



A Future Worth Investing In

2018
Sustainable Electricity
Annual Report



Canadian Electricity Association
Association canadienne de l'électricité



Sustainable Electricity | Électricité durable

TABLE OF CONTENTS

About this Report	1
About the Sustainable Electricity Program	2
Executive Message	3
Public Advisory Panel Letter	6
Performance at a Glance	7
SUSTAINABILITY PILLAR I Low-Carbon Future	9
SUSTAINABILITY PILLAR II Infrastructure Renewal and Modernization	14
SUSTAINABILITY PILLAR III Building Relationships	19
SUSTAINABILITY PILLAR IV Risk-Management Systems	25
SUSTAINABILITY PILLAR V Business Excellence	32

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Sustainable Electricity™ is a mandatory sustainability program developed and implemented by the corporate utility members of the Canadian Electricity Association (CEA). The goals of the program are to integrate sustainability in company operations; foster continuous performance improvement; and advance the public acceptance and support for utility operations through meaningful engagement, collaboration, transparency and accountability. In that context, this report provides an overview of the sustainability performance of CEA corporate utility members in 2017. CEA would like to thank member companies for reviewing the drafts.

CEA kindly asks that you read this report electronically rather than from a printed copy.

www.electricity.ca
www.SustainableElectricity.ca
www.SustainableElectricityCompany.ca

About this Report

This report discloses metric-specific performance by Canadian Electricity Association (CEA) members, under five reporting pillars, for calendar year 2017 and the two preceding years. It describes their operating environment and other considerations that impact performance and includes brief case studies illustrating specific efforts to advance sustainability.

The five reporting pillars were adopted in 2016 following a CEA-level materiality assessment of sustainability issues. The objective was to identify those aspects of the Canadian electricity sector's performance that are of most interest to stakeholders, and most likely to significantly influence the sector's future success. This exercise also involved a reconsideration of which specific metrics provide the best basis for assessing

member performance within each pillar, and, in some cases, a refinement of the specific nature and scope of the metrics.

Data in this report therefore typically extends back to 2015 but the disclosure timeframe will be extended in future reports. Refinement of data collection and analysis will be ongoing, and for the purposes of this report included more rigorous member data verification.

CEA has attempted to capture and communicate member performance in a balanced manner, including commentary on performance trends and on the reporting framework from a multi-stakeholder Public Advisory Panel ([see page 6](#)). Reader feedback is welcome and can be provided to info@electricity.ca

THE FIVE REPORTING PILLARS

1. LOW CARBON FUTURE
2. INFRASTRUCTURE RENEWAL & MODERNIZATION
3. BUILDING RELATIONSHIPS
4. RISK-MANAGEMENT SYSTEMS
5. BUSINESS EXCELLENCE





About the Sustainable Electricity Program

The preparation of this report — and the performance disclosure on the part of individual companies that makes it possible — is a key element of the CEA's Sustainable Electricity™ Program, participation in which is mandatory for all member utilities.

Additional program components include adherence to a CEA Sustainable Development-Corporate Responsibility Policy and having an environmental management system in place consistent with the ISO 14001 standard.

The program also includes performance verification requirements, the precise nature of which were under review and revision at the time this report was prepared.

A Board Committee on Sustainability is responsible for the strategic implementation of the program. A Steering Committee, reporting to the Board Committee, oversees the program and the related performance disclosure. Increased assurance and comparability of carbon and infrastructure-investment data reported by members were among the priorities it set in 2017, and work was underway on the part of both CEA and member companies at the time this report was prepared. Other specific objectives set by the committee are referenced in the reporting sections below.

CEA recognizes members for excellence in specific aspects of the pursuit of sustainability each year, along with an individual leadership award. See who shone in 2017: <https://bit.ly/2mDo28q>

Both CEA and non-CEA member companies can apply for the separate CEA-administered Sustainable Electricity Company™ designation, which requires compliance with key international sustainability-related standards and third-party verification. To date, six CEA member companies have received the designation, including Saint John Energy in June, 2018. The Board Committee has set the objective of all non-designated CEA members having completed a gap analysis relative to designation requirements by the end of 2020.





Executive Message

We are pleased to present our 2018 Sustainable Electricity Annual Report. It documents the performance of CEA corporate utility members across what we believe to be the most relevant and impactful aspects of sustainability. While such an exercise always points to improvement opportunities, we are gratified to be able to report largely favourable outcomes. In 2017, CEA members continued to anticipate and address various regulatory, technical, competitive and other business changes.

Foremost among those changes is the ongoing transition to lower-carbon energy future. Probably more complex and consequential than any other global macro-trend, this is shaping up to be no less an era-defining inflection point than was the Industrial Revolution. CEA members were at the forefront of enabling and advancing that transition here in Canada in 2017 through a host of investments in a greener and more sustainable future.

This report is the second we have prepared using a framework adopted in 2016. Through

discussions with members and stakeholders, we arrived at five reporting “pillars” which we believe best illuminate the challenges and achievements along our pathway towards sustainability. We also continually refine and strengthen our metrics and data and submit each year’s performance report to the scrutiny of our Public Advisory Panel.

In 2017, CEA members sustained their multi-pronged efforts to cut carbon intensity, adding modest further improvement to a track record of dramatic longer-term reductions. These efforts included added generation, acquisition and integration of renewable electricity, and both internal and external efficiency programs. Initiatives to support electric vehicle adoption were also widely pursued.

At a sectoral level, Canada’s electricity industry has reduced greenhouse gas emissions by more than 30 per cent since 2005 — a larger reduction than any other industrial sector — and is on track for a further 30 per cent reduction by 2030.

Infrastructure investments totaling well into the billions of dollars continued to be made in

2017 — although the most recent assessment of the needs associated with the energy transition suggests that even this impressive pace likely needs to be accelerated.

CEA and its members have pursued ever-more robust relationships with Indigenous groups, including extensive business arrangements and innovative partnership-based approaches on matters such as applications for regulatory approvals. Rigorous risk management practices drove priority air emissions down lower — again, building on large-scale reductions in earlier years — and reduced the severity of workplace injuries.

As always, we looked to governments and regulators for collaboration and cooperation — in order to safeguard the industry’s competitive position and to ensure its ability to get approval for and to invest in innovation and non-emitting generation. Our input on legislative initiatives in 2017 was intended in part to ensure that multiple layers of regulation, both federal and provincial, don’t come to impede the very actions



needed to effect the energy transition. We called for due consideration of the cumulative cost and other impacts of the proliferating regulatory prescriptions to which our members must adhere.

In 2018 and beyond, our efforts as an association and as individual companies will be guided by the principles embedded in our Sustainable Electricity Program, and by more specific objectives set by its steering committee. Key current ones are referenced in this report, and will hone our efforts relating to climate adaptation, Indigenous relations and supply-chain management, among other endeavours.

Our 2017 results identify momentum to be sustained and gaps to be closed — improved leadership diversity being an example of the latter. But we also see clear indications of an industry seized of its responsibilities, sensitive to its stakeholders' interests, and determined to help to build a clean, collaborative and competitive future. That is a future well worth investing in, as CEA members did in 2017 and are continuing to do in 2018 and onward.

Sincerely,



A handwritten signature in black ink, appearing to read 'M. Cananzi'.

Mr. Max Cananzi
President, Alectra Utilities Chair,
CEA Board Committee on Sustainability



A handwritten signature in black ink, reading 'Sergio Marchi'.

Hon. Sergio Marchi
President & Chief executive Officer
Canadian Electricity Association (CEA)



About the Canadian Electricity Association and Electricity in Canada

THE CEA AND ITS SERVICES AND ACTIVITIES

Founded in 1891—12 years after the invention of the incandescent light bulb—CEA is the national forum and voice for Canada's electricity industry.

We help our members stay at the forefront of customer service, innovation and sustainability; and help ensure Canadians have access to safe, secure and sustainable electricity.

OUR KEY ACTIVITIES ARE:

- services to support member business effectiveness, including analytics, safety management and many others
- developing and delivering clear and compelling industry positions to governments and others on policy issues
- working with our members to identify and address emerging issues that will shape the industry of tomorrow

THE CEA MEMBERSHIP

35 of the companies whose operations are the backbone of Canada's electricity system: integrated utilities, independent power producers, transmission and distribution companies, and power marketers.

A larger number of corporate partner members who provide products and services to the electricity industry.

CEA MEMBERS:

- generate electricity, transmit it across often large distances to where it is needed, and distribute it to millions of customers across Canada
- provide an essential service that individuals, businesses and institutions rely on continuously
- maintain some of society's most important infrastructure while constantly innovating and improving their service delivery

THE CANADIAN ELECTRICITY INDUSTRY:

Employs more than 81,000 people

Adds more than \$30 billion to national GDP

Generates ~650 TWh of electricity annually

Generates international trade revenue of **\$2.7 billion annually**

Generates **~40% fewer GHGs today** than in 2000, we use more than 80% non emitting energy sources!

Plays a central role in the ongoing energy transition and further de-carbonisation of our economy and day-to-day lives



Public Advisory Panel Letter

August 23, 2018

Mr. Max Cananzi
President, Alectra Utilities
Chair, CEA Board Committee on Sustainability

Re: Public Advisory Panel's Annual Letter

The members of the Sustainable Electricity Program's Public Advisory Panel are pleased to submit the 2018 Annual Letter of Advice to the Canadian Electricity Association (CEA) Board Committee on Sustainability and the Board of Directors regarding your members' sustainability performance during the 2017 reporting year.

As a first point, the Public Advisory Panel would like to acknowledge and congratulate you on your organization's response to the concerns we raised about reported data quality last year. This year, the data submissions and associated quality control processes have done well. In almost all cases the information was compiled and reported by a competent company employee, verified by a supervisor, and signed off by a company officer. The result was that this year the Panel had much more complete and better quality data to review.

We also found that there were no significant problems within the results of the various indicators reported. Neither did we find startling improvements, but we recognize that the CEA is building on a strong historical sustainability baseline, so modest incremental improvements are the goal going forward.

Greenhouse gas emissions were essentially flat last year when plotted against previous years. We await scheduled coal plant closings before we see significant reductions in this indicator. Similarly, we expect the flat trend in NO_x and SO_x emissions in recent years will abruptly change with these closures.

We note that more electricity conservation was achieved in 2017 — there were some improvements in reliability and the number of priority spills tracked recorded were at historic levels. Those data all speak to the level of diligence and persistence by members.

There is never an acceptable level of lost time and/or injuries, but we note that your members' safety programs continue to produce consistent results.

We were pleased to see that there was significant progress on the advancement of women into key positions. We look forward to seeing further progress on the diversity assessment initiative we recommended

last year and to the times when this progress will advance into gender diversity at the Board level. In addition, it is equally important that diversity is considered more inclusively, including employment and advancement of visible minorities and other traditionally disadvantaged groups.

