A PERSPECTIVE ON CANADA'S ELECTRICITY INDUSTRY IN 2030

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13 DECEMBER 2017

The cost of solar and wind energy and energy storage have been coming down at double-digit rate per year for many years. Every year. Double-digit percentages. Again. It continues. Tirelessly. No end in sight. Capitalism and innovation at their best. No government regulation nor corporate ego will stop it. And it will reshape — no, it is reshaping — the power industry in Canada.

By 2030, renewable energy and energy storage will be so inexpensive that they will have upended the traditional economics of the industry. But perhaps we can see this transformation to its logical conclusions, based on how the power industry is evolving elsewhere in the world and how other industries went through similar transformations.

If ever lower-cost renewables and energy storage triggered the reshaping of the electricity industry, other factors tint how industry stakeholders react: the impacts of climate change, our increased dependence on reliable electricity, and the higher cybersecurity threats. Each of these factors helps define how utilities, customers, regulators, policy makers and product and service vendors react to or take advantage of the situation, sometimes by trying to accelerate change, sometimes by attempting to slow down. However, if broad conclusions can be drawn, we need to be mindful that local specificities in resource availability, cost structure, stranded assets, and ownership will mean that the end game will not exactly be the same in every province.

Wind, solar and storage are not only becoming increasingly cost effective, but doing so at a much smaller size than traditional generation. By 2030, many customers will have solar panels on their side of the electricity meter, on rooftops and backyard, even in absence of incentives or net metering, taking whatever "free electrons" they can and wasting what they will not be able to use or sell. If wasting electricity seems heresy, think about the iPhone in your pocket: it has more computing power than a supercomputer of a generation ago, and yet it is idling most of the time, its vast computing power wasted. Yet, the iPhone has transformed our daily relationship to computing. Similarly, inexpensive renewables and storage will transform our relationship to electricity – it will become far more personal.

Commercial and industrial customers, as well as some residential customers, will take this a step further by having energy storage as well. By adding storage, customers can arbitrage time-of-day rates or peak demand charges, shifting consumption at other times to reduce costs. Having local generation and storage also turns a customer site into a microgrid or a nanogrid able to maintain power during grid disturbance or outage, maintaining production for businesses and food stuff cold for consumers. Smart communities and campuses will also become microgrids regrouping multiple customers and utility-scale resources for better resiliency and efficiency.

Even with this abundance of distributed generation, grid defection will be the exception, as most customers will keep the utility connection as an insurance policy and because space constraints and the low energy intensity of solar and energy storage make it impractical to generate all the energy needed in urban areas. Nevertheless, abundance will cause energy (kWh or MWh) price to plummet, taking traditional utility revenue along, especially since electricity consumption has already plateaued in Canada.

Given how low-cost renewables and storage are advancing, by 2030, if not before, the traditional, centralized grid will have been transformed into a transactional grid of microgrids integrated to distributed renewable energy resources. This will have repercussions across the industry, transforming competition, energy markets, regulation, grid architecture, customer relationships, utility operations, service providers and industry suppliers.

RETAIL UNBUNDLING AND COMPETITION

By 2030, customer-owned distributed energy resources will put pressure on policy makers and regulators to allow retail competition, so that distributed generators may sell surpluses on open markets. With retail competition, customers will have more choices in what energy they sell, what they buy, and how they use it, including sophisticated demand response programs to support energy balancing on the grid.

The retail arm of utilities and the wire business will be unbundled (as it is already the case in Alberta), allowing new energy service providers to compete in energy retail, perhaps along with utilities' unregulated subsidiaries. This will also expose the capacity-driven (kW or MW) cost of the distribution grid, now charged separately. This is similar to long-distance telephone service unbundling in the 1990s. With competition forcing energy market players to keep price low, energy price regulation will be lightened, just like telephone regulations are much lighter now than they were 25 years ago.

RENEWED ENERGY MARKETS

Today's energy markets and their supporting technologies were not designed for the large number of players distributed across the grid with varying capabilities that we will have in 2030 – in fact, retail energy markets are currently non-existent in most provinces. Energy markets will evolve to improve the way electricity is priced, scheduled and procured in order to ensure reliability, transparency, efficiency and at the lowest cost. Through the new energy markets, distributed energy storage systems will accumulate electricity when the sun is shining or the wind blowing, releasing it at time of use. Demand management will shape the load curve to better match availability of inexpensive renewable resources. Electric vehicles will be charged during the day, and give power back to the grid if needed.

New transactional technologies, such as blockchain, may be required to deal with the sheer volume of automated transactions. Market intermediaries will act on behalf of distributed asset owners, simplifying the process and offering financing.

PERFORMANCE-BASED REGULATION

In the traditional Canadian rate-of-return regulatory framework, electric utilities earn a return on investments based on the depreciated cost of past capital expenditures approved by the regulator. This model will no longer be suitable in 2030 to regulate the wire business of utilities because of its "capital bias", its insensitivity toward grid reliability, its inhibition of innovation, and its short-termism.

By 2030, the provincial regulatory regimes will have evolved toward a performance-based model. This new model will incentivize lower total costs (operating expenses and capital expenditures, including incentives to use non-wire alternatives such as third-party energy storage) and better reliability (to avoid momentary service interruptions that trip distributed generators offline). In a performance-based regulatory model, utilities are freed to implement innovative solutions without regulators and interveners second-guessing investment in technology. Multi-year incentive plans will allow utilities to plan ahead better. Similar approaches already exist elsewhere, as in Great Britain, where the regulator developed its RIIO (Revenue = Incentives + Innovation + Outputs) 8-year framework.

