshaping the competitive landscape for energy companies around the world – and this is one race I can assure you where the tortoise does not win."

To expand on Elyse's point, and link to issues that have been raised in ECC/WEC discussions over the past while, I offer the following observations.

In a sharing economy, for example, fewer people will own an individual car. Peer-to-peer energy transactions enabled by blockchain and diverse microgrids will change asset ownership, affecting how power and heating and cooling services are delivered and by whom. Virtual aggregators will serve "community" grids of infinite potential configurations.

Demand patterns are shifting as the electrification of cars, home heating, and mass transport encompasses increasingly greener forms of generation.



The pace of innovation is picking up, with rapid disruption becoming the norm (a topic explained in more detail by the ECC's Young Energy Professionals group in its article entitled "Mutually Assured Disruption").

Sectors are converging even more quickly, inside the energy sector and increasingly with outside sectors as well – responding to a roaming consumer looking for bundled "set and forget" services (entertainment and communications, home security, a charged EV, and a comfortably heated or cooled home) from whichever provider wins on convenience and affordability.

Distributors could simultaneously become *more local* (individual prosumers and microgrids) and also *less local* (crossing global regions thanks to interconnectivity) and will focus on services as opposed to capital. The same way paying for minutes for your phone has largely shifted to unlimited calling, energy pricing will shift away from the underlying electrons and gas molecules to the services supplied. Regulators will likewise have to transform, themselves converging across sectoral domains.

Driven by corporate social responsibility and the desire for resilient investments that can withstand the increasing number of extreme weather events and cyberattacks, for example, corporate and public sector boards are increasingly building sustainability principles into their long-term fiduciary obligations *and* reporting on them – enabled by better data, carbon accounting methodologies, and a growing recognition of shared societal responsibilities.

What does this mean for our energy future? These four D's are going to require innovation, and lots of it, as summarized in Chart 2, which I used as the basis for separate remarks on Energy Digitalization, as well as Climate Change Resiliency, at the recent 2017 World Energy Week put on by the World Energy Council in Lisbon.

Energy Innovation: Driven by the "4 D's"

Policy - decarbonization, energy poverty	Alliances - environmental groups and Indigenous peoples
Financing- - Green bonds, tax credits, partners	Engaged Consumers - prosumers
Markets - hybrids – competition/certainty	Politics - Interjurisdictional /global - federal/provincial/municipal
Regulatory and Standards - Who pays and how, social license	Nexus issues - gas/electricity/water - Triple bottom lines
Contracting - Combos – renewables & storage	Social License - All politics is local (and policy too?) - Transparency, accountability in a twitter world
Technology - Pico projects, set & forget, offgrid	Digitalization - Evaporating business models - The role of misinformation
Utilities/Providers - Service providers not death spirallers	Delivery and Research Partners - private, self, broader public sector

With a recent "Chatham house rules" discussion at an Ontario Energy Network roundtable also as inspiration, I am going to use the regulatory construct as a framing device to highlight a few of the areas listed. As past CEPY honouree Michael Cleland writes in his article in this series entitled *A New Energy Future for Canada?*, "Canadians no longer accept that energy decisions should be made by governments. Governments are not trusted, deference to authority has steadily declined. At the same time, tolerance for risk has sharply declined even as the risks appear ever more complex and difficult to understand." Deference to authority is a thing of the past, and as a result, our current regulatory constructs need a rethink.



On a similar note, a finding I heard several times at the World Energy Council's recent Executive Assembly in Lisbon: 70 per cent of world energy leaders don't think regulators are ready for what lies ahead. With an engaged consumer empowered by a blockchain-enabled transactive grid, sector convergence, disruption and innovation are what lie ahead for energy regulators.

Regulators have no choice but to keep up and, indeed, are doing so.

Regulators often get a rough ride when it comes to their perceived lack of enthusiasm for encouraging innovation – whether it is in technological change, utility experimentation, or consumer empowerment. Indeed, they are seen by some as captured by Boomer processes and immune to Millennial realities, unable to quickly remove barriers to innovation and integrate proven technologies faster. Getting out of the way is often seen as a major regulatory innovation in and of itself.

The world is going there regardless – regulators have no choice but to keep up and, indeed, are doing so.

With sectors converging (energy, telecom, consumer protection, transportation safety), siloed regulators must likewise come together in how they work. This includes dealing more closely with planners and governments owing to the increasing complexity of issues both are facing. Ideally, governments should decide upon an overall framework and then leave it to the regulatory and planning bodies to implement and adjudicate.

Space does not permit me to delve into other areas of the Canadian energy sector as deeply, but many of these electricity ideas and examples apply equally. Indeed, in WEC's words, we are in the middle of a Grand Energy Transition – not just an electricity transition.

And as we progress through this Grand Transformation there is one big issue that I sincerely hope we crack once and for all. Two billion people live in energy poverty worldwide. Regrettably, there are people in Canada in that situation, primarily living in remote, largely Indigenous communities in the north. As we decarbonize, digitalize and decentralize it would be a shame not to address this issue. As UN Secretary-General Ban Ki-Moon said: "Energy is the golden thread that connects economic growth, social equity and environmental sustainability." The Grand Transition is underway, and hopefully this part of our energy past will not be part of our energy future.

I hope you enjoy the articles in this series. Happy 150th Canada and happy reading.

Colin Andersen is the principal of Colin Andersen Consulting Services and Chair of the Energy Council of Canada. Previously CEO of the Ontario Power Authority; he has also served as Deputy Minister of Finance, of Revenue, and of the Cabinet Office (Policy) in the Ontario government; and has served as Treasury Board Secretary. Andersen has advised successive governments on all aspects of fiscal planning and stewardship of financial resources; and led strategic asset management initiatives, extensive intergovernmental negotiations, and large-scale infrastructure and procurement projects.