We were also pleased to see progress on the biodiversity issue. The CEA webinar held on June 6th, entitled "The Vital Role of the Canadian Electricity Industry in Biodiversity Conservation," attracted 45 participants from among the member companies and was reported to be well received. We continue to encourage CEA and its members to work towards the development of a best practice framework on biodiversity.

Finally, with Canada's adoption of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and the movement toward reconciliation, we suggest that member companies initiate plans on how to advance reconciliation with Indigenous peoples in Canada in their work and operations if they have not done so already. These plans can look to CEA's National Principles for Engagement of Indigenous Peoples and goals for engagement for guidance, although the plans should be specific to the members' local context and operations.

Overall, the Panel had some interesting discussions as we reviewed the results of the various indicators this year. It was clear that we are all part of an evolving organization in a rapidly changing environment. We recognize that it is critically important to constantly review the sustainability indicators and ensure that they are kept updated and relevant to stakeholders. In that regard we thought that it was valuable to receive strategic insight into trends and developments by meeting with knowledgeable individuals from within your member companies in a workshop setting.

In summary, the Public Advisory Panel was pleased with both the responsiveness of CEA to our suggestions from last year and the progress that has been made to date. We trust you will find this year's comments useful as you deliberate areas for improvement in the future.

Sincerely,

Gord Miller
Chair, Public Advisory Panel





PERFORMANCE AT A GLANCE

Electricity Generated

Net Generation by Fuel Type (gigawatt-hours)	2016	2017	Annual Change
Coal	62,414	61,356	1058 ↓
Diesel	659	508	151 ↓
Natural Gas	29,838	30,664	826 ↑
Oil	2,370	2,070	300 ↓
Total Fossil	95,281	94,598	682 ↓
Hydroelectric	297,244	303,458	6,215 ↑
Nuclear	72,316	70,175	2,142 ↓
Renewables (biomass, wind, solar, tidal, biofuel, other)	9,004	9,104	100 ↑
Total Non-Fossil	378,564	382,737	4,173 ↑
TOTAL Net Generation	473,845	477,335	3,490 ↑

Low-Carbon Future

	2016	2017	Annual Change
CEA Member Carbon Emissions — Absolute (total carbon equivalent emissions from operations, Mt)	77.2	75.9	1.3 ↓
Energy Savings — Internal Programs (MWh/year)	84,997	96,430	11,433 ↑
Energy Savings — External/Customer Programs (MWh/year)	3,551,348	4,948,682	1,397,334 ↑

Note: The figures above are absolute measures (in contrast to intensity measures, expressed on a per-unit-of-production basis). They can therefore be impacted by CEA membership changes from one year to another, as well as by acquisitions or divestments on the part of members. 2015 data not shown.



Infrastructure Renewal & Modernization

	2016	2017	Annual Change
Total Infrastructure Investments (\$B)	13.34	14.55	1.21 
Reliability — SAIDI (outage duration)	5.65	7.92	2.27 
Reliability — SAIFI (outage frequency)	3.10	2.61	0.49 

Building Relationships

	2016	2017	Annual Change
Members that Have Formal Stakeholder Engagement Policy	78%	87%	9 
Value of Formal Relationships with Indigenous Communities (\$MM)	\$863	\$829	34 
Members that Provide Help for Low-Income Customers	41%	33%	8 

Risk-Management

	2016	2017	Annual Change
NOX emissions — Intensity (tonnes/net generation)	1.43	1.39	0.04 
S02 emissions — Intensity (tonnes/net generation)	2.59	2.58	0.01 
Mercury emissions — Intensity (kg/net generation)	0.007	0.006	0.001 
Number of Priority Spills	120	125	5 
All Injury/Illness Rate (frequency per 200,000 hours worked)	1.58	1.78	0.2 

Business Excellence

	2016	2017	Annual Change
Total Employee Compensation (\$B)	\$7.17	\$7.63	0.46 
Innovative Tech — Members that Deploy Energy Storage	50%	63%	13% 
Innovative Tech — Members that Deploy Electrification	56%	67%	11% 
Female Representation on Boards of Directors	29%	32%	3% 

Note on data from prior years: Various performance metrics for 2015 and 2016 have been re-stated, relative to disclosures in prior Sustainable Electricity Annual Reports. This reflects particularly extensive efforts on the part of CEA and its members in 2018 to improve the quality, comparability and verification of all data included in this report.



SUSTAINABILITY PILLAR I

LOW-CARBON FUTURE

The Canadian electricity sector continues to lead the transition to a low-carbon economy and has already far exceeded its share of Canada's national commitment under the Paris Climate Agreement to cut emissions by 30 per cent from 2005. Between 2005 and 2015 — primarily as a result of an ongoing shift from combustion-based to non-combustion generation — the sector reduced its greenhouse gas emissions by 40 megatonnes (MT CO₂ eq) net. Sectoral emissions are projected to be at less than 60 per cent of their 2005 level by 2020 (*Source: Environment and Climate Change Canada, Canada's Emissions Trends 2014*).

In 2017, CEA members generated more renewable and non-emitting electricity, while finding innovative means of cutting emissions from remaining fossil fuel use. They continued to reduce their own operational consumption, assisted their customers and communities to reduce their consumption, and helped make it possible for electricity to be used to meet a broader range of energy needs.

The sector remains well-positioned to help meet the various emission reduction targets in place across Canadian jurisdictions, and to operate with what is expected to become a federally mandated minimum carbon price. Draft federal regulations published in early 2018 will accelerate the already well-advanced phase-out of conventional coal generation — due to be completed by 2030, subject to possible jurisdiction-specific equivalency agreements — and require even greater efficiency from new natural gas generation.

With more than 80 per cent of Canadian electricity already emissions-free, the sector remains within reach of an aspirational federal goal of 90 per cent emissions-free generation by 2030 — providing it has the benefit of sufficient project-review and other regulatory efficiencies, a competitive business environment, and the capacity to invest in infrastructure and innovation.



Climate Change Management and Mitigation

The Canadian electricity sector (CEA and non-CEA member companies) represents 11 percent of GHG emissions in Canada, with absolute emissions of 79 million tonnes (in 2016).¹ CEA members accounted 77 million tonnes (or 97 percent) of total electricity-sector GHG emissions in 2016, which continued to decline in 2017 to 75.8 million tonnes.

With a small reduction in absolute greenhouse gas emissions, and a small increase in net generation, carbon intensity for CEA member companies decreased slightly in 2017. While natural gas generation increased marginally, and nuclear generation decreased somewhat, net-generation trends were otherwise consistent towards less fossil fuel and more non-emitting sources. CEA members also purchased more renewable electricity, including from customer-generated sources.

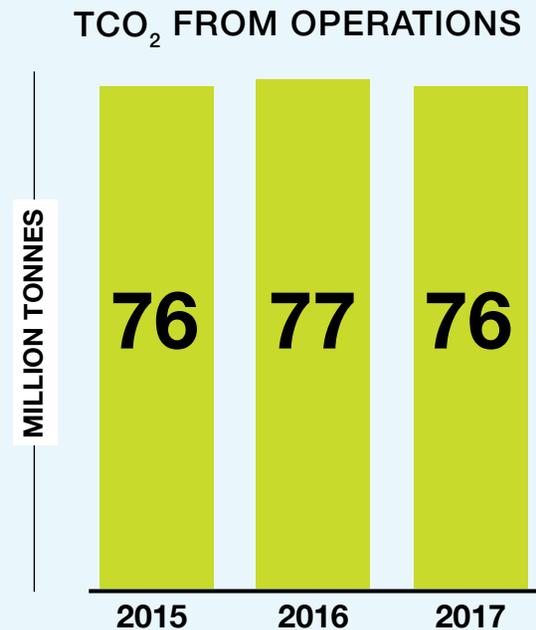
The modest level of current year-over-year improvement on carbon emissions reflects the impressive scope of reductions achieved in

Clean Power and Consensus Building — read a CEA discussion paper on balancing the benefits and costs of Canadian climate action: <https://bit.ly/2tbtW1z>

earlier years. A more significant additional step-down in emissions will result from the retirement of remaining conventional coal generation prior to the 2030 deadline (subject to possible jurisdiction-specific equivalency agreements). Innovations such as carbon capture-and-storage technology also have the potential to impact trend lines as their development and implementation advances.

Since climate change impacts are inevitable in the future given global rise in temperature, CEA and its members increasingly focused on climate adaptation in 2017. The association released a Climate Adaptation Guide and has set an objective of all member companies having an adaptation plan in place by the end of 2020.

FIGURE 1 | Electricity Sector GHG Emissions — 2015–2018



37% of CEA Members had a Carbon Reduction Target in 2017

Note: GHG emissions are intended to include total company emissions from all facilities, including from generation facilities, fleets and buildings. For 2017, not all CEA members were able to report on that basis, while the balance reported emissions from electricity generation facilities only. All members are expected to report on a corporate-wide basis by 2020.

¹ National Inventory Report, 1990–2016, Greenhouse Gases and Sinks In Canada, Canada's Submission to the United Nations Framework Convention on Climate Change

Internal Efficiency, Customer Conservation Programs

Close to half of CEA members had a formal internal energy conservation program in place in 2017, although there was a further drop off in the energy savings delivered by these programs.

Many members engaged extensively with their customers to help them use energy more efficiently. These programs delivered significantly increased energy savings and greenhouse gas reductions in 2017, while also helping customers to manage costs.

External efficiency programs are diverse and often highly tailored to customer circumstances. They range from equipment and services for households, to involvement with municipal infrastructure upgrades, to initiatives executed cooperatively with large-scale commercial and industrial electricity users.

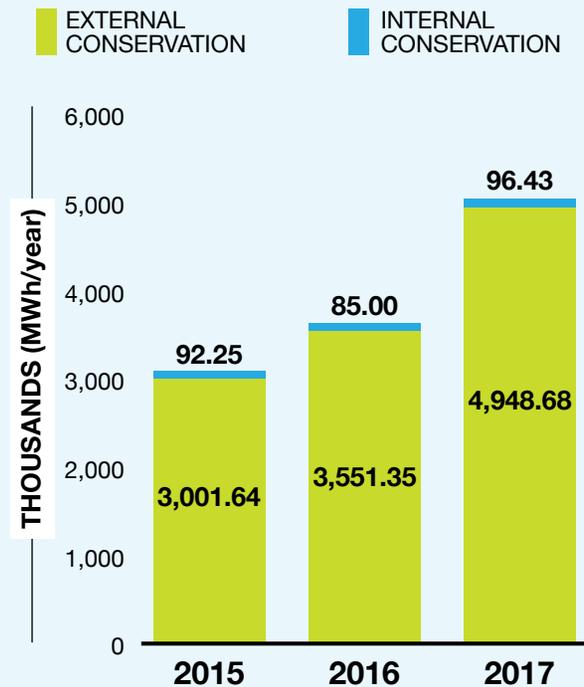
Electrification of Transport, Buildings and Processes

Broadening the proportion of our total energy needs that can be met with electricity is widely acknowledged as a key de-carbonisation strategy. This reality is driving the need to both generate more electricity (see also Infrastructure section, [page 14](#)), and to facilitate new and expanded uses for it.

