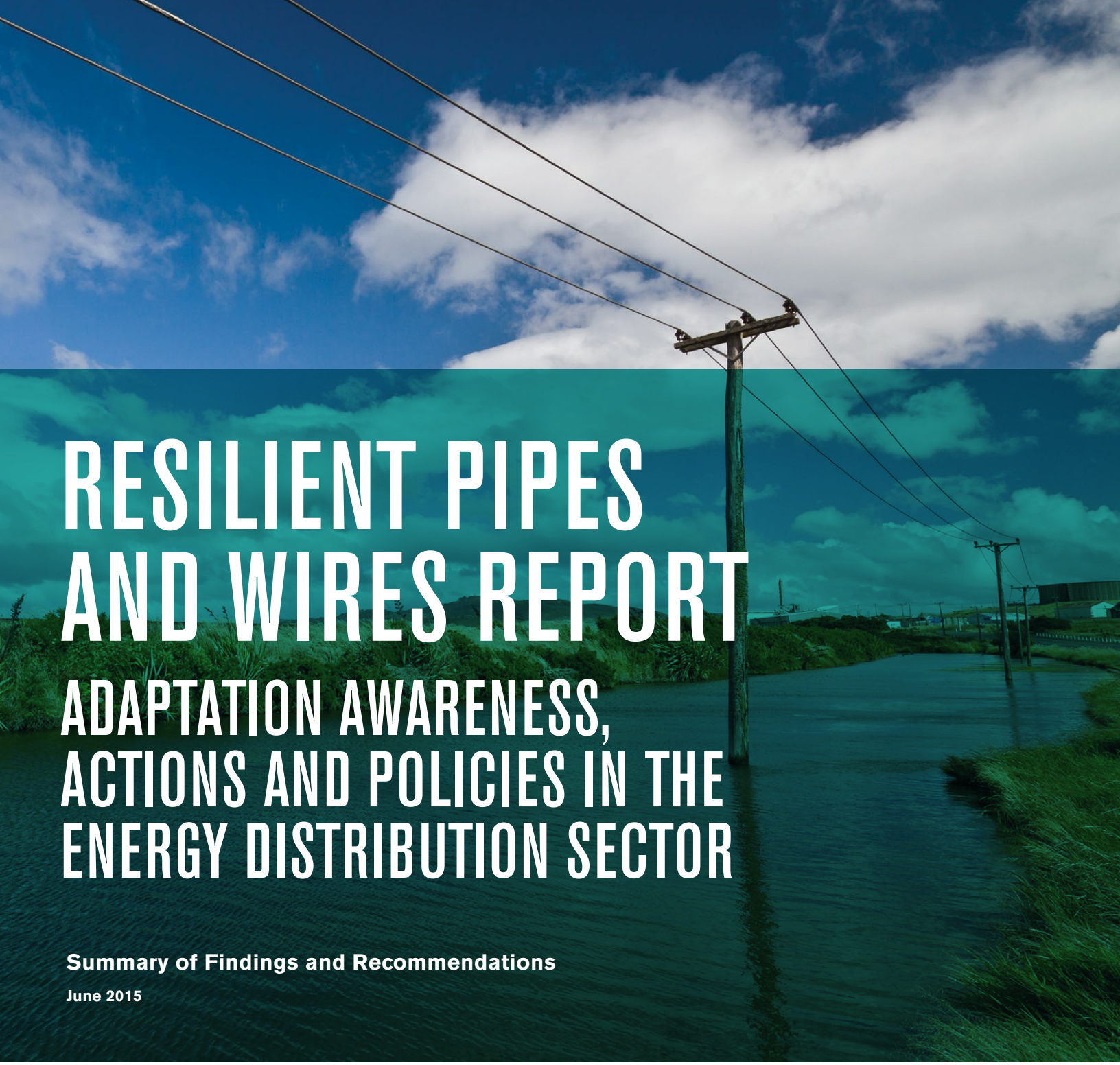

RESILIENT PIPES AND WIRES REPORT

ADAPTATION AWARENESS, ACTIONS AND POLICIES IN THE ENERGY DISTRIBUTION SECTOR

Summary of Findings and Recommendations

June 2015

QUEST
Quality Urban Energy Systems of Tomorrow

CANADIAN GAS ASSOCIATION
ASSOCIATION CANADIENNE DU GAZ

Canadian Electricity Association | Association canadienne de l'électricité

INTERNATIONAL DISTRICT ENERGY ASSOCIATION

ICLEI Local Governments for Sustainability

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QUEST | Quality Urban Energy Systems of Tomorrow

QUEST is a non-profit organization that conducts research, engagement and advocacy to advance Smart Energy Communities in Canada. Smart Energy Communities improve energy efficiency, enhance reliability, cut costs, and reduce greenhouse gas emissions. With the help of 8 provincial and regional Caucuses, QUEST brings together key stakeholders from government, utilities & energy providers, the real estate sector among others to transform Canada's 5400 communities into Smart Energy Communities.

