STATE OF THE CANADIAN ELECTRICITY INDUSTRY 2019

Canadian Electricity Association | Association canadienne de l'électricité

RE·SIL·IENCE

THE CAPACITY TO RECOVER QUICKLY FROM DIFFICULTIES; TOUGHNESS

CONTENT

INTRODUCTION

Founded in 1891, the Canadian Electricity Association (CEA) is the national voice of the electricity industry in Canada, contributing to the regional, national and international success of its members. CEA members generate, transmit and distribute electrical energy to industrial, commercial, residential and institutional customers in all provinces and territories in Canada.

CEA is pleased to present this inaugural State of the Electricity Industry report. It provides a high-level assessment of the electricity industry's progress to date and provides a prospectus on what is ahead on issues of national significance to Canadians.

Several national issues and trends are woven throughout this report. One significant challenge facing the industry is the substantial cumulative impact of federal/provincial/territorial regulations. With approximately $20 billion per year required for infrastructure renewal and market growth, the electricity industry needs an efficient regulatory framework to build the electricity system of tomorrow. Unnecessary regulatory burden could delay and suspend major infrastructure projects that are fundamental to the prosperity of Canadians.

The electricity industry is moving towards a low carbon, clean energy future. In fact, it is collectively committed to further reducing greenhouse gas (GHG) emissions; investing in renewable energy sources; pursuing electrification of transportation, buildings and industrial processes; and integrating innovative energy storage solutions to make the system flexible, reliable, sustainable and resilient for generations to come.

This outlook will guide CEA's public policy agenda through 2019 as the industry navigates the evolving energy policy landscape in Canada. We ask our stakeholders to join us in this public policy dialogue and work towards achieving a clean energy future for all Canadians.

01 COMPETITIVENESS, INVESTMENT AND REGULATORY ENVIRONMENTS IN CANADA

OVERVIEW:

Canada excels in many socio-economic areas vis-à-vis the rest of the world but continues to lag on competitiveness, investment climate and regulatory effectiveness. Keeping up with peer countries, particularly those within the Organization for Economic Cooperation and Development (OECD), has been a goal of successive Canadian governments but there hasn't been much progress made towards this commitment in the recent past. Canadian businesses - from banking and manufacturing, to energy and natural resources-have been unanimous in their concern about these issues being major impediments to operating in Canada and growing the economy. These are the same businesses that also depend on a reliable, sustainable and cost - effective electricity system to conduct their daily operations. In a recent report, the Canadian Chamber of Commerce noted there were 131,754 federal government regulatory requirements on Canadian business"[1], making government rules a significant hurdle for attracting new investments.

At the federal level alone, the electricity industry is affected by over 90 different regulations that are either in force or pending. These stretch across 31 different statutes, covering issues as diverse as greenhouse gas (GHG) emissions, species at risk, migratory birds, navigation protection and more. The proposed Impact Assessment Act (Bill C-69) and the Fisheries Act (Bill C-68) will only add to this growing level of regulation in Canada.

[1] The Canadian Chamber of Commerce, Death by 130,000 Cuts: Improving Canada's Regulatory Competitiveness, May 2018

The electricity industry recognizes the vital role of regulation. However, legislative and regulatory requirements should be outcome-driven, predictable and, to the greatest extent possible, non-duplicative. In the absence of that, the cumulative impact of a myriad of regulations has the ultimate effect of inhibiting new investments and increasing costs to electricity end-users, including residential, industrial, commercial and institutional customers.

An effective investment and regulatory environment will be critical as Canada moves to a more resilient, low-carbon economy. In 2012, the Conference Board of Canada (CoB) estimated that the electricity industry would need to invest at least $350 billion by 2030[2] to meet demand growth and modernize its aging infrastructure. Considering the growth in regulatory requirements, particularly related to GHG reductions, this estimate for the industry has now been updated to $1.7 trillion by 2050[3].

Meeting this investment requirement will require an efficient and effective investment and regulatory system in Canada. We call upon governments to work towards that end. These investments are crucial for growing Canada's economy and reducing our carbon footprint. They create good jobs, promote clean economic growth and ensure that businesses and households can continue to benefit from access to safe, sustainable and reliable energy. Addressing issues related to competitiveness, investment climate, and cumulative regulatory burden will pay dividends into the future.

TAKING ACTION & MANAGING RISKS

Addressing Canada's macroeconomic variables is a long, complicated, and multifaceted endeavour requiring dialogue among all key stakeholders – government, industry, non-governmental organizations and civil society. For its part, the electricity industry in Canada has been proactively engaging the business community and government officials over the past year to find effective solutions which, in many cases, transcend all economic sectors. The federal government's 2018 Fall Economic Statement (FES) is a testament to this growing collaboration between the federal government and industry. The FES clearly articulated that the government will explore making efficiency and economic growth a legislated part of regulators' mandates to ensure that cumulative impacts are considered. CEA believes this is a great start to ensuring that there is a competitive investment and regulatory environment in Canada. Other federal government initiatives, including the proposed review of the Red Tape Reduction Act, equivalency agreements with provinces on various regulatory measures and reduction of internal trade barriers through the Regulatory Cooperation Table also hold significant promise.