More than two-thirds of CEA members reported involvement in electrification initiatives during 2017, up from previous years. While electrification opportunities are diverse, the most immediate and promising ones commonly relate to personal-use electric and hybrid vehicles (EVs).

Many CEA members were at the forefront of efforts in 2017 to improve ease-of-use of EVs — for example, through increased availability of charging infrastructure — as well as to better understand and accommodate the impacts that wide-scale EV adoption will have on electricity grids.

FIGURE 2 Annual Energy Saved through Conservation Programs



40% of CEA Members had an Internal Energy Conservation Program in 2017



EXTERNAL PERSPECTIVES:

*MERRAN SMITH, EXECUTIVE DIRECTOR,
CLEAN ENERGY CANADA*

What does a truly sustainable Canadian electricity system look like, say by 2040?

Let's start with the good news: 65 per cent of Canada's electricity comes from renewable sources, and 80 per cent comes from non-emitting sources. We're lucky that we have so much hydro in this country. You compare our electricity grid with that of countries around the world, and it's clear we're starting in a privileged position. We know that getting to 100 per cent non-emitting is entirely possible by 2040 in Canada—in fact, it's entirely possible before 2040.

What is a key improvement opportunity for CEA members to focus on now in order to get there?

It's important to remember that electricity isn't the only thing powering Canada. There's fuel — the fuel used to drive cars and trucks, to heat homes and power industry. Unlike much of our electricity grid, most of that fuel isn't clean — it's gas, it's diesel. The cleanest fuel is in fact electricity. And so the opportunity — it's a massive opportunity, really — is to make electricity the new dominant fuel source. Electric cars. Electric heating. That's the longer road ahead.

Member Action to Reduce Carbon

Capital Power Introduces a New Standard for Thermal Generation

Located west of Edmonton, the Genesee Generating Station is already one of the cleanest coal-fueled facilities in Canada. In 2017, Capital Power completed the first year of the “Genesee Performance Standard” — a five-year, \$50-million efficiency improvement program. These investments will reduce Capital Power’s carbon footprint by approximately one million tonnes of greenhouse gas emissions by 2021, an 11 per cent drop. 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.

Hydro-Québec Harnessing the Northern Sun

Hydro-Québec installed 69 solar panels (20 kW) in the Village of Quaqtq, in Quebec’s northern Nunavik region. This pilot project will help lay the groundwork for the introduction of renewables in off-grid communities, and guide efforts to ensure they too can join in the transition to cleaner electricity. Insights gained in Quaqtq will help identify constraints and evaluate installation, maintenance and operating costs for renewables in an Arctic environment. The project has the potential to reduce fossil-fuel consumption by 5,000 litres annually in Quaqtq, and additional renewable equipment may be added in 2018.

ENMAX Net Zero Energy at Cardston Municipal Facilities

ENMAX worked with the southern Alberta Town of Cardston to install more than 500 solar modules on about 1,200 square metres of roof space on its Charlie Cheeseman Memorial Ice Arena and Civic Centre. The two installations will generate over 200 MWh of electricity annually — enough to cover 100 per cent of the facilities’ consumption — and reduce greenhouse gas emissions by 136 tonnes and electricity costs by almost \$20,000. The town administration sees this net-zero achievement as the first of many steps it will take in exploring cleaner forms of energy within its community. See drone footage at: <https://bit.ly/2toljPz>

Newfoundland Power Helping Non-Profits Take Charge

Through its takeCharge program, Newfoundland Power donated over 3,000 LED bulbs to local non-profit organizations across the island of Newfoundland. Some of these groups distributed the energy-efficient bulbs to individuals and families in their network, while others used them in their own facilities to reduce operational costs — helping these charities and those they support save energy and money.

Oakville Hydro’s Geo-Exchange Generates Savings in Oakville

In 2017, Oakville Hydro was able to quantify the benefits of having implemented a Geo-Exchange system for heating and cooling at its head office. Electricity use was reduced by more than one million kWh annually, freeing up enough energy to power over 110 residential homes and avoiding 45 tonnes of carbon emissions. The resulting annual savings on electricity costs amount to more than \$200,000. This system will also cut demand for natural gas for space heating and cooling by a projected 19,000 cubic metres annually, avoiding about another 38 tonnes of carbon emissions.

Alectra Drive for the Workplace

Alectra Utilities’ two-year pilot project at Markham Civic Centre is helping determine how businesses can cost-effectively provide the infrastructure to encourage electric vehicle adoption among employees. The Civic Centre has been provided with an 18 kWh battery storage system and 16 Level-2 charging stations located indoors and outdoors. Greater accessibility of EV charging systems is key to reduced battery range anxiety and increased consumer pick-up on this key electrification opportunity, while minimizing the impact on customer’s electricity bills.



SUSTAINABILITY PILLAR II

INFRASTRUCTURE RENEWAL AND MODERNIZATION

Several factors are driving the need for large-scale investment in electricity infrastructure expansion, refurbishment and innovation. First, a growing customer base in many markets is driving net increases in demand, despite the considerable success of conservation efforts. These demand growth trends have the potential to accelerate significantly along with increased electrification.

Second, a large portion of existing infrastructure is at or approaching the end of its life expectancy, with reliability implications if timely renewal is not undertaken. And third, and perhaps most importantly, infrastructure investment is essential to maintaining momentum in the ongoing transition to a cleaner energy future. This involves both added renewable generation capacity of varying types — particularly as we near the deadline for conventional coal phase out — and further investments to ensure efficient transmission and distribution of higher volumes of clean energy.

The scale of the resulting investment requirement is daunting but undeniable. A Conference Board of Canada assessment in 2017 projected a need for close to \$1.7 trillion for electricity generation alone by 2050. This level of investment is expected to be sufficient to achieve a 60 per cent emissions reduction from 1990 levels, and to put Canada on a trajectory to achieve its shorter-term Paris Climate Agreement commitments.

While CEA members stepped up with significantly increased infrastructure investments in 2017, there are several potential impediments to achieving the scale of investment required, and CEA engaged with government and other stakeholders in efforts to address each of them.

Canadian businesses become less competitive and less able to attract investment as regulatory burdens and taxation costs diverge from those

in other jurisdictions — a trend now clearly evident. At the same time, rate-setting processes do not always adequately accommodate investments in innovation, despite the fact that tomorrow's infrastructure needs will clearly not be met with yesterday's technology.

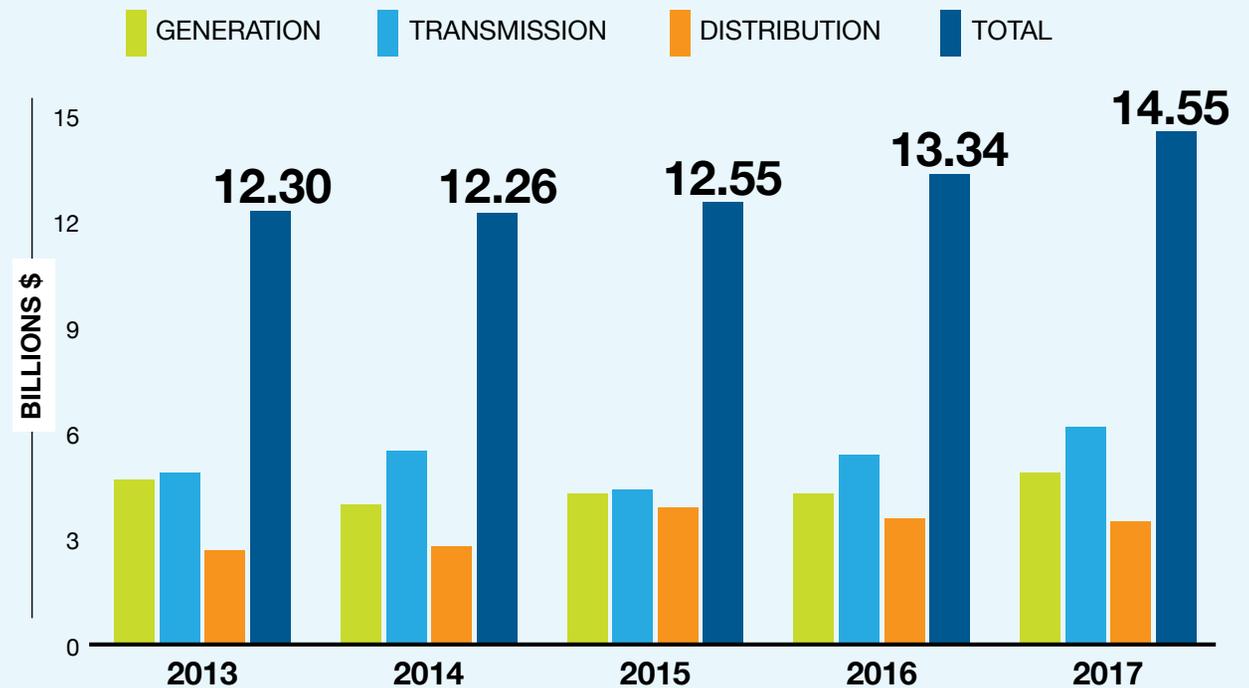
Compounding this is an absence of sufficient public understanding and consensus with respect to the cost of the clean energy transition. Efforts such as the "Generation Energy" dialogue, initiated by the Minister of Natural Resources in 2017, are important steps in attempting to address this deficiency.

Investments in New and Refurbished Infrastructure

Infrastructure investments on the part of CEA members in 2017 totaled close to \$15 billion dollars, with total investments over the past three years exceeding \$40 billion. A modest decline in distribution-related investments from 2016 was more than offset by increases in both generation- and transmission-related investments, for an overall increase of nine per cent.

Among the largest spends on the part of individual CEA members were \$1.9 billion in generation investments by Ontario Power Generation, which includes ongoing refurbishment of nuclear generating capacity; and \$2 and \$1.6 billion in transmission spending on the part of Hydro-Québec and Manitoba Hydro respectively.

FIGURE 3 | Investments: New and Refurbished Infrastructure



Integration of Renewable Energy

CEA members generated and purchased a total of 35,521 gigawatt-hours of renewable electricity in 2017 (in addition to much larger volumes from hydroelectric and nuclear generation, which are also non-emitting). This was a 14 per cent increase over 2016, representing diverse investments in increased renewable generation capacity.

Wind energy generated the large bulk of renewable energy self-generated by CEA members and

continued to trend upward year-over-year. Year-over-year trends were variable for other forms of renewable generation.

Integration of renewables requires alterations to both transmission and distribution systems to better accommodate more dispersed and smaller-scale generation. This entails investments in such things as greater ease of grid connection, transmission technology enabling reversibility of flow direction, and faster responses to supply-demand imbalances. Integration may also entail deployment of batteries and other

storage technology to maintain reliability while using larger amounts of intermittent generation. CEA member companies made a variety of investments of these types in 2017.