INTRODUCTION

The interruption or loss of energy at the distribution level is not only a serious public health and safety risk, it can have long term negative impacts on economic activity, energy distribution rates, public and customer confidence, and distributor reputation.

As energy delivery systems[1] age, communities continue to grow and an increasing amount of our economic activity relies on a continuous supply of electricity, natural gas, and thermal energy, Canadian homeowners and businesses are more at risk from widespread and prolonged outages from extreme weather events.[2]

These risks are real for Canadian electric, natural gas and thermal energy distributors that are now responding to more frequent, longer and extreme weather events. The vast majority of energy distributors in Canada who participated in the Resilient Pipes and Wires study (90 percent) have been impacted by extreme weather in the last decade, and the Insurance Bureau of Canada has documented that the frequency, duration and intensity of extreme weather events will increase over the next 50 years.[3]

Resilient energy distribution is important not only for ensuring the health and welfare of our cities and communities, but also for advancing Smart Energy Communities, which improve energy efficiency, enhance reliability, cut costs and reduce greenhouse gas emissions. In order to achieve resilience, electric, natural gas and thermal energy distributors must adapt their infrastructure, operations, organizational structure, and communications to address the climate change risks.

Resilient energy distributors are characterized by the following four indicators:[4]

Robustness: the ability of an energy distributor to withstand extreme weather events and continue operating;

Resourcefulness: the ability of an energy distributor to effectively manage operations during extreme weather events;

Recovery: the ability of an energy distributor to restore operations to desired performance levels following a widespread outage, and

Adaptability: the ability of energy distributors to incorporate lessons learned from past events to improve resilience in the future.

This is a summary of the findings from research examining the level of awareness among electric, natural gas and thermal energy distributors about climate change adaptation, as well as policy drivers and barriers to the integration of climate change adaptation actions into the planning and operations of the energy distribution sector. The summary of the report identifies some of the 28 recommendations made to help enable energy distributors to adapt to climate change and enhance their resilience to extreme weather events.

The findings are based on a literature review, a survey, two working sessions and one-on-one interviews with subject matter experts.

The full *Resilient Pipes and Wires* report can be accessed at www.questcanada.org/rpw

[1] Such as pipelines, distribution wires, transformers and other equipment used for the movement of energy at the distribution level.

[2] (QUEST, 2014)

[3] (Insurance Bureau of Canada, 2012) (Sandink & Gilbeaut, 2014) (ICLEI Canada) (SENES Consultants Ltd., 2011)

[4] (Keogh & Cody, 2013)

THE FACTS ABOUT EXTREME WEATHER IMPACTS ON ENERGY DISTRIBUTORS

There is a strong case to be made for supporting climate change adaptation in the energy distribution sector.

- All energy distributors are vulnerable to extreme weather events including high winds, ice storms, extreme extended cold or heat, flooding, storm surges and drought.[5]

- A 2013 report by the Executive Office of the President of the United States of America estimated that between 2003 and 2012, weather-related outages cost the U.S. economy an average of $18 billion to $33 billion a year.[6]

- A TD Economics report projects that:

  - The long-term fiscal impact of natural catastrophes in Canada may increase to more than $40 billion annually by 2050 and urges businesses and policy-makers to start thinking about the potential consequences of inaction.[7]

  - For every dollar invested in climate change adaptation, $9-$38 of future damages are avoided.[8] Not only can these investments help energy distributors become more robust and better equipped to restore services after extreme weather events, investing in resilience can help them prepare for other risks, including threats to data security and terrorism.

- While electric distributors tend to achieve reliability rates of 99.93 percent, they are permitted to exclude outages that are beyond their control from reliability indicators. This includes extreme weather events.[9] Excluding these events is problematic. It leaves little incentive for distributors or regulators to calculate or understand how an increase in frequency and duration of extreme weather events will impact service reliability going forward and what customers might be willing to pay to avoid future widespread, extended outages.

[5] The extent to which they may be impacted depends on the geographic location of the infrastructure and to a large extent on whether the infrastructure is above or below ground. Nevertheless, the impact goes beyond extreme weather, posing health and safety risks for energy distributor field staff.