[2] The Conference Board of Canada, Infrastructure Investments, 2012
[3] The Conference Board of Canada, Climate Change and Infrastructure, 2018

LOOKING AHEAD: 2019 AND BEYOND

2019 will be a defining year for Canada – one that will determine whether Canada takes serious action to enhance its competitiveness position in the world. The 2019 Federal Budget will be one indicator of Canada's commitment to addressing these issues. CEA policy options suggested in this section, including setting up a formal framework for addressing cumulative regulatory impacts, increasing the territorial "debt caps" to raise private capital, federal investments in transformative energy projects, and corporate tax policy adjustments, would go a long way in ensuring a reliable, sustainable, and cost-effective electricity system to power the daily needs of industrial, commercial, residential and institutional customers across the country.

PRESIDENT AND CEO OF NOVA SCOTIA POWER, KAREN HUTT, REPRESENTS THE INDUSTRY ON CANADA'S ECONOMIC STRATEGY TABLES – RESOURCES OF THE FUTURE

THE RESOURCES OF THE FUTURE PANEL CALLED ON GOVERNMENTS AT ALL LEVELS TO:

- **Develop and test a regulatory path for electrical utilities to implement smart grids and enable investment in clean technologies and allow firms to use a reserved portion of ratepayer funding to undertake this testing**
- **Pilot the process outlined in the proposed Impact Assessment Act (Bill C-69) to give project proponents certainty on how to advance key projects; particularly, develop comprehensive, one-time science-based regional impact assessments, setting standards and resolution mechanisms for consultation**
- **Within government facilities, pilot renewable energy storage solutions and use these to address permitting challenges under federal and provincial environmental assessment acts**

02 INFRASTRUCTURE RENEWAL AND INNOVATION

OVERVIEW:

While the electricity industry continues to work with governments on issues related to competitiveness, investments and regulatory impediments, there is also an urgent need to renew and modernize our existing infrastructure. Much of that infrastructure-including generation, transmission and distribution was initially constructed in the post-war years and needs to be renewed. With a projected investment requirement of nearly $1.7 trillion by 2050, Canada's electricity companies are stepping up to the challenge. The industry is currently investing nearly $20 billion per year in infrastructure renewal and market growth, including some projects in partnership with Indigenous-led businesses.

> **Investment in electricity infrastructure is really an investment in Canada's economic future. By investing strategically, we can continue to be among the world's leaders in the production of the clean, reliable and sustainable electricity and contribute to Canada's competitiveness and economic prosperity.**

New investments made to date have further strengthened the resiliency of the electricity system, but governments and utilities alike must identify measures to overcome some of the remaining impediments to investments.

TAKING ACTION & MANAGING RISKS

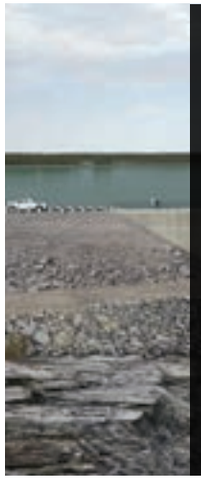
Even with regulatory hurdles, the electricity industry is moving forward with significant investments in Canada. According to ReNew Canada's 2019 Top 100 Infrastructure Projects, six of the top ten projects (ranked by capital investment) are directly related to the industry with a total investment of $64.4 billion.

Canada's Top Ten 2019 Infrastructure Projects

Rank	Project	Value	Industry
1	Bruce Power Refurbishment	$13.0 Billion	Electricity Generation
2	Darlington Nuclear Refurbishment	$12.8 Billion	Electricity Generation
3	Muskrat Falls Project	$12.7 Billion	Electricity Generation
4	Site C Clean Energy Project	$10.7 Billion	Electricity Generation
5	Eglinton Crosstown LRT	$9.1 Billion	Transportation
6	Keeyask Hydroelectric Project	$8.7 Billion	Electricity Generation
7	Romaine Complex	$6.5 Billion	Electricity Generation
8	Réseau électrique métropolitain	$6.3 Billion	Transportation
9	Gordie Howe International Bridge	$5.7 Billion	General / Transportation
10	Southwest Calgary Ring Road	$5.0 Billion	General / Transportation

Source: ReNew Canada, 2019 Top 100 Infrastructure Projects

Beyond these projects, Canadian utilities are investing in hundreds of other generation, transmission, and distribution infrastructure projects and other ancillary technologies to improve efficiencies and environmental performance, integrate renewable technologies, ensure resiliency against severe weather impacts, and protect against cyber-attacks, among other system upgrades. These investments will continue in the years ahead, but it is essential that governments and other stakeholders work with the industry to address some of the core challenges stifling infrastructure investment and innovation in the industry.