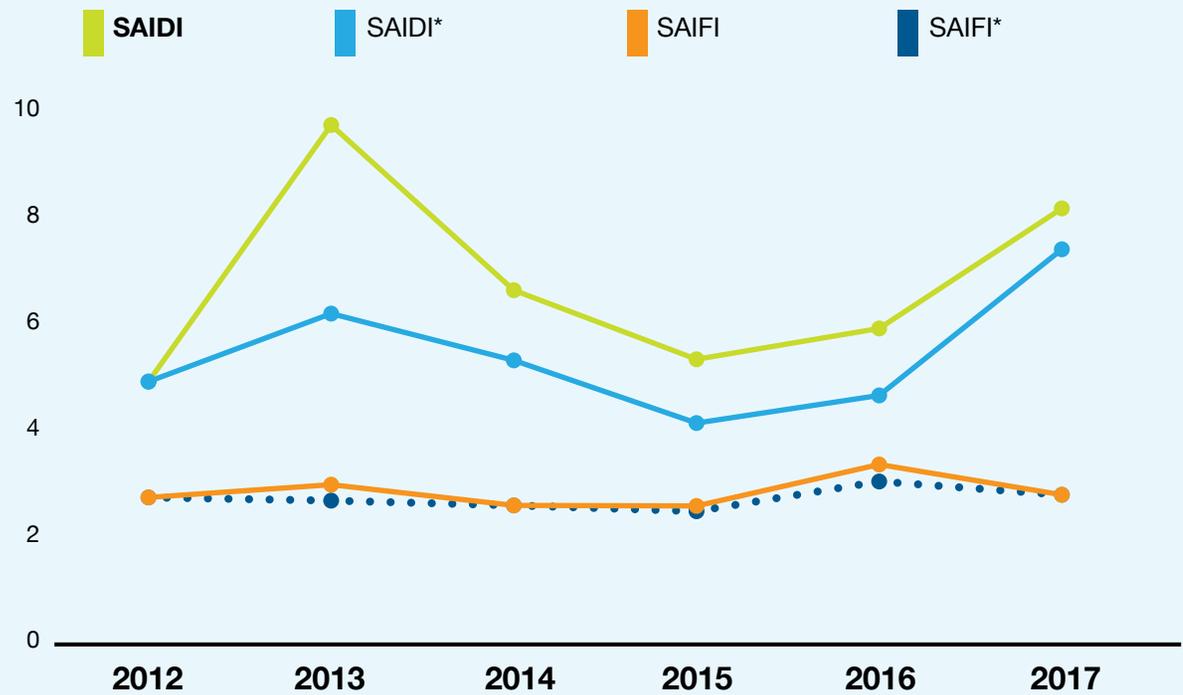
System Reliability and Resiliency

While customers experienced less frequent power interruptions during 2017, those that occurred lasted longer on average. This reflected the impact of a number of weather events which, while falling short of the extreme threshold, were nevertheless more severe than usual and resulted in longer outages than had been experienced in the preceding years.

As part of broader climate adaptation strategies, CEA members continued to invest in improving the electricity system’s ability to withstand what is expected to be an ongoing trend towards more frequent high-impact weather events.

Reliability figures for 2017 include remote areas (such as in the far north) that are not connected to the national electricity grid, and which were previously excluded from the measures. The fact that such service areas are somewhat more prone to outages also contributed to an increase in average duration.

FIGURE 4 | Reliability Indices



System Average Interruption Duration Index (SAIDI) –
total length of outages over one minute long divided by number of customers

System Average Interruption Frequency Index (SAIFI) –
total number of outages over one minute long divided by number of customers

(* denotes exclusion of severe weather events)

EXTERNAL STAKEHOLDER PERSPECTIVE:

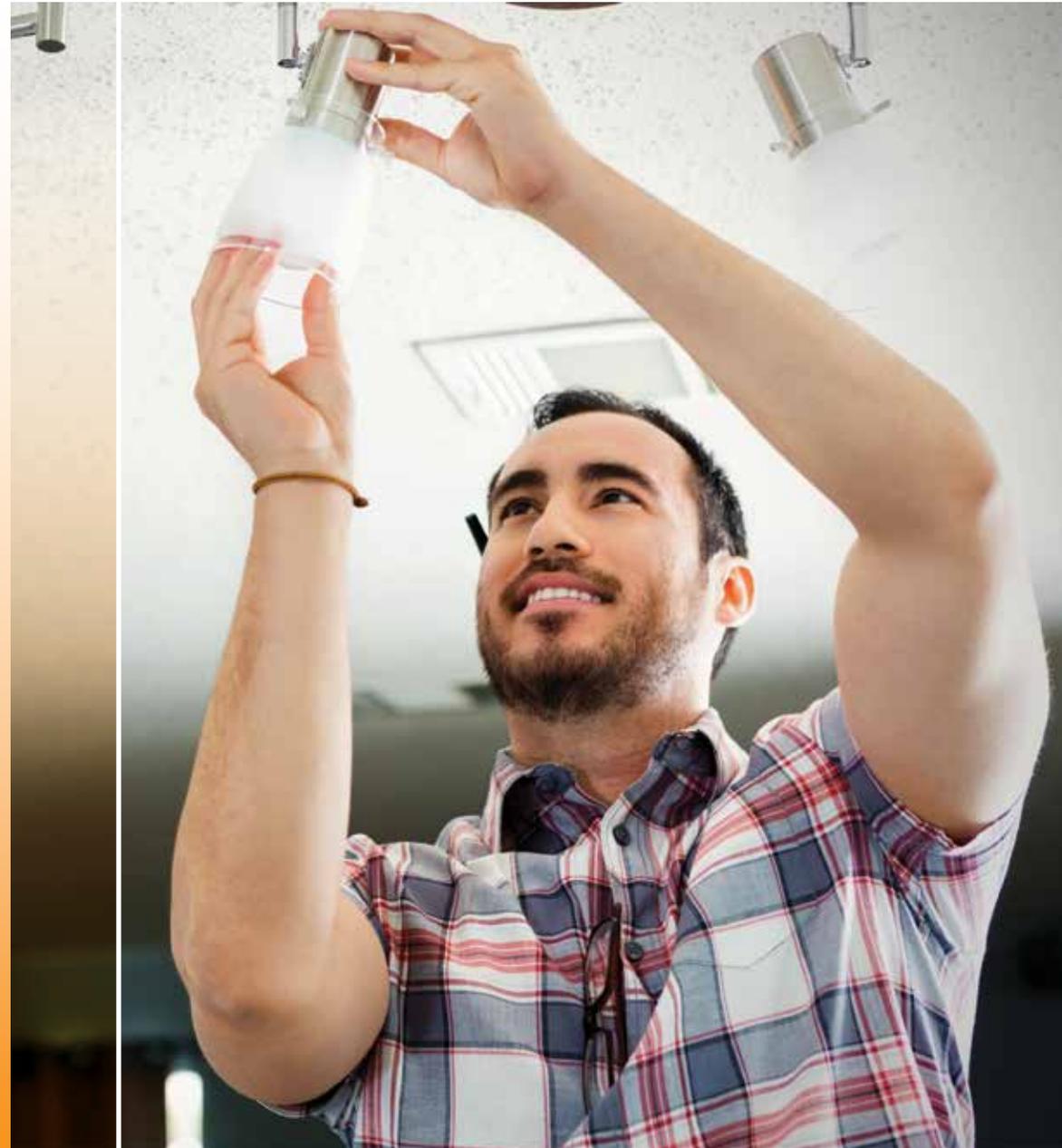
JACOB IRVING, PRESIDENT,
ENERGY COUNCIL OF CANADA

What does a truly sustainable Canadian electricity system look like, say by 2040?

Renewable natural gas from landfills and other waste sources will be put to greater, productive use. Hydro, solar and wind will come to be known as traditional sources of clean and renewable electricity. They will have all grown in their share of Canada's generation mix. Having refurbished our existing fleet, new nuclear generation options will also be piloted in new, strategic locations. All sources of electricity generation will be better interconnected and will be deployed together more strategically. Canadian electricity projects will be seen as opportunities for reconciliation with Indigenous communities as much as they will be seen as sources of economic development or environmental improvement.

What is a key improvement opportunity for CEA members to focus on now in order to get there?

This optimistic view of Canada's electricity future will likely not be quick, cheap or easy. Few things that are truly worthwhile in this country, ever are. Continuous concentration on improving electricity and making the necessary investments to achieve it, remains in Canada's best, long-term strategic interest. It always has been, it always will be.



Member Action to Renew Infrastructure

Manitoba Hydro Assembling the Right Local Expertise

Manitoba Hydro's Lake Winnipeg East Transmission Project required tower assembly under very challenging weather and terrain conditions. At Pine Falls, this work was facilitated by Black River Development Corporation (BRDC), an Indigenous owned-and-operated company. A total of 141 transmission towers were assembled by BRDC employees, on-time and ahead of schedule. They are being used to connect the Pine Falls Generating Station to the Manigotagan Corner Station — a new substation that will improve service in the region. The project highlighted the mutual benefits that can emerge through collaboration with community stakeholders and local trades professionals when developing key infrastructure.

NB Power Strengthening a Storm-Damaged System

NB Power's multi-year transmission line rebuild program, which includes \$20 to \$27 million annually in reliability improvements, is part of the utility's more than \$100 million in annual transmission and distribution investments. In 2017, it constructed footings for 17 steel power poles on the Lamèque causeway, to strengthen its transmission system from Lamèque to Shippagan. This followed a thunderstorm with 190-kilometre per hour winds that damaged a large number of poles on the Acadia Peninsula. The installation of the poles and other equipment was completed in January 2018.

AltaLink's Transmission Flows Move in a New Direction

Quick reversal of the direction of power flow on AltaLink's Western Alberta Transmission Line (WATL), which deploys high-voltage direct-current technology, cost-effectively brought energy to where it was needed in the province. For example, in May 2017, 41 per cent of the energy transmitted on WATL was primarily wind-generated energy moving south to north, the most ever in Alberta on a monthly basis. By year-end the link had been dispatched to different power flows over 380 times, including 68 south to north reversals. AltaLink also had 100 per cent peak utilization of WATL in March 2017 to facilitate planned outages on the Alberta Interconnected Electric System (AIES).

Brookfield Renewable Keeping Blades Sharp and Efficient

Wind turbine blades inevitably deteriorate over time due to leading edge erosion, chip outs, lightning strike damage, trailing edge splits, and laminate damage. Left un-repaired, deterioration impacts blade efficiency, structural integrity and aerodynamics. Brookfield Renewable has an ongoing blade maintenance program to address these concerns. In 2017, 234 blades were inspected, and any blade with damage that could affect performance or reliability was repaired. This program not only extends the life expectancy of the blades, but also helps to minimize noise and to keep turbines operating within an efficient range of wind speeds.