[6] (Executive Office of the President, 2013)

[7] (Alexander & McDonald, 2014)

[8] Ibid.

[9] (Keogh & Cody, 2013)

[10] (Government of Canada, 2009)

KEY FINDINGS AND RECOMMENDATIONS

The recommendations provide a pathway forward for energy distributors to adapt their operations, infrastructure, organizational structure and communications to become resilient energy distributors as well as for policymakers to help enhance the resilience of critical electric, natural gas and thermal energy distributors.

The most significant recommendations for energy distributors and policymakers are included here. The complete list of 28 recommendations and examples can be found in the full report.

KEY FINDINGS – ENERGY DISTRIBUTORS

1. Awareness of historical climate change impacts to the distribution sector is high.
- 90 percent of energy distributors surveyed for this study stated their organization was negatively impacted by a significant weather event in the last decade.

2. Awareness of predicted impacts of future climate trends to the energy distribution sector is low but developing.
- Though energy distributors are aware that extreme weather events are generally becoming more frequent, longer and more severe, the understanding about how this will affect their future operations and infrastructure is low.

3. All energy distributors expressed concern about the impacts of future climate trends on energy distribution reliability.
- The majority of electricity and thermal energy distributors surveyed identified climate change to be of similar concern to other stressors like ageing assets and changing regulatory requirements.
- Due to its inherent resilience of being mostly underground, natural gas and thermal energy distributors tend to be less concerned about climate change impacts on their infrastructure.

4. All energy distributors are taking some actions, however adaptation response continues to take place on an ad-hoc, reactive basis in the aftermath of extreme weather events,[10] and there is an opportunity to address risks and improve resiliency in a more systematic fashion.
- Over 90 percent of the electric distributors surveyed worldwide by the Carbon Disclosure Project identified that they were at risk from climate change. However, less than a third of the same respondents claimed to undertake any financial or quantified evaluation to the impact of climate change on their business.

KEY RECOMMENDATIONS - ENERGY DISTRIBUTORS

Adaptation Planning and Risk Assessments

Recommendation: Electric, natural gas and thermal energy distributors have adaptation plans/risk assessments in place using local climate models to better identify risks to the distribution system.

Toronto Hydro, Ontario

In 2012, Toronto Hydro partnered with Engineers Canada to pilot a Climate Change Engineering Vulnerability Assessment.[11] The assessment was developed in collaboration with field staff, control room staff, engineering staff and the planning department. It provides an inventory of existing infrastructure, detailing which parts of the distribution system are most at risk to outages. The next phase of the pilot project will examine how future weather risks are expected to impact the system.[12]

Adapting Infrastructure

Recommendation: Electric, natural gas and thermal energy distributors improve the robustness of their infrastructure based on identified future vulnerabilities and integrate resiliency planning, including distributed generation, into asset renewal planning.

BC Hydro, British Columbia

BC Hydro is implementing a number of concurrent strategies to prevent future outages, including incorporating energy storage for peak load shaving, implementing corrosion-resistant hardware, using a dynamic thermal circuit rating and using a dynamic rating for transformers.[13]

Adapting Operations

Recommendation: Electric, natural gas and thermal energy distributors examine opportunities to enhance operations before, during and after extreme, extended outages through enhanced weather forecasting systems, predictive asset management programs, advanced outage management and distribution automation solutions, improved right-of-way management and smart metering solutions.

Nova Scotia Power, Nova Scotia

Following the tropical storm Arthur in the summer of 2014, Nova Scotia Power was ordered by the Nova Scotia Utility and Review Board to review its vegetation management practices. Nova Scotia Power proceeded to submit a proposal to double its tree trimming budget from $10 million to $20 million per year beginning in 2016. Trees falling on electricity distribution wires caused 90 percent of outages during the storm.[14]

Adapting Organizational Structure

Recommendation: Electric, natural gas and thermal energy distributors clearly define staff roles for before, during and following an extreme, extended outage, including mutual assistance agreements which include detailed information about crews, spare equipment and design specifications. Lessons learned need to be clearly documented to ensure that the processes are well understood and passed on within the organization.

Canadian Gas Association Mutual Assistance Agreements

Following Hurricane Sandy in November 2012, all Canadian gas distributors initiated a process to revise and update mutual aid agreements (including commonly understood procedures and lessons learned such as considerations about unions, drug testing and border crossings), via the Canadian Gas Association (CGA) Standing Committee on Operations. The CGA holds this agreement for its members and the agreement is scheduled to go into effect as of July 1st, 2015.