KEY IMPEDIMENTS TO INFRASTRUCTURE INVESTMENTS:

- Community opposition to new infrastructure projects
- Lengthy, multi-year, project impact assessments, permitting, and approval delays
- Regulator concerns around cost implications for ratepayers
- Lack of regulatory innovation to support investments in new technologies
- Lack of government policy certainty and predictability

LOOKING AHEAD: 2019 AND BEYOND

As we look ahead, one of the challenges Canada will have to address is the framework for energy regulation and innovation. Federal, provincial, and territorial governments must work collaboratively to ensure energy regulators are given the mandate to accommodate infrastructure investments and innovation into the rate-making processes. The industry appreciates the need for utilities to control costs, but strategic innovation can result in significant benefits and even produce cost-savings over "investment as usual."

CEA is working with key stakeholders to communicate the impediments for infrastructure investments. Recent recommendations from Canada's Economic Strategy Tables: Resources of the Future, convened by the federal government – such as fast-tracking approvals for innovation, establishing a cost-shared innovation fund, and defining the percentage of utilities' investments to be dedicated to innovation – are excellent steps in the right direction[4].

KEEYASK HYDROELECTRIC PROJECT

One of the largest projects in Canada, this $8.7 billion project is a 695-megawatt (MW) hydroelectric generating station that is being developed in a partnership between Manitoba Hydro and four Manitoba First Nations: Tataskweyak Cree Nation, War Lake First Nation, York Factory First Nation, and Fox Lake Cree Nation.

When completed in 2021, it will add approximately 4,400 gigawatt-hours of renewable electricity per year to Manitoba Hydro's total supply. That's enough electricity to power 400,000 homes.

[4] Innovation, Science, and Economic Development Canada (October 2018), Canada's Economic Strategy Tables: Resources of the Future, p. 9. Accessed December 21, 2018: https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISEDC_ResourcesFuture.pdf/$file/ISEDC_ResourcesFuture.pdf

03 ENVIRONMENTAL SUSTAINABILITY AND COMPLIANCE IN THE INDUSTRY

OVERVIEW:

The electricity industry has a long-standing commitment to environmental sustainability and compliance. In 1997, CEA launched the Environmental Commitment & Responsibility (ECR) Program, which mandated each member company to conform to the internationally recognized ISO 14001 Environmental Management System. In 2009, the industry further enhanced this commitment through the transformation of the ECR program to a sustainable development initiative by launching the Sustainable Electricity Program™. Now in its tenth year, the program aims to integrate sustainability into company decision-making, foster continuous performance improvement, and advance the public acceptance and support for utility operations.

Today, over 80 percent of the electricity generation mix in Canada is greenhouse gas free, making it one of the cleanest energy systems in the world. The industry is within reach of an aspirational federal government goal of 90 percent emissions-free generation by 2030, provided it has the benefit of regulatory efficiencies, a competitive business environment, and the capacity to invest in infrastructure and innovation.

SINCE 2000, THE SECTOR HAS REDUCED:

39%	51%	59%	67%	82%
CARBON DIOXIDE	NITROGEN OXIDE	SULPHUR DIOXIDE	MERCURY	PARTICULATE MATTER

TAKING ACTION & MANAGING RISKS

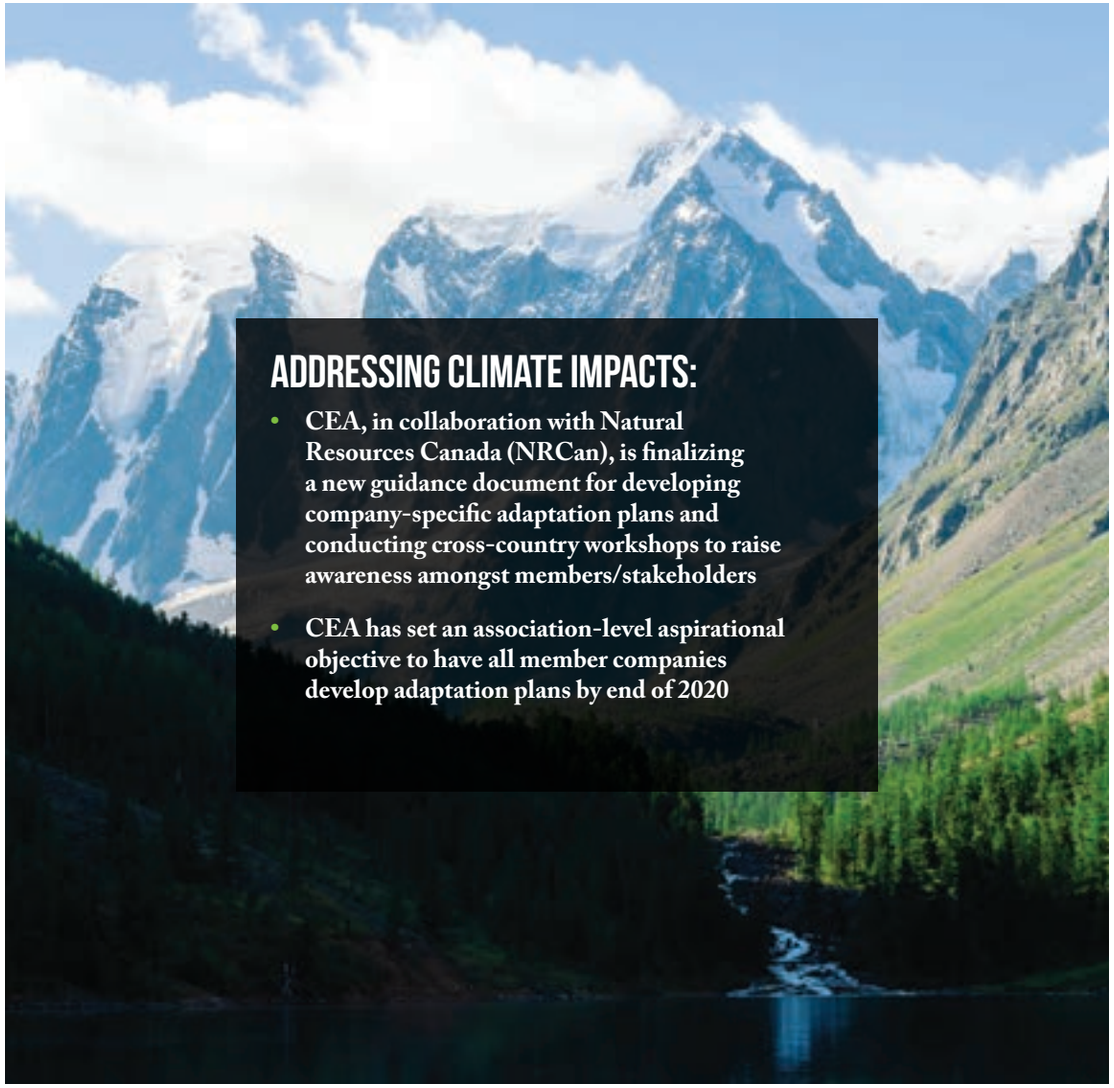
The Canadian electricity industry represents 11 percent of GHG emissions in Canada, with absolute emissions of 79 million tonnes in 2016[5]. The sector continues to lead the transition to a low-carbon economy and has already far exceeded its share of Canada's national commitment to the Paris Climate Agreement to cut emissions by 30 percent from 2005. Between 2005 and 2016 – primarily as a result of an ongoing shift from coal to other low or non-GHG emitting generation – the industry has reduced its absolute GHG emissions by approximately 41 megatonnes (Mt CO2 eq)[6]. It is further estimated that GHG emissions from the industry will be less than 60 percent of their 2005 level by 2020[7].

In fact, the industry remains well positioned to help meet the various emission reduction targets in place across Canadian jurisdictions. Federal coal and natural gas regulations published in late 2018 will further accelerate the already well-advanced phase-out of conventional coal generation – due to be completed by 2030, subject to jurisdiction-specific equivalency agreements – and require even greater efficiency from new natural gas generation.

However, the mandated early retirement of coal plants is not without financial implications for asset owners, rate payers, coal suppliers, and local communities. We must manage the transition carefully. Ensuring a "just transition" for affected communities needs to be an important component of the coal phase-out strategy. The electricity industry is also taking action to address the impacts and vulnerabilities of climate change. 2018 was a year of major weather events. From high winds, to flooding, to forest fires, to extreme winter weather, electricity companies faced an unparalleled year of changing elements.

In the nation's capital, six tornadoes struck the region, blacking out Ottawa and Gatineau. Winds exceeded 260 km/hr. Over 350,000 customers were impacted in the Ottawa area, resulting in more than 9 million customer hours of interruptions. Changing weather patterns are visible across North America, reinforcing the need to take proactive action to address climate change impacts.

[5] Environment and Climate Change Canada, National Inventory Report 1990 – 2016, Executive Summary
[6] Environment and Climate Change Canada, National Inventory Report (1990-2016), GHG Emissions by Economic Sector, page 62
[7] Environment and Climate Change Canada, Canada's Emissions Trends (2014).



ADDRESSING CLIMATE IMPACTS:

- **CEA, in collaboration with Natural Resources Canada (NRCan), is finalizing a new guidance document for developing company-specific adaptation plans and conducting cross-country workshops to raise awareness amongst members/stakeholders**
- **CEA has set an association-level aspirational objective to have all member companies develop adaptation plans by end of 2020**

LOOKING AHEAD: 2019 AND BEYOND

This will be an important year for the electricity industry with the introduction of the federal government's Output-Based Pricing System (OBPS). These carbon pricing rules will have varying implications for utilities across the country based on their current electricity generation sources. Over the next few years, the industry will have to meet a myriad of other regulatory obligations on climate change, including coal and natural gas regulations, the clean fuel standard, and stringent carbon pricing requirements.