HIGH-AVAILABILITY DISTRIBUTION GRID

By 2030, we will obviously not have replaced all poles, conduits and wires that make up the legacy grid – nor should we try to. Utilities, however, will have transformed this critical infrastructure to make it resilient (especially against the impacts of climate change) and reliable (essential to keep distributed energy resources online, which will be essential).

Leading utilities are already showing how this can be done. For example, according to surveys and government reports, Florida Power & Light has the most efficient operations in the USA, has the best electric reliability in the USA, and the highest rating in customer satisfaction among large utilities in the southern USA – all at once. This is accomplished by rigorous storm-proofing of critical feeder sections, including undergrounding of mainlines, with intelligent protection devices on laterals, near customers and distributed energy resources to minimize disturbance while faults are being cleared on overhead lines. Grid sensors help locate grid problems before they cause outages. Protection devices, switches and sensors are automated to the best extent possible and remotely operated, from a control room or from a truck. In other instances, remote setting of protection devices limits the risk of forest fires caused by reclosing on the electrical grid. Ultimately, the more resilient and reliable grid saves on operating expenses by reducing of truck rolls and by more efficient and safer operations.

STRAINED CUSTOMER RELATIONSHIPS

Reshaping the electric industry will also transform the relationships between the customers and their energy service providers. In particular, utilities will need to learn from the lessons of other industries that went through deregulation, such as airlines and telephone companies. Twenty years ago, an Angus-Reid survey put Bell Canada #2 among most admired corporations in Canada. In 2017, Bell Canada ranked #291 in a University of Victoria brand trust survey. People love their Apple or Samsung phones, are addicted to Facebook to stay in touch with friends, and use Microsoft Skype to see remote family members, but they now mostly hate their phone company.

This is a very real risk for utilities, as customer having choices will start making comparisons. Many developers are already complaining about the rigidity of utilities. In 2030, there will be even more potential friction points between utilities and customers. The solution probably resides in more open communications and flexible processes.

NEW OPERATING MODEL IN DISTRIBUTION

In a technology-intensive environment in constant innovation and with ever-increasing cybersecurity threats, utilities will develop new skills and will learn to leverage partnerships with vendors. They will become better integrators. This is very different than traditional distribution grid operation, still largely relying on physical work and manual switching.

In their new high-tech and fast-changing environment, utilities will implement new business process and organizational structures to take advantage of the latest technology innovations. At the same, new technology skills are required, including cybersecurity. Rather than doing things internally, as they are often used to do, utilities will partner with technology vendors that have the scale and the expertise to provide better products and professional services at a lower cost. Essentially, utilities will follow the path already taken by telecom network operators.

NEW BUSINESS MODELS IN THE INDUSTRY

Twenty years ago, Google and Facebook didn't exist, and Apple was a niche computer manufacturer; today, they all compete with legacy telecom service providers.

New businesses will cater to energy customers, distributed generators and microgrid owners, removing complexity and turning energy into commodity services.

Energy customers, distributed generators, and microgrid owners will be supported by an ecosystem of third-party vendors and unregulated utility subsidiaries. Energy service providers will support customers with low-cost financing and technology to optimize the use of distributed assets on energy markets, lowering costs. For utilities, this is a clear non-regulated growth opportunity, not limited to traditional territories. With transportation electrification, the electric industry will essentially replace the petroleum industry, with new businesses supporting public charging of electric vehicles – a welcome development as it could offset further reduction in electricity consumption.

A NEW GENERATION OF ELECTRIC HARDWARE VENDORS

Cisco System, a start-up in the 1980s, is now the largest networking company in the world, while many legacy telecom vendors, such as Nortel, went bankrupt or were acquired in the 1990s or 2000s, unable to keep up with innovation in the industry, while the price of commodity products plunged with manufacturing in Asia.

By 2030, the same will have happened to some electric hardware vendors that are well known today. For many electric hardware vendors whose skills reside with manufacturing steel and copper devices, the advent of a distributed, transactional and digital-enabled electrical grid will be challenging. Hardware vendors unable to develop cybersecured control systems than can be integrated into the new systems used by utilities, or entirely new systems, such as microgrid controllers, will face uncertain futures, either pushed out because they cannot keep up with innovation or priced out of the market. New vendors are also not immune to failures, as shown by the many storage developers who failed in the last few years.

This puts energy service providers and utilities in a difficult position, as they need to rely on vendors to build the new grid. The solution probably resides in better integration skills within service providers and a more flexible technology architecture. Utilities should also lead better standardization and interoperability efforts in the industry. If iPhones can connect to Ericsson cellular base stations, shouldn't smart meters be like that too?

CONCLUSION

This new, distributed, transactional and digital-enabled electrical grid will be more resilient and sustainable. Its resiliency is based on multiple and alternate energy local sources and paths, with reduced reliance on large infrastructure. This new resilience is welcomed given the growing importance of electricity in energy use, as residential and industrial customers are dependent on electricity to power our modern life in smart communities and with the advent of electrical transportation. The new grid will also be more sustainable, reducing the environmental impact of communities and improving quality of life – while being financially affordable.

Preparing for the future is essential for Canadian electric utilities and new players. In an industry traditionally defined by centralized generation and rigid geographic boundaries between utilities, new linkages need to occur: utilities and customers, vendors and entrepreneurs, cities and businesses, ensuring that all see the opportunities that didn't exist before and have the support they need to get their ideas to market quickly. The structure of the industry will emerge transformed, with Canadian-owned service providers offering novel energy solutions in Canada, backed by a web of hardware, software, and professional service vendors. Realizing this vision will increase competitiveness and opportunities for Canadians to export their energy, their expertise, and the fruit of their labor.