Adapting Communications

Recommendation: Electric, natural gas and thermal energy distributors have a communications strategy in place. They are the lead point of communication for stakeholders and the public, and have a clear communication process in place to address interdependencies following an extended or widespread outage.

ENMAX, Calgary, Alberta

EXMAX is making several changes to the way it communicates with emergency responders and city staff following widespread extended outages in an effort to improve the speed at which reconnections can be made. It will enhance its ability to share geospatial data with the Calgary Emergency Management Agency regarding the status of power re-connections. The City of Calgary has also agreed to provide ENMAX and city staff with enhanced information system tools.[15]

[11] (AECOM, 2012)
[12] Ibid.
[13] (Clean Air Partnership, 2011)
[14] (Withers, 2015)
[15] (City of Calgary Expert Management Panel on River Flood Mitigation, 2014)

KEY FINDINGS – FEDERAL, PROVINCIAL AND LOCAL POLICYMAKERS

Energy distributors operate under a complex set of policies and regulations established at the federal, provincial/territorial and local level. The policy and regulatory context has significant influence over the ability of energy distributors to make decisions to withstand and recover from extreme weather events, as identified in the table below.

Policymaker	Key Areas of Policy and Regulatory Influence
Federal Policymakers	– Developing and implementing a national adaptation strategy – Enforcing of building standards through the National Building Code – Knowledge sharing, capacity building and data collection – Supporting projects and leading by example – Providing clarity for stakeholders about privacy legislation
Provincial and Territorial Policymakers	– Developing and implementing provincial adaptation or climate change plans – Requiring or encouraging local adaptation planning – Encouraging distributed generation, supporting projects and leading by example – Requiring or encouraging technology adoption (e.g. smart meters) – Enforcing emergency management standards and protocols – Enforcing of land use tools and policies – Establishing building code requirements and design standards
Provincial and Territorial Regulators	– Rate setting for electric, gas and in some cases thermal energy distributors to allow for recovery of costs of adaptability and resilience needs
Local Policymakers	– Developing municipal adaptation plans and climate risk assessments – Enforcement of land use tools and policies – Encouraging locally-owned energy generation and distribution, supporting projects and leading by example

KEY RECOMMENDATIONS - FEDERAL GOVERNMENT

National Adaptation Strategy

Recommendation: Enhance current efforts to communicate the relevance of climate change and the associated impacts on the quality of life of Canadians.

Federal Sustainability Strategy and an Adaptation Framework

The Federal government has developed a Federal Sustainability Strategy and an Adaptation Framework which sets out a federal vision and approach to climate adaptation. One of the objectives of the Framework is for Canadians to understand the relevance of climate change and associated impacts on their quality of life. This is perceived by energy distributors as essential for enabling energy distributors to garner support for investing in adaptation efforts. There is a sentiment that more can be done by the Federal government to communicate the value of resilience to policymakers, stakeholders and the public.

Canadian Standards and Building Codes

Recommendation: The Standards Council of Canada and the National Research Council of Canada to lead a review of standards impacting the ability of electric, natural gas and thermal energy distributors to withstand and recover quickly from outages caused from climate change, and the Federal government adopt these updated standards in the National Building Code.

CSA S501-14 moderating the effects of permafrost degradation on existing foundations

CSA S501-14 is an example of a policy driver for adaptation in the energy distribution sector. It was developed by the Standards Council of Canada in 2015 to upgrade design standards to take permafrost degradation into consideration. Public Safety Canada has recognized the need for northern building codes and standards to take accelerated climate change impacts into account going forward.[16]

Privacy Legislation

Recommendation: Clarify what data electric, natural gas and thermal energy distributors can and cannot share with various organizations such as municipalities under the *Personal Information Protection and Electronic Documents Act.*

The Personal Information Protection and Electronic Documents Act, 2000

The Personal Information Protection and Electronic Documents Act, 2000[17], defines the rules for the sharing and use of utility data, including energy consumption data and internal operations data, such as mutual assistance information. The law currently does not permit utilities to share information of energy consumption. Distributors would benefit from receiving clarity about what information can be shared with key strategic stakeholders, like local governments, to understand where the energy system is most vulnerable, and to help distributors improve recovery procedures following extreme weather events.