Three drivers will shape the contours of the future electricity system. First, climate mitigation regulations will continue to push low and non-emitting generation assets to replace more GHG-intensive power sources. Second, the movement towards electrification will increase overall electricity demand. Third, the push for security and resiliency, combined with increased severe weather due to climate change, will force the industry to strengthen its infrastructure and consider new ways to keep customers' connected. Each of these drivers will require massive and sustained investments in new and upgraded electricity infrastructure. This, in turn, will require a cohesive regulatory regime that will allow these projects to be piloted, permitted and built.

CAPITAL POWER'S GENESEE GENERATING STATION

Located west of Edmonton, the Genesee Generating Station is already one of the cleanest coal-fired facilities in Canada.

In 2018, Capital Power completed year two of a five-year $50 million efficiency improvement program at the Genesee Generating Station.

These investments will reduce Capital Power's carbon footprint by approximately one million tonnes of greenhouse gas emissions by 2021, an 11 percent reduction.

Capital Power is also exploring other options to drive immediate and longer-term reductions in emissions from thermal generation. Converting coal units to natural gas, for example, would leverage existing infrastructure and workforces, and lower transition costs.

04 ELECTRIFICATION OF THE CANADIAN ECONOMY

OVERVIEW:

Electrification is one of the key emerging issues facing the electricity industry. Although electrification is generally discussed in the context of electric cars, it is also about broadly increasing the use of electricity as a primary source of low-carbon energy in the overall economy. While the transportation industry, which includes passenger vehicles, mass transit, and heavy-duty trucking, is positioned to lead this move towards electrification, buildings, including their space heating, water heating and industrial applications, must also be considered in any electrification strategy. A recent North American Assessment by the Electric Power Research Institute (EPRI) identified electrification as potentially increasing electrical load by 24-52 percent by 2050[8]. Thus, managing demand and utilizing efficient behind the meter technology will be key variables as Canada proceeds with electrification.

The shift to electrification is a world-wide phenomenon. Shell Energy's Sky Scenario predicts that by 2070 the rate of electrification of final energy in the world will more than triple, with global electricity generation reaching nearly five times today's level[9]. These changes will strain current infrastructure and delivery design to its maximum, making it crucial that electricity companies invest in new infrastructure. As the industry continues to migrate from fossil fuel-based generation, new challenges will be presented based upon the limitations of renewable energy. Energy storage, distributed energy resources, and grid modernization will be critical in bringing new generation to residential, industrial, commercial, and institutional customers.

[8] Electric Power Research Institute (EPRI), The US National Electrification Assessment, April 2018
[9] Shell Energy, Sky Scenario, 2018

TAKING ACTION & MANAGING RISKS

The electricity industry is taking action to meet these new demands and protect assets and investments made in recent years. Through a committee of senior industry members, CEA has developed potential future scenarios and identified signposts and trends that will impact the speed and direction that change will come to the electricity industry. Those drivers of change include customer needs and demands, disruptive technology, new competitive dynamics, multiple government policy directions, and outdated regulation. Canadian electricity companies and manufacturers have embraced the introduction of electric vehicles (EVs) and are working with technology leaders on managing residential charging and integrating high-speed charging stations into the system. In Shell's Sky Scenario, more than half of global car sales by 2030 will be electric, extending to all passenger cars by 2050[10].

The transport industry transformation will accelerate in the decades ahead, although the industry realizes the customer concern around range anxiety needs to be overcome. Charging electric vehicles at home will be an issue if all customers return home from work and plug in. It's imperative that companies have access to consumer data and are given the ability by regulators to invest in these new customer demands. The industry continues to monitor and invest in energy efficiency measures for their customers. Building trust and facilitating customer power requirements, at an affordable price are priorities.

Where some jurisdictions are vertically integrated and have sole electricity providers, others are becoming more open to competition and, in particular, non-traditional competition. This is changing the business model of many organizations from a solely regulated entity to a regulated and non-regulated enterprise. This progression will be important to watch as the need to invest in future technology and infrastructure runs up against the limitations and challenges imposed by the current energy regulatory framework. The industry will continue to work with governments to expand and modernize regulatory policy that limits utilities from meeting new customer demands.

> **"The best way to predict your future is to create it." - Abraham Lincoln**

[10] Ibid., (Shell Energy, Sky Scenario, 2018)

LOOKING AHEAD: 2019 AND BEYOND

Two-way grid communication and customer data on usage are important to ensuring future supply is available when the customer requires it, no matter what future scenario develops. A Navigant research report shows that utilities are projected to spend nearly $100 billion globally on networking and communications equipment and services over the next decade[11]. Non-traditional competitors will play a role in this data collection as we see with new technology such as smart speakers, like Alexa and Echo, and home control apps. Organizations that solely supply power will be a vulnerable commodity-based company in a changed market.