SaskPower Getting Poles out of Fields

Through its long-standing Rural Rebuild Program SaskPower is removing old infrastructure and making what needs to remain in place more efficient. Upgraded lines and equipment have reduced line losses, and since the program's inception in 2009 have enabled the company to save 64,160,309 kWh of electricity, with a monetary value of about \$25.5 million. The reduction in overhead lines and poles crossing farm fields has the added benefit of allowing for more efficient and safer farming operations. This work is part of SaskPower's annual investment of approximately \$1 billion to modernize its infrastructure and grow its generation capacity to meet increasing customer demand.

Newfoundland & Labrador Hydro Partnering for Cleaner Power

Newfoundland & Labrador Hydro partnered with an Indigenous group in an effort to deploy a smart grid system in an isolated community currently supplied by diesel generation. This would involve construction of wind and solar generation sources to be connected to an existing diesel plant through a grid controller. The project has the potential to increase electricity generation per litre of diesel fuel consumed. Funding is being sought through the federal government's Clean Energy for Rural and Remote Communities program.



SUSTAINABILITY PILLAR III

BUILDING RELATIONSHIPS

In Canada today, the unprecedented need for investment in new and refurbished electricity infrastructure is coupled with heightened expectations regarding stakeholder engagement and buy-in. CEA members are responding with rigorous stakeholder relations practices — employing diverse programs and platforms — in the context of both new project development and ongoing operations.

Local community outreach is among the first considerations when a significant project is contemplated and includes a focus on the unique rights and interests of Indigenous groups. While consultation and accommodation must happen, CEA members are increasingly entering into mutually beneficial arrangements involving workforce and other capacity development, procurement contracts, and equity participation. Innovations such as co-management of regulatory processes are also being deployed.

Many CEA members also have direct and continuous relationships with customer bases commonly numbering in the tens of thousands of people or more. These members continued in 2017 — through surveys and other



means — to systematically improve their understanding of their customers' evolving needs and preferences, and to optimize their own pursuit of the dual imperatives of reliability and cost-effectiveness accordingly.

Early Engagement and Consultation

A large majority of CEA members continued to have formal policies in place in 2017, providing a structured process through which they go about identifying stakeholder concerns and opportunities.

More than three-quarters of members have already taken steps to formally identify local Indigenous groups within their service areas, and have procedures requiring early consultation and engagement with these groups during project planning and development.

While there is a natural ebb-and-flow in the value of formal business relationships between CEA members and Indigenous groups in any given year, the total value remained significant in 2017 at well above three-quarters of a billion dollars. These were mainly supply arrangements, but also included broader arrangements such as joint ventures. Indigenous project participation is in some cases specified through community benefit agreements.

Six National Principles for Engagement of Indigenous Peoples — developed in 2016 by the CEA's Aboriginal Relations Task Group — continued to guide member efforts in 2017. CEA committed to develop a set of performance metrics to assess member implementation of the principles.

CEA National Principles for Engagement of Indigenous Peoples

1. Respecting Indigenous culture, traditional values and rights
2. Nurturing constructive relationships
3. Enhancing communications
4. Fostering Indigenous capacity building
5. Promoting economic prosperity

CEA has also made clear to the federal government that the electricity sector stands ready to play its part in the ongoing effort to advance reconciliation between Indigenous peoples and broader Canadian society, and the association increased its direct engagement during 2017 with national Indigenous organizations.

Members that Have Formal Stakeholder Engagement Policy, including processes to identify stakeholder concerns and opportunities	2015	2016	2017
	91%	78%	87%

The sub-set of CEA members responding to varies in both size and composition from one year to the next. Longer-term trends are therefore more meaningful than specific year-to-year variation.

Indigenous Relations Policies (%)	2015	2016	2017
Members that Have Formally Identified Local Indigenous Groups within Service Area	72%	81%	77%
Members that Have Procedures Requiring Early Engagement During Project Planning and Development	81%	81%	79%
Value of Formal Relationships with Aboriginal Communities (\$MM)	2015	2016	2017
	\$1,032	\$863	\$829

Enhanced Customer Experience

As customers recognize the value of a widening range of energy-related services, their expectations of the utility sector are changing. Surveys are among the means by which CEA members track satisfaction levels and gain insights into evolving needs. About three-quarters of members conducted customer surveys in 2017, and some supplemented them with focus groups and other market research tactics.

Relationship building is further enhanced by diverse educational and awareness programs for audiences such as students, local businesses and community groups; by enhanced contact points such as social media feeds and apps; and by other opportunities such as on-site visits.

Members that Conduct Customer Satisfaction Surveys	2015	2016	2017
	59%	75%	73%



Support for Low-Income Customers

There is a growing awareness of the affordability challenge that electricity bills pose for some low-income customers, particularly in light of the scope of infrastructure investment needs. One third of CEA members continued to offer programs to help low-income customers with their bills in 2017, often, although not always, in response to a regulatory requirement. Assistance was in some cases strategically linked with energy-conservation and broader community-investment objectives.

Low Income Customers	2015	2016	2017
Members that Provide Help for Low-Income Customers	28%	41%	33%
Members that do this in Response to Government Requirement	19%	28%	27%



EXTERNAL PERSPECTIVES:

*CHRIS HENDERSON, PRESIDENT,
LUMOS ENERGY & EXECUTIVE DIRECTOR,
INDIGENOUS CLEAN ENERGY (ICE) ENTERPRISE*

What does a truly sustainable Canadian electricity system look like, say by 2040?

Canada's 21st Century electricity infrastructure should reflect four D's: Decentralized, Decarbonized, Digital and Democratic. For local stakeholders, like Indigenous communities and municipalities, that means partnership with electricity sector companies on clean energy projects. Such collaboration is essential to make the business case for reformed electricity regulations and rate structures to catalyze the major investment required to build a modern, reliable and clean electricity system for Canada— as a model for the world.

What is a key improvement opportunity for CEA members to focus on now in order to get there?

Indigenous communities and electricity sector companies are "natural allies". Firstly, most of the over 150 medium to large power generating projects with Indigenous participation across Canada have been developed with electricity utilities and development companies. Secondly, new grid generation and demand management innovations will be that much stronger with Indigenous support and investment. Thirdly, there are abundant opportunities to enhance and expand electricity-Indigenous partnerships to make electricity a national economic driver for power, heat/cooling and transportation.

Member Action to Build Relationships

Saskatoon City and Tribal Council Partner on Water Power

The City of Saskatoon and the Saskatoon Tribal Council (STC) signed an MOU regarding development of a new hydropower station located at the Saskatoon Weir — a partnership the mayor called “reconciliation in action”. The First Nations Power Authority, through its existing master agreement with SaskPower, will support STC involvement in this project, which will have equal ownership and multiple socio-economic and environmental benefits. Pre-feasibility findings were favourable and the next step will be a full feasibility study for what is expected to be a \$60-65 million project.

Yukon Energy Collaborates on Regulatory Processes

Yukon Energy’s water use license for its Aishihik hydro facility expires at the end of 2019. The Champagne and Aishihik First Nations (CAFN) and Yukon Energy have decided to take a new, more collaborative approach to the license renewal process, and have signed a protocol agreement to co-manage it. It sets out a process involving input from a technical advisory group and a CAFN community-based advisory group, and participatory decision making involving CAFN and other stakeholders.

NB Power Works for Safe Passage of Fish

Improved survival of wild Atlantic salmon and other fish species in the St. John River watershed is the goal of a downstream fish passage at the Tobique Generating Station. Unveiled in November 2017, the passageway was constructed by NB Power at a cost of \$9 million. This grew out of a protocol agreement signed by NB Power and the federal Department of Fisheries and Oceans in 2010, aimed at improving the protection of fish and fish habitat around hydro facilities in the watershed. This led NB Power to work with First Nations and local stakeholder groups to identify, prioritize and address relevant issues, including the need for safe passage for salmon through the Tobique Generating Station.

ATCO Power Working with Communities Impacted by the Transition to a Lower Carbon Future

With the ongoing transition to a clean energy future, ATCO Power has continued to consult and work closely with employees, communities and all levels of government to share information and help facilitate effective change. Senior leadership makes concerted efforts to reach into communities affected by the move away from coal-fired electricity generation; offering the community updates on environmental initiatives and federal activities and policy reviews, as well as details on coal-to-gas and repowering options that are being studied. Such options would allow for continued operation, minimize the immediate need for new infrastructure, and continue to provide employment opportunities for skilled workforces.

Nalcor Energy Churchill Falls Enhances Communications

Nalcor Energy Churchill Falls operates one of the world’s largest underground hydro facilities, and also manages and oversees the town in which it’s located. Community engagement takes on a whole new importance in this true company-town setting. Engagement platforms include a community email distribution list, a mobile alert system for critical and emergency communications, a community website (churchillfalls.ca), and an information monitor in the town’s central public centre. The company also works with local organizations to help them communicate their activities and events, and in 2017 began using the community website for feedback through surveys and polls.

Saint John Energy Managing Community Investments

Saint John Energy (SJE) heightened the impact of its donation program through an advisory partnership with United Way and sharpened its focus on generational poverty. The company sits on a United Way committee that pre-screens community investment opportunities. Selected investments are actively managed and progress toward goals is reported on twice a year. From this portfolio of investment opportunities, SJE employees select initiatives to help end the cycle of generational poverty within Saint John. SJE was recognized for exceptional growth in its employee United Way campaign, from 19 to 30 per cent participation in 2017.

Hydro One Hearing the Customer's Voice

On February 16, 2017, nearly 30 senior leaders from Hydro One joined the company's Customer Call Centre team from 7:30 a.m. to 8:00 p.m. and encouraged customers to call in and provide direct feedback. It's all part of Hydro One's effort to engage in meaningful dialogue with customers and transform into a customer-focused company. The senior leaders listened and engaged with more than 800 customers with conversations centred on affordability and billing. Nearly 48,000 people engaged with Hydro One Day online videos and social media posts.

Maritime Electric Improves its Web Platform

Building a website to suit today's high customer expectations is no small task, and Maritime Electric's new site was the product of 18 months of work. The process included a user survey, development of personas of typical customers to guide the development work and focus group testing of the site as it took shape. The new site was designed for simplicity, ease-of-use and maximum alignment with the "mental model" users had of how it should work.



SUSTAINABILITY PILLAR IV

RISK-MANAGEMENT SYSTEMS

CEA members operate within stringent regulatory frameworks designed to minimize the environmental impact of operations and to sustain their already impressive contribution to greenhouse gas reductions and the clean energy transition. This includes intensive regulatory review and consultation processes for the construction of or significant alternations to infrastructure, and ever-evolving requirements for ongoing environmental management during operations.

Major federal legislative initiatives underway in 2017 are expected to significantly impact the scope and nature of environmental management requirements for CEA members. These culminated in legislation tabled in early 2018 which will create a new national impact assessment process and agency (for major projects) and a new energy regulator, and will amend provisions relating to navigable waters and fisheries protection.