KEY RECOMMENDATIONS - PROVINCIAL GOVERNMENT

Adaptation or Climate Change Plans

Recommendation: Provincial and Territorial governments encourage or require local governments to develop community energy plans and also include guidelines for local governments to consider adaptation for critical energy distribution into local energy planning.[18]

Government of Nova Scotia Municipal Climate Change Action Plans

In Nova Scotia all municipalities are required to develop a Municipal Climate Change Action Plan (MCCAP).[19] MCCAPs must identify possible climate impacts, disaster-prone areas, infrastructure vulnerabilities and priorities for action.

Supporting Distributed Generation and Storage Projects and Leading by Example

Recommendation: Provincial and Territorial governments support projects to enhance the resiliency of electric, natural gas and thermal energy distribution systems (through matched funding or cost sharing for pilot projects).

Government of Alberta

The Government of Alberta has established and administers a Climate Change and Emissions Management Fund, sourced from high greenhouse gas emitters.

The mandate of the Fund is to establish or participate in funding initiatives that improve the province's adaptability to climate change.[20] The fund is currently supporting ENMAX to implement distributed solar and wind generation projects.[21]

Technology Adoption

Recommendation: Provincial and Territorial governments require or encourage technologies (e.g. smart meters) as a way of improving utility operations and strengthening the resilience of energy distribution systems.

Government of Ontario

In July, 2004, the Ontario Minister of Energy gave a directive to the Ontario Energy Board, under Section 27.1 of the Ontario Energy Board Act, 1998 requiring the Board to develop an implementation plan to install electricity smart meters for every customer in Ontario by 2010.

[16] (Pembina Institute , 2011)

[17] (Government of Canada, 2000)

[18] Across Canada, over 180 communities have developed a community energy plan (CEP). A CEP is a tool that helps define community priorities around energy with a view to improving efficiency, cutting emissions, and driving economic development. Provincial governments can encourage or require local governments to develop CEPs, and to incorporate adaptation efforts into the CEP.

[19] (Service Nova Scotia)

[20] (Climate Change and Emissions Management Corporation, 2014)

[21] (CCEMC, n.d.)

KEY RECOMMENDATION - PROVINCIAL ENERGY REGULATOR

Rate Setting Rules and Guidelines

Recommendation: Energy regulators make expectations related to infrastructure adaptation explicit and apply rate application rules consistently.

Ontario Energy Board - Performance Based Regulation
In 2012, the Ontario Energy Board introduced the Renewed Regulatory Framework for Electricity Distributors. The framework demonstrates the Ontario Energy Board's shift from a cost-of-service rate-setting framework toward a performance-based regulation (PBR) rate-setting framework. PBR focuses on long-term value for money, rather than cost and cost recovery. This approach can support investments in the electricity distribution system that enable utilities to achieve specific outcomes, and can result in cost savings for customers, compared to the cost-of-service framework.[22]

KEY RECOMMENDATIONS - LOCAL GOVERNMENT

Municipal Adaptation Plans and Climate Risk Assessments

Recommendation: Local governments develop local adaptation plans, floodplain maps and municipal risk assessments to help local stakeholders, including energy distributors, make infrastructure siting decisions.

City of Toronto
In 2012, the City of Toronto released the Toronto's Future Weather & Climate Driver Study Outcomes Report.[23] The report, developed by Senes Consulting Ltd., includes climate trends and models and is intended to help the city better plan for infrastructure investments.

Land Use Tools and Policies

Recommendation: Local governments coordinate with electric, natural gas and thermal energy distributors regarding right-of-way management practices (e.g. vegetation management, including trimming cycles, tree species and setback bylaws), as well as through coordinating on the use of rights-of-way.

The Union of British Columbia Municipalities Planting for our Future: A Tree Toolkit for Communities
Local governments can play a role in preventing outages through tree species selection and funding tree maintenance.[24] The Union of British Columbia Municipalities Planting for our Future: A Tree Toolkit for Communities is an example of local guidelines that illustrate the importance of coordination among utilities and municipalities to mitigate outages caused from tree species selection and tree branches and roots coming into conflict with distribution infrastructure.

Recommendation: Local governments comprehensively review bylaws to identify opportunities to enhance the resilience of energy distribution systems. Local bylaws and regulations be examined to enable greater uptake of distributed energy resources.

City of Sudbury
The City of Sudbury has an Official Plan policy requiring the installation of all electricity distribution wires underground in new subdivisions and roads. The cables are buried deep enough to avoid freeze-thaw cycle damage and they are more resilient to ice or wind storms.[25]

[22] (Ontario Energy Board, 2012)
[23] (SENES Consultants Ltd., 2012)
[24] (Hauer, 1994)
[25] (Ontario Centre for Climate Impacts and Adaptation Resources)

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