Today, we again find the Canadian electricity industry in challenging times with aging infrastructure, regulatory constraints, and an increase in demand. And once again, the industry will have to embrace the change that is needed to solve these challenges and implement a cost-effective, safe and reliable solution for the power system of the future.

ALECTRA UTILITIES POWER.HOUSE PROJECT

Alectra Utilities has introduced POWER.HOUSE, a pilot program that connects an aggregate fleet of 20 residential solar and energy storage systems located at customer homes to an intelligent software management system. The network simulates a single, larger power generating facility, integrating individual solar systems into the electricity grid.

POWER.HOUSE:

- **Collects solar energy through solar panels and converts it into electricity**
- **Sends that energy to a battery backup, customer's home, or the grid**
- **Controls the entire process with a software management system**
- **Powers the customer's home with solar even after the sun goes down**
- **Provides electricity in a black-out**

[11] Digital Journal, December 26, 2018

05 CYBER SECURITY & RESILIENCY

OVERVIEW:

The cyberthreat to the electricity industry has been increasing year-over-year, with increases both in the number of and complexity and sophistication of the attacks. There are two types of cyber-attacks: those aimed at business systems, which every computer user is subject to (IT); and attacks aimed at Industrial Control Systems, also called Operating Technology (OT). OT attacks are of most concern to the electricity industry as these are the attacks that could impact the supply of electricity to customers. Key vulnerabilities exist in utility supply chains as well, with recent attacks having sought to penetrate the electricity industry through meter data aggregators and rooftop solar providers[12].

Electricity companies also crossed a virtual Rubicon in 2015 with cyber-attacks in the Ukraine that, for the first time ever anywhere in the world, resulted in the loss of electricity to customers. There is a growing need for the sharing of best practices and increased exercises and drills to identify weaknesses and help ensure that utilities are prepared to respond to potential attacks.

TAKING ACTION & MANAGING RISKS

Through CEA, Canadian electricity companies have been engaged with each other and with government partners on cyber security issues for two decades, beginning with coordinated preparations for Y2K. CEA members have been sharing innovative practices in recognition that we are only as strong as the weakest link, as well as advocating for improved partnerships with a range of stakeholders to improve the quality and timeliness of the threat information that the electricity industry requires to protect assets that are critical to Canadian society at large.

The Canadian electricity industry has successfully built relationships with government partners, such as the Canadian Cyber Incident Response Centre and the Communications Security Establishment, a partnership which has now evolved into the creation of the Canadian Centre for Cyber Security. This partnership will ensure access to information and tools to help the industry secure our systems. These agencies have been at the forefront of cyber defense for the past decade and the quality of the cyberthreat information they provide to Canadian electricity companies is timelier and more actionable than the information from any other source.

[12] Utility Perspectives Conference, Toronto, 2018

LOOKING AHEAD: 2019 AND BEYOND

Cyber adversaries are evolving, and constantly developing new tactics, techniques and procedures. The threat will be more substantial when adversaries begin integrating artificial intelligence as part of their attack tools. Such advancements will be occurring during a time when the potential attack surface is rapidly expanding, as new distributed energy resource players enter the electricity space and create significantly more attack vectors. In this context, it will be ever more critical for the electricity industry to be able to access the most timely and actionable cyberthreat information, whether from federal agencies, the Electricity Information Sharing and Analysis Center (E-ISAC) under NERC, cross-industry partnerships, or from the broader consulting community.

In the year ahead, the industry will work with these partners and stakeholders, will continue to advocate for additional government resources to further build-out the Canadian Centre for Cyber Security, and will work with E-ISAC partners to improve their offering to Canadian companies and to deliver the fifth iteration of the North American-wide table-top exercise, GridEx V, which will include a Canadian Executive Exercise.

HYDRO-QUÉBEC WORKS TO OPTIMIZE GRID DEVELOPMENT AND OPERATIONS TO BETTER PREPARE FOR CYBER SECURITY:

Staff from every Hydro-Québec business unit took part in the GridEx IV biennial exercise that simulates a cyber and physical attack on electric and other critical infrastructure.

Organized by the North American Electric Reliability Corporation (NERC), the exercise gives power utilities and other stakeholders an opportunity to test their crisis response plans, including emergency measures and chain-of-command.

Participants must coordinate their response with neighbouring authorities, including, in Hydro-Québec's case, ISO New England, New York Independent System Operator (NYISO), NB Power and the IESO.

Hydro-Québec's world-class laboratory, Hydro-Québec's research institute (IREQ), is regarded as a global benchmark in the field. Hydro-Québec shares the laboratory with other electricity utilities.