CEA was and remains actively engaged with government on these legislative proposals. It sought to ensure that environmental objectives are achieved with due regard for the cumulative impact of multiple layers of regulation, and that ongoing clean energy and infrastructure investments are able to move forward at a reasonable pace.

Members continued to minimize the environmental impacts of their operations, often with species- and habitat-specific focal points. Priorities such as spill prevention and polychlorinated biphenyl (PCB) phase out also continued to be addressed. CEA worked with member subject-matter experts to develop a management practices guide relating to migratory birds, following-up on a recommendation from its Sustainable Electricity Public Advisory Panel.

Environmental Stewardship

CEA members achieved further reductions in priority emissions in 2017 ranging from one per cent for sulphur oxides to seven per cent for mercury. The intensity of all three priority emissions, including NO_x, has trended consistently downward over the last three years.

Reductions in these emissions have been dramatic when assessed over a longer timeframe, with each having been cut by half or more in absolute terms since 2000. These reductions have largely been achieved in tandem with efforts to reduce carbon emissions.

Relatively consistent performance is likely in the short- to mid-term, as a significant proportion of remaining emissions are associated with conventional coal facilities that are due for phase out by 2030 (subject to possible jurisdiction-specific equivalency agreements).

FIGURE 5 | NO_x and SO₂ Emissions (2015–2017)



51% Electricity Sector Reductions in NO_x Emissions, 2000–2016

9% Sector's share of remaining national emissions

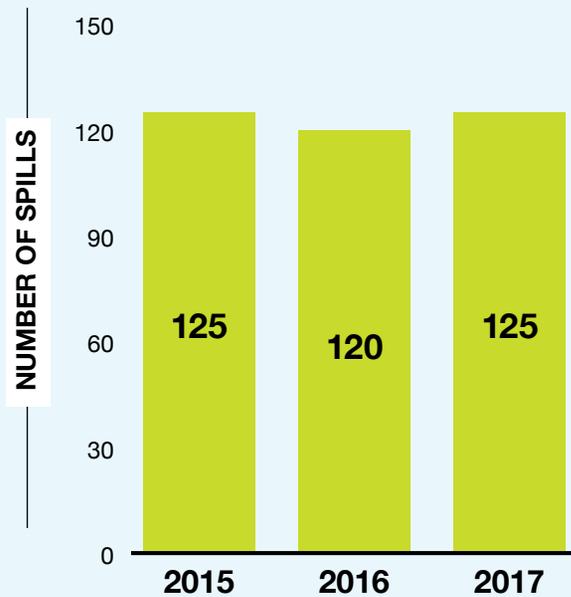
59% Electricity Sector Reductions in SO₂ Emissions, 2000–2016

24% Sector's share of remaining national emissions

67% Electricity Sector Reductions in Mercury Emissions, 2000–2016

17% Sector's share of remaining national emissions

FIGURE 6 | Annual Priority Spills



Priority spills are defined with reference to volume, substance and the environment into which the spill occurred. Year-to-year fluctuation in the total number is typical given the wide range of potential contributing factors. Rigorous detection, containment and response procedures are in place.

Sulphur hexafluoride is a highly effective electrical insulator (and can be a substitute for PCBs), but also a highly potent greenhouse gas. Usage is tracked with reference to the volume required to top up equipment for maintenance purposes.

FIGURE 7 | SF₆ Usage (for maintenance purposes)²



² The large increase in SF₆ usage in 2016 is attributable to an equipment failure at a Hydro-Québec sub-station. Given the specific circumstances, the loss of SF₆ was calculated by subtracting the amount recovered at the sub-station, from the average nominal capacity of SF₆ in use across all of the utility's sub-stations. While this methodology was required for the purposes of the independent verification of Hydro-Québec's response, it over-estimated actual SF₆ emissions.

Employee, Contractor and Public Health and Safety

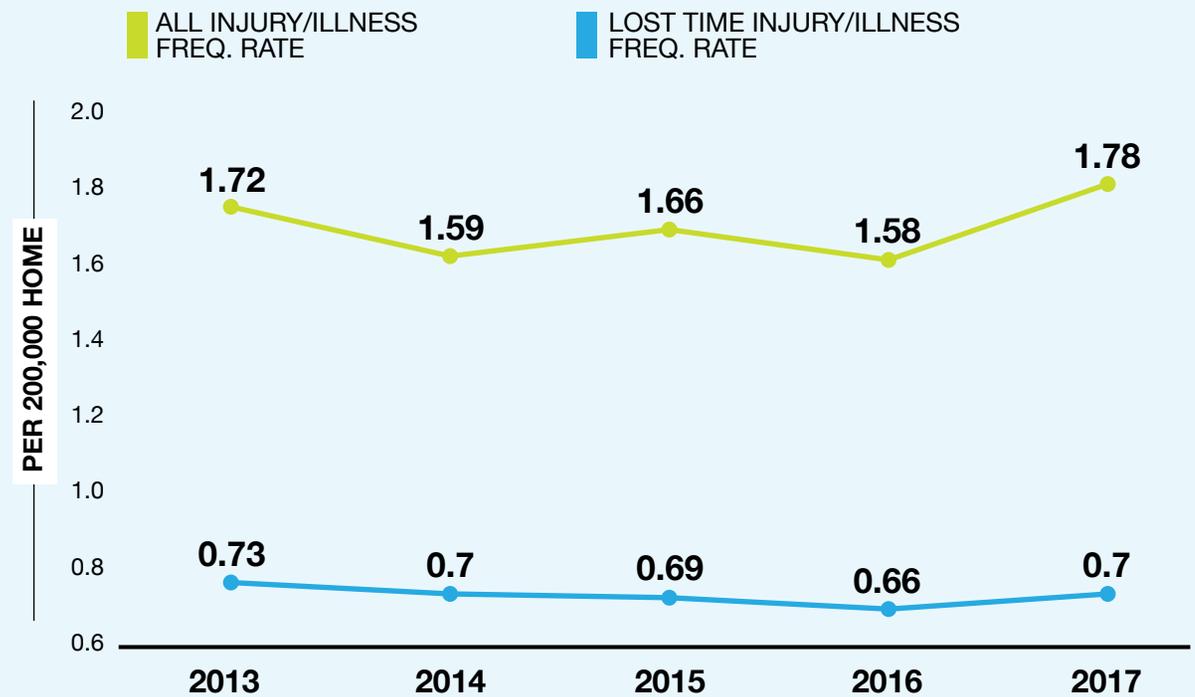
There was an increase in 2017 in the all-injury/illness frequency measure. Analysis indicates, however, that this most likely resulted from better and more comprehensive incident reporting and data collection on the part of CEA and its members, rather than from a deterioration in actual performance.

Encouragingly, the frequency of more serious lost-time injuries remained in a range consistent with recent years, and there was a noteworthy decrease in the severity rate (that is, injuries resulted on average in less time lost than in any recent year).

Members continued to maintain rigorous safety management systems, standards and practices; along with extensive awareness and issue-specific prevention initiatives. Such initiatives in 2017 sometimes targeted commonly occurring injury types, and in other cases focused on groups such as contractors and summer students.

Several members also made substantial investments in better educating the general public about safety risk factors associated with hydroelectric facilities and with the electricity system more generally. Site-specific emergency response plans are also in place and are tested and refined as required.