KEY AGENCIES CEA WORKS WITH:

CSE
Communications Security Establishment

CSIS
Canadian Security Intelligence Service

RCMP
Royal Canadian Mounted Police

E-ISAC
Electricity Information Sharing & Analysis Center

CCCS
Canadian Centre of Cyber Security

06 THE CANADA – UNITED STATES ELECTRICITY RELATIONSHIP

OVERVIEW:

Canadians and Americans share custody of a highly integrated electricity grid by more than 35 cross-border transmission lines, with several more currently under development. This integrated electricity system is critical to the positive and mutually beneficial North American energy relationship. Integration has resulted in a flexible, reliable and secure grid on both sides of the border, contributing to North American energy security and resilience.

Interconnection allows for a mutually beneficial and bi-directional electricity trade relationship. Over 80 TWh of electricity flowed across the border in 2017. Thirty states engage in electricity trade with Canada each year and almost every Canadian province participates in wholesale electricity markets. Mutually beneficial, two-way electricity trade allows electric supply to meet demand in the most efficient manner, increases resilience, boosts affordability for customers, and helps regions meet policy and business goals. Many Canadian and U.S. electricity companies own assets in both countries.

Overall, the Canadian and American electricity relationship is working well and must be protected. In the context of the continuing uncertainty regarding overall Canada- U.S. trade, those messages must be emphasized and shared by industry with governments on both sides of the border. They seem to be resonating. The renegotiated North American Free Trade Agreement maintains the zero-tariff electricity trade construct. It also contains a Canada-U.S. side letter on energy that recognizes the value of energy integration and notes that Canada and the U.S. will endeavor to promote North American energy cooperation.

Uncertainty remains as the new trade agreement must be ratified and as overall trade relations between Canada and the U.S. remain unsettled. Beyond trade, in 2018 utilities faced challenges such as major storms and a continually evolving cyberthreat environment. Meanwhile, industry and policy makers continue to consider how to keep the grid resilient and reliable in the face of a shifting generation mix as more renewables and natural gas come online. This occurs as many utilities and jurisdictions seek to meet clean energy goals, harness new technologies, and modernize infrastructure.

TAKING ACTION & MANAGING RISKS

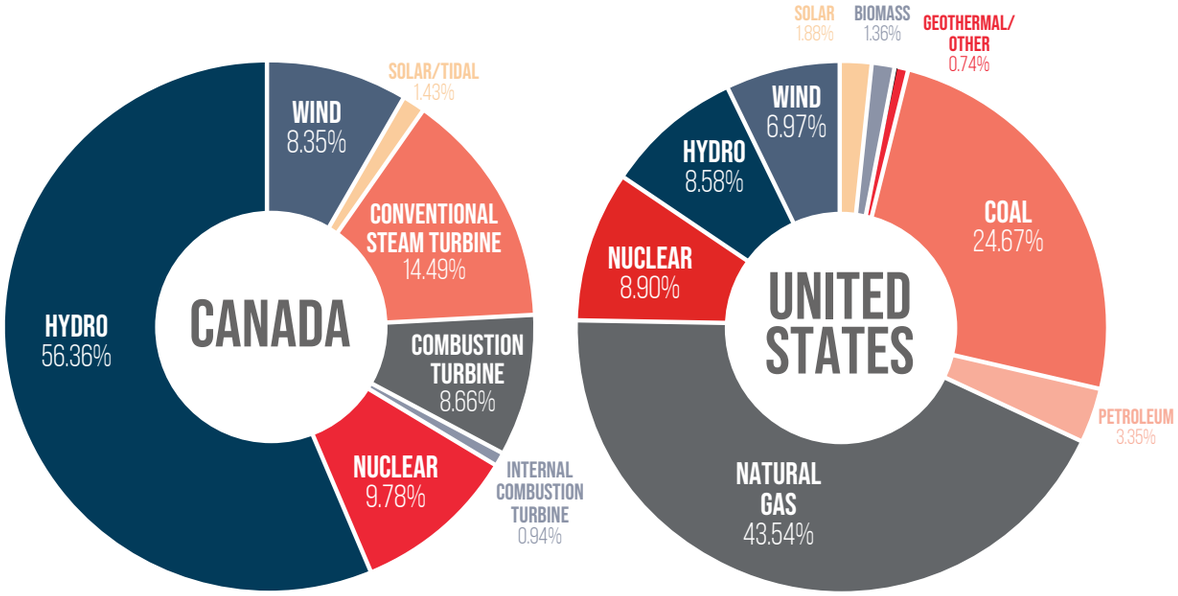
Considering the integrated nature of the North American power grid, industry and governments on both sides of the border have developed close working relationships and effective cross-border institutions in support of a safe, secure and reliable electricity system to the shared benefit of U.S. and Canadian businesses and communities.

Canadians and Americans work together to protect the grid from threats, and to develop the standards and best practices that keep the grid reliable and secure. For example, electric reliability standards developed by the North American Electric Reliability Corporation are mandatory and enforceable in the U.S. and in all Canadian provinces connected to the bulk power system.