FIGURE 8 | All Injury/Illness and Lost Time Injury Frequency Rates

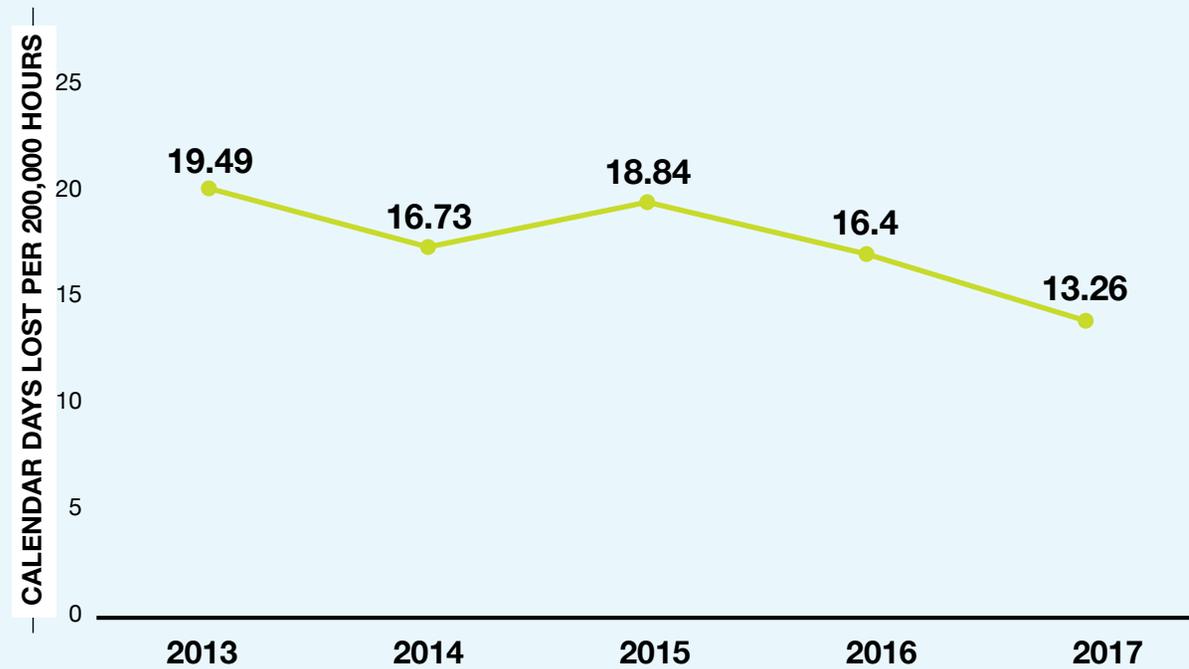


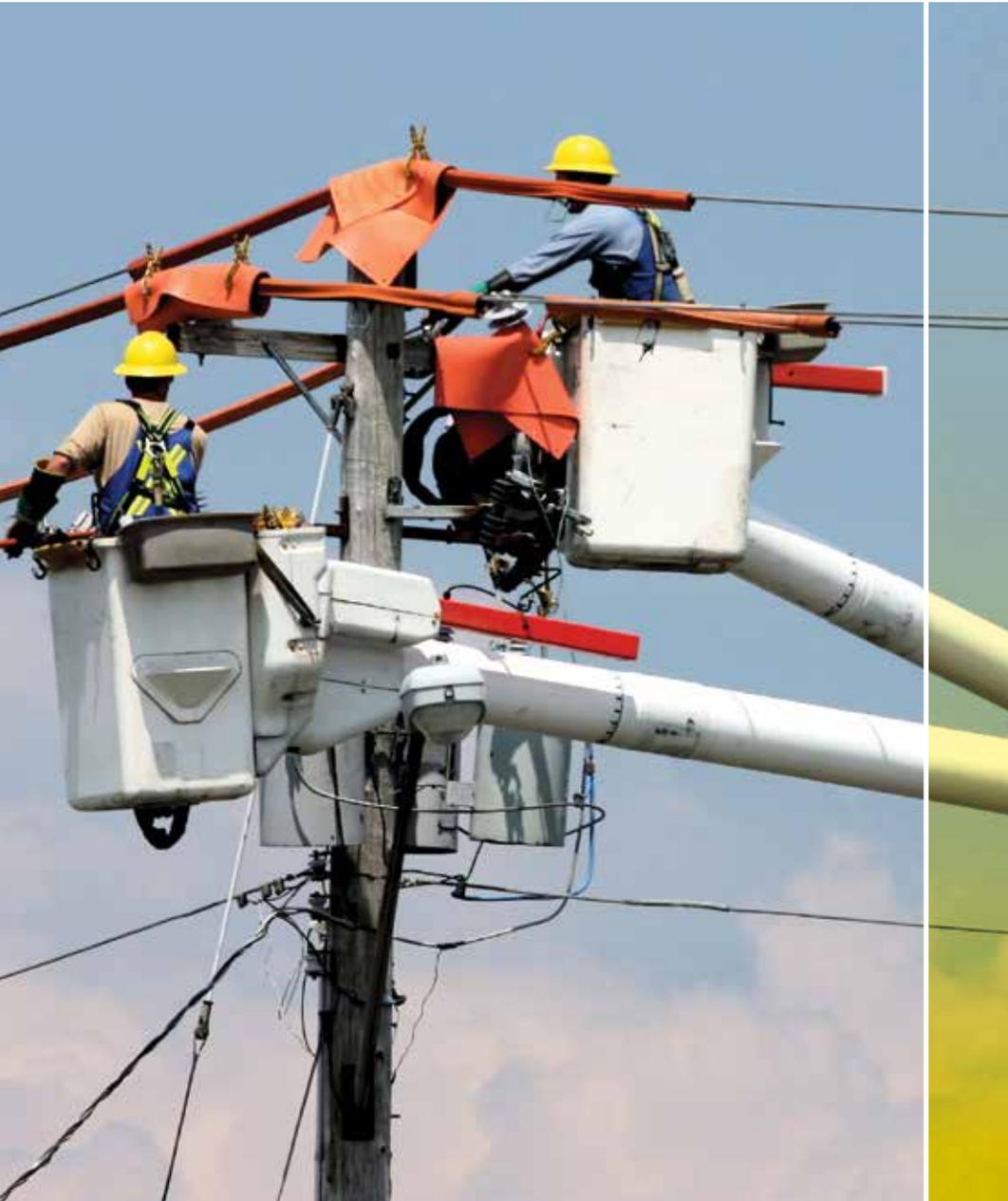
Security Management Systems and Standard

Cybersecurity is an increasingly important priority across all energy infrastructure, and particularly with respect to the inter-connected Canada-U.S. electricity grid. CEA is engaged in various forums and reviews aimed at collaboratively protecting the electricity system from both physical and cyber threats.

Many members took steps in 2017 to improve the cybersecurity of their own assets. Efforts ranged from initiatives to improve internal cyber security awareness, to participation in an attack simulation involving utilities and other stakeholders from across North America.

FIGURE 9 | Lost- Time Injury Severity Rate





EXTERNAL STAKEHOLDER PERSPECTIVE:

*DR. BLAIR FELTMATE, HEAD,
INTACT CENTRE ON CLIMATE ADAPTATION,
UNIVERSITY OF WATERLOO*

What does a truly sustainable Canadian electricity system look like, say by 2040?

In 2040, a sustainable Canadian electricity system will be able to withstand a new normal of extreme weather that will result due to climate change. Recognizing that climate change is irreversible, extreme weather — flood, drought, heat waves, fire, hail, wind, ice loading and permafrost loss — predetermines that the actions taken today portend the state of robustness for Canada's electricity system in the future. Today's decision-makers in the electricity sector must realize that the weather of the past will not characterize the weather of the future. Accordingly, every day that adaptation is not factored into new electricity design and operation is a lost opportunity.

What is a key improvement opportunity for CEA members to focus on now in order to get there?

CEA members must defer to ensemble climate models to identify near certain challenges that extreme weather will present, and then the sector must ensure that climate change is factored into both new builds and scheduled refurbishments. If the Canadian electricity system does not account for climate change today, the sector risks having to rebuild all or much of the system prematurely, at great cost. Conversely, if the electricity sector builds adaptation to climate change into new system design, this will help to ensure an economically and socially robust Canada in the future.

Member Action to Lower Risk

AltaLink Strengthens Safety Performance & Measurement

AltaLink has moved to tracking the more comprehensive Total Recordable Injury Frequency rate (TRIF), which includes all lost time and medical aid incidents, as well as those that result in a need for restricted work on the part of an injured employee. The company has top tier TRIF performance but is targeting 10 per cent year-over-year improvement. In 2017, it successfully encouraged a higher level of reporting of hazards and near misses — “see something, say something” — to reduce the potential for incidents.

Capital Power Addresses Contractor Health and Safety Management

In 2017, Capital Power trained supervisory personnel on additional measures to address contractor health and safety management within its operations. Over the previous three years, contractors were responsible for over 65 per cent of recordable incidents and serious-injury potential near-misses at Capital Power facilities. Capital Power therefore developed pro-active processes and procedures extending from pre-qualification to work completion, including focused performance monitoring.

Newfoundland Power Keeping the Public Safe

Newfoundland Power launched a set of Key Safety Principles in 2017, setting out its core safety values and defining clear expectations of employees. It also concluded a \$2 million, three-year project to improve public safety around its hydroelectric facilities. This included upgrading safety signage and installing barriers, warning booms and buoys on surrounding waterways.

Toronto Hydro Making the City More Resilient

Toronto Hydro participated on the City of Toronto’s Resilient City Working Group to identify grid vulnerabilities to extreme weather events and to improve information sharing and readiness and mitigation capacities. This included support for and input to a risk-identification project undertaken by researchers at Western University. The efforts of the working group contributed to the City of Toronto’s acceptance in 2017 into the 100 Resilient Cities Network.

Yukon Energy Factoring in Climate Change Impacts

Yukon Energy continued to develop a distributed hydrological modelling and forecasting system to support hydroelectric production in Yukon under both current and changing climate conditions. The impacts of climate change on watershed hydrology, glacier dynamics and permafrost add to the uncertainty of assessing hydrological trends over decades-long periods. The new model will help better account for climate change in the planning, management and re-licensing (for 25-year periods) of hydroelectric reservoirs. It is to be completed at the end of 2019.

Hydro Québec Tackles Cyber and Physical Threats

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 infrastructures. 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 neighboring authorities, including, in Hydro-Québec’s case, ISO New England, New York Independent System Operator (NYISO), NB Power and the Independent Electric System Operator.



SUSTAINABILITY PILLAR V

BUSINESS EXCELLENCE

Excellent business results in the Canadian electricity sector will help generate both returns to shareholders and the capital needed to invest in infrastructure and in strong environmental performance. They will also help sustain the significant employment and other socio-economic benefits generated by CEA members, while better positioning them to cost-effectively deliver the expanding range of products and services that customers require.

While business results are still typically thought of primarily in terms of traditional financial metrics, CEA has identified three broader indicators of its members' long-term ability to sustain and improve the soundness of their business.

The first is meaningful investment in a range of innovative technologies that are vital to the development and operation of a lower-impact and more efficient and flexible electricity system.

The second is effective engagement with regulators and business partners. The sector is already highly regulated and is experiencing increased

intervention in support of objectives such as carbon reduction. It needs to actively help shape its regulatory environment, while also engaging with upstream participants in its supply chain.

The third is effective responses to human resource challenges, such as large cohorts of retiring employees and competitive labour markets for key skills. A related imperative for all members is achieving a more diverse workforce profile that better aligns with that of the communities in which they operate.

Employment	2015	2016	2017
Total FTE Positions	68,141	64,869	65,795
Total Employee Compensation (\$B)	\$6.98	\$7.17	\$7.63

Investment in Innovation and Technology Advancement

There has been a predominantly upward trend in recent years in the deployment of various key technology innovations that offer compelling environmental and other benefits, and that are widely seen as foundational to a transformed electricity system of tomorrow.

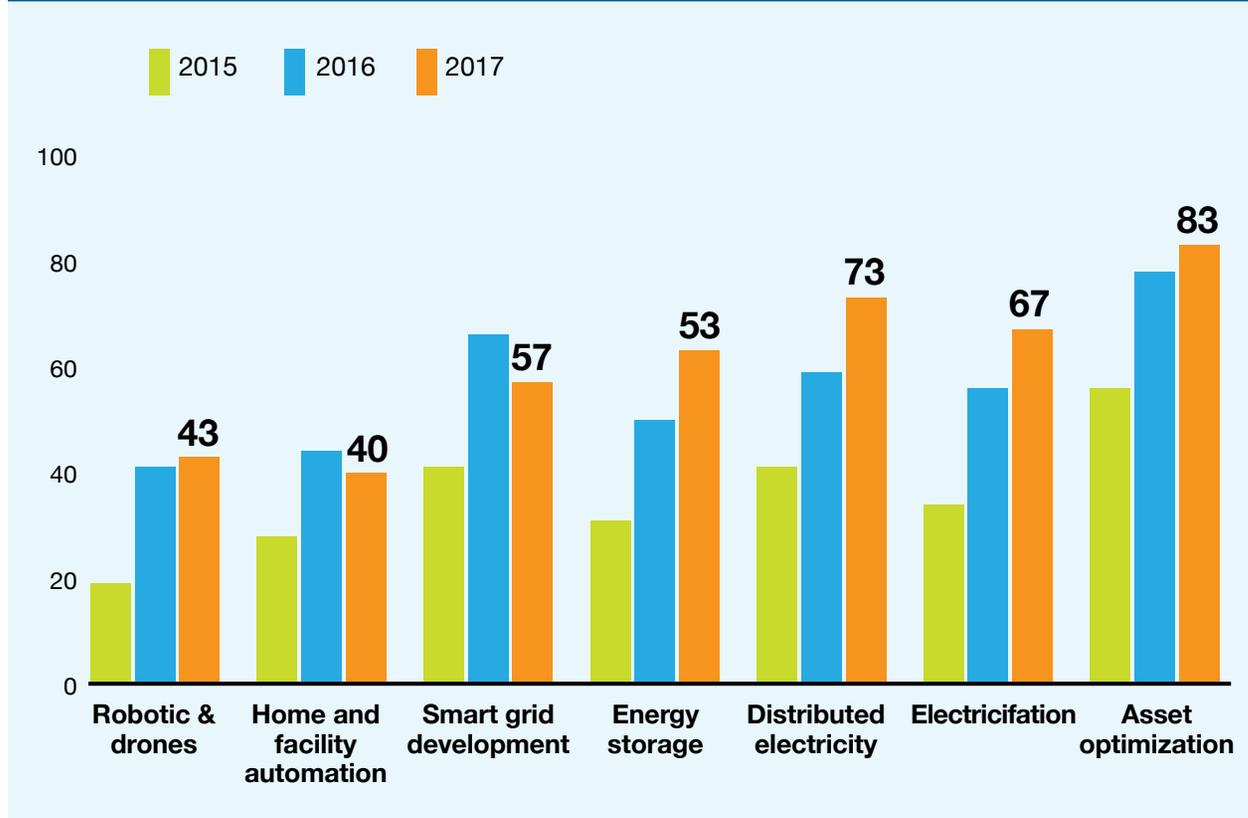
This progress is all the more noteworthy in light of the challenges often faced in securing regulatory approval to fund trials and applications of emerging technology during rate setting. This process risks creating an “innovation gap”. CEA assists its members in maintaining a strong understanding of the potential applications and impacts of various trends and innovations, in part through the work of its Emerging Issues Committee.

Engagement of Regulators, Partners and Others

CEA is the primary vehicle through which the Canadian electricity sector engages with the federal government. The association supports a taxation framework and regulatory environment that is conducive to the ongoing energy transition and to addressing the climate change imperative.

At the same time, it seeks sensitivity to competitiveness considerations, such as those arising from diverging U.S. regulatory approaches, and to the cumulative impacts of successive layers of regulation. Each new

FIGURE 10 | Innovative Technology Deployment (% of companies using each)



requirement invariably compounds the cost and compliance implications of the complex and multi-jurisdictional regulation to which the sector is already subject. The association believes it is vital at this juncture that regulation meets the test of enabling good, sustainable projects — that serve the interests of Canadians — to move forward at a reasonable pace.

Key engagement focal points in 2017 included the re-design of major project assessments and amended provisions relating to navigable waters and fisheries protection. While CEA supported some of the underlying objectives and overall direction of these initiatives, it cautioned against increased regulatory burdens that are unlikely to provide meaningful environmental benefit, and that could inhibit infrastructure investment. CEA also advocated for member access to potential funding through the new Canada Infrastructure Bank.

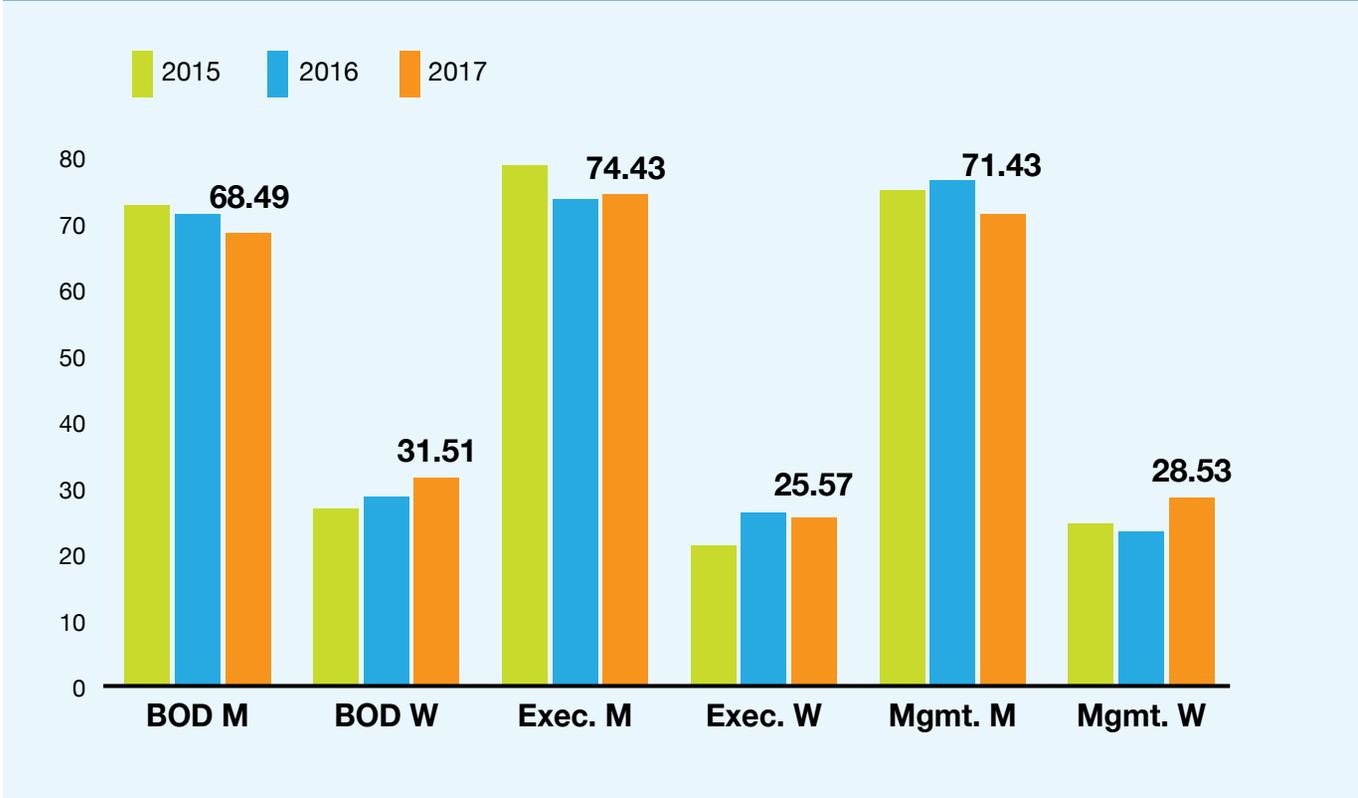
Recruitment, Training and Retention

Members continued to pursue various training and professional development initiatives in 2017, both in-house and in partnership with external partners, along with initiatives to foster employee satisfaction and retention. Some members also focused specifically on promoting workforce diversity and inclusion, in positions such as managerial and trades.

Almost half of CEA members have a documented and publicly available diversity and inclusion policy. Female representation improved at the board and senior managerial levels, although not at the executive level, and a considerable gender parity gap persists at all levels.

CEA has identified improved diversity as an association priority, in part in response to input from its Sustainable Electricity Public Advisory Panel. The CEA Human Resources Committee, with assistance from a member-company senior executive with particular expertise in the area, initiated CEO interviews and other research in 2017 in an effort to find ways of accelerating progress.

FIGURE 11 | Advancement of Women in Key Positions



Expanding the Supply Chain Focus

The sustainability of a product depends not only on the practices of the company that produced it, but on the practices of all of its supply chain partners. To that end, the CEA’s Sustainable Electricity Steering Committee set an objective in 2017 of having all member companies develop supply-chain sustainability strategies within the next five years.

EXTERNAL STAKEHOLDER PERSPECTIVE:

*TOBY HEAPS, CEO,
CORPORATE KNIGHTS*

What does a truly sustainable Canadian electricity system look like, say by 2040?

It will be renewable, resilient and networked, and it will power a 100 per cent electrified economy. A much higher proportion of generation will come from distributed sources, including individual homes and cars. And electricity will move back-and-forth on the grid with the ease that information does today. Centralized generation will remain important — especially in large urban centres where demand will exceed what distributed sources can provide — but will likely account for half or less of total generation.

What is a key improvement opportunity for CEA members to focus on now in order to get there?

We need a lot more transmission capability and integration of Canadian grids. If we get this right on an east-west axis, we'll be in a formidable position to supply our neighbour to the south — for example with hydroelectricity from Manitoba potentially passing through Alberta and B.C. on its way to California. We could export more electricity to the U.S., in gigajoules and dollar value, than current liquid and gas hydrocarbon exports combined. Better integration will also avoid waste as we move to nearly 100 per cent renewable electricity by 2040, much of it intermittent. And I expect an order-of-magnitude increase in storage capacity, split between distributed storage in forms such as EV batteries and larger-scale technology liked pumped storage, hydrogen compressed air and industrial scale batteries.



Member Action to Strengthen Their Business

Ontario Power Generation Assessing Virtual Reality and Other X-Lab Innovations

Ontario Power Generation's X-Lab, hosted at its Pickering Nuclear Generating Station, is assessing the potential of emerging technologies in electricity-industry applications. Virtual Reality kiosks are in the testing phase and may provide an effective and much more efficient training platform. Augmented reality via smartglasses is also promising — with the ability to deliver real-time alerts for production staff and the potential to replace often awkward-to-use physical manuals, diagrams and written procedures.

Alectra Utilities Testing Alternative Power Pricing

Alectra Utilities is testing new electricity pricing models designed to better suit the varied lifestyles of residential customers. Features of the alternatives now being offered on a trial basis include variable pricing during on-peak periods, larger on-peak and off-peak differentials, and a “super off-peak” overnight price that is ideal for people with large flexible loads like electric vehicles. Alectra will apply the results to future customer service, regulatory and energy-services strategies. The results will also better enable the Ontario Energy Board to determine how alternative rate structures can fit into the province's Regulated Price Plan for residential customers.

Nova Scotia Power Develops a Diversity Strategy

Nova Scotia Power is committed to a workplace culture that actively includes a diversity of employees at all levels and values their input and opinions. In 2017, Nova Scotia Power collaboratively developed a Diversity and Inclusion Strategy with employees from across the business. A key component of the strategy is the ‘Diversity and Inclusion Network,’ which comprises over 50 employees that act as ambassadors throughout the organisation. The strategy emphasises education of employees, attraction of new talent, celebration of diversity and measurement of success.

FortisBC hosts a Forum for Energy Leadership

FortisBC hosted its first Energy Leadership Forum in the summer of 2017 to discuss the future of the energy sector and the implications for British Columbians. It provided an opportunity to connect and hear from energy sector experts and stakeholders on how to transition to a clean and affordable energy system of the future. In 2017, FortisBC itself invested over \$333 million in capital projects to provide safe, reliable and affordable energy for consumers across BC.

Oakville Enterprises Corporation Future Proofing the Business

Oakville Enterprises Corporation established a formal Innovation and Growth Team in 2017. It is tasked with championing innovation in response to changing customer expectations and technology, and in response to disruptive forces in the electricity marketplace. Among its priorities are translation of research and development into marketable services and products; and alignment of resources, technology and partnerships in support of productivity and profitability.

Toronto Hydro's Light-Footprint Energy Storage

Toronto Hydro worked with Ryerson University and eCAMION to pilot a pole-mounted unit that stores energy during off-peak hours and releases the power as required. The initial results of the project have demonstrated that the unit can reduce the strain on the local transformer, potentially increasing the lifespan of the equipment. The pole-mounted unit has a 15 kW/15kWh capacity. An additional benefit is that it does not have a physical footprint because it is attached to existing poles.