The Canadian electricity industry is an active participant in cross-border programs that aim to secure the grid. For example, Canadians and Americans participate in cyber and physical mutual assistance programs. Many Canadian utilities responded to storm-related damage in the aftermath of a deadly Nor-Easter that hit the Northeastern U.S.; when Hurricane Florence struck Georgia and surrounding states; and, when major fires burned in California.

Over 400 personnel were deployed from Canada to facilitate restoration efforts south of the border during 2018. Canadian utility CEOs are also members of the Electricity Subsector Coordinating Council (ESCC). The ESCC, an effective forum and good example of U.S.-Canada security cooperation, enjoys the participation of senior government officials and electricity industry CEO's from both countries. The Canadian electricity industry and government also participate in major incident response exercises, including GridEx exercises, that simulate likely cross-border impacts of coordinated attacks and natural disasters.

GENERATION MIX (CANADA / US)[13]



[13] Data Source: U.S. Data from Energy Information Administration, 2016; Canada Data from StastCan, CANSIM Table 127-0009 | Data Retrieved: May 2018; Visual Created by the Canadian Electricity Association

LOOKING AHEAD: 2019 AND BEYOND

The cross-border electricity relationship has provided Canada and the U.S. with the reliable, resilient, affordable, clean and secure electricity that has helped power Canadian and American economies for over a century. However, in both Canada and the U.S., the realities of the dynamic electricity environment today bring new challenges and opportunities that the cooperative nature of the Canada-U.S. electricity industry is well-suited to meeting.

These challenges and opportunities are often borderless in nature, from continuously evolving cyber threats, to more frequent and extreme weather, to keeping the grid reliable and resilient as generation mixes change and as new technologies come online.

Utilities on both sides of the border continue to build, protect, and modernize their infrastructure and systems in regulatory and political environments that are increasingly uncertain, fragmented, and complex. This must be accomplished in the context of policy imperatives for a more resilient and cleaner grid, and while delivering the business models and electricity that customers demand.

The shared nature of these challenges and opportunities require continued Canada-U.S. electricity cooperation. First and foremost, we must protect what works – and the Canada-U.S. electricity relationship works well. Beyond that, there are further opportunities for Canada and the U.S. to leverage the positive electricity partnership to continue to promote energy security and affordability; strengthen energy infrastructure protections; and make North America the world's leading energy region – all while keeping the customer—residential, commercial and industrial—top of mind.

OPPORTUNITIES FOR CANADA-US COOPERATION:

- **Connect existing R&D efforts and provide a framework for new joint initiatives**
- **Protect electricity infrastructure from cyber and physical threats**
- **Develop a 21st century workforce**
- **Reduce regulatory red tape**
- **Establish a framework for ongoing consultation and dialogue between governments, supported by business-sector participation**

THE ELECTRICITY INDUSTRY HAS COME A LONG-WAY, BUT THE JOURNEY AHEAD REQUIRES THE SUPPORT OF ALL KEY PLAYERS, INCLUDING GOVERNMENTS, BUSINESSES, INDIGENOUS PEOPLES, ENVIRONMENTAL ORGANIZATIONS, CUSTOMERS, AND THE GENERAL PUBLIC.

As we look ahead to 2019 and beyond, the industry requires:

- Greater regulatory certainty and predictability on key issues, including energy policy, climate change, and broader environmental issues;
- Efficient project approval processes and timelines;
- Improved investment conditions, including corporate tax reductions;
- Adjustments to the territorial "debt-caps" to allow northern communities to raise private capital;
- Direct government investments in transformative electricity infrastructure projects, including new innovative clean energy technologies;
- A clear Canadian strategy on electrifying the Canadian economy;
- Continued investment in cyber security and infrastructure protection; and,
- Enhancement of the United States - Canada trade relationship.

The electricity industry is committed to meeting the evolving needs of Canadians and contributing to Canada's prosperity. However, we cannot do this alone - we need the support of our governments and all Canadians. Together, we can meet the challenges of tomorrow and create a better future for generations to follow.

ACKNOWLEDGEMENTS:

CEA would like to acknowledge the contributions of CEA staff, particularly Francis Bradley, Channa Perera, Julia Muggeridge, Michael Powell, Justin Crewson, Stephen Koch, Dan Gent, Jay Wilson, Leah Michalopulos, and Patrick Farley in producing this report.

In addition, CEA would like to thank Douglas Turnbull (Vice-Chairman and Country Head, Canada, DBRS Ltd.), Devin McCarthy (Vice-President, Federal & Energy Practices, Sussex Strategy Group) and David Oulton (Former Assistant Deputy Minister, Federal Government) for their review of the draft report.

FOR MORE INFORMATION:

Please visit our website: **electricity.ca**
or email Julia Muggeridge your questions: **muggeridge@electricity.ca**

Canadian Electricity Association | Association canadienne de l'électricité

electricity.ca • electricite.ca