

# Are we prepared?

## Canada's Energy Sector Resilience – An Overview

Presented at the APEC Energy Resiliency  
Enhancement Project Workshop

San Francisco (CA), November 9, 2023

By: Guy Félio



# Acknowledgements

The author expresses his gratitude to the following organizations that provided input for this presentation:

- Infrastructure Canada
- Hydro One (Ontario)
- Hydro Quebec
- Manitoba Hydro



# Topics covered

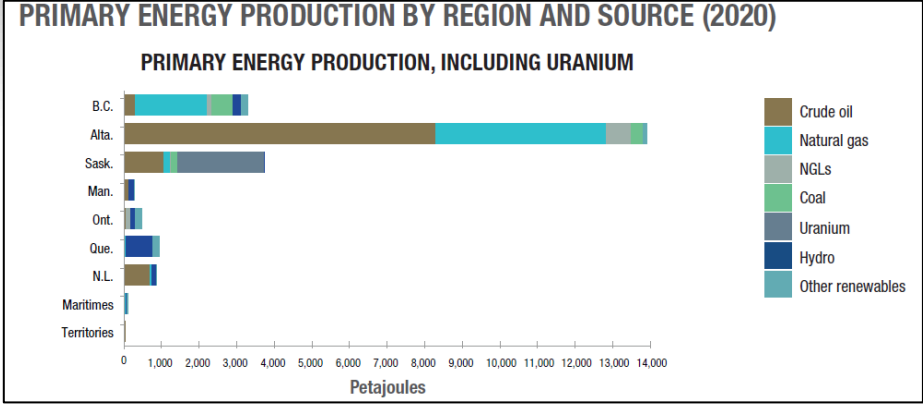
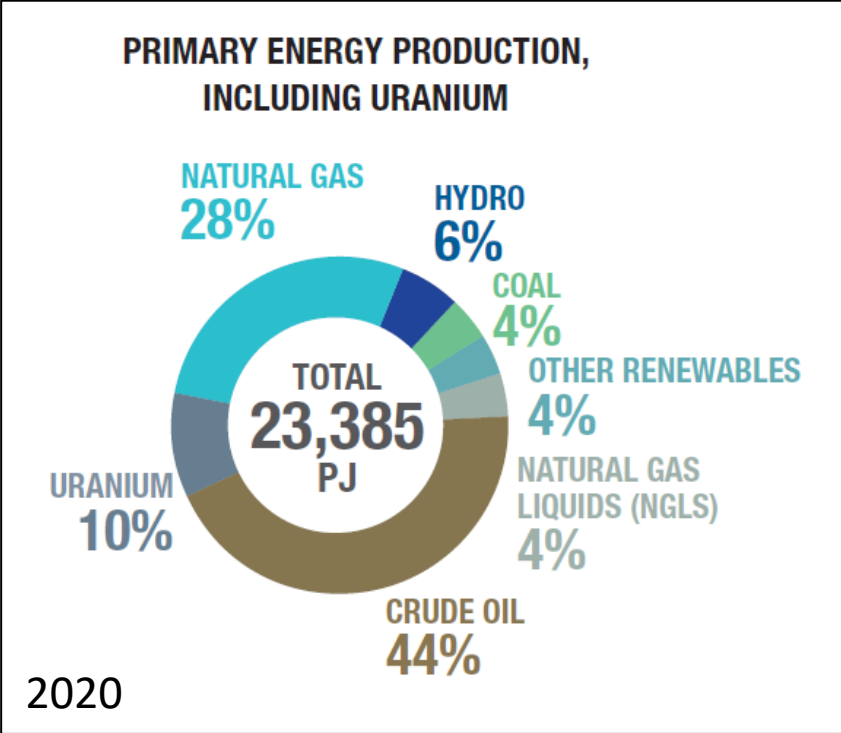
- Context
  - Canada's energy sector
  - Recent disruptions
    - Climate-related
    - Cybersecurity
- Risks
  - Climate and Cyber
  - Projections
- Resilience measures



# Context



# Context – Canada’s energy sector



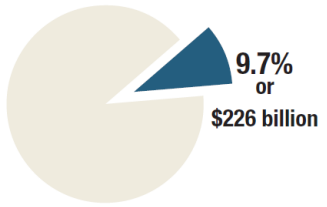
Source: Energy Fact Book 2022-2023, Natural Resources Canada

# Context – Canada’s energy sector

## ECONOMIC CONTRIBUTIONS

NOMINAL GROSS DOMESTIC PRODUCT (2021)  
ENERGY’S NOMINAL GDP CONTRIBUTION FOR CANADA

NOMINAL GDP (% OF CURRENT DOLLARS)

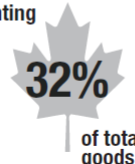


**CANADIAN GDP**  
**ENERGY DIRECT 7.7% (\$180 billion)**  
 PETROLEUM 5.7%  
 ELECTRICITY 1.7%  
 OTHER 0.3%  
**ENERGY INDIRECT 2.0% (\$47 billion)**

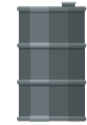
## ENERGY TRADE (2021)

### Energy exports

**\$154.3 billion**  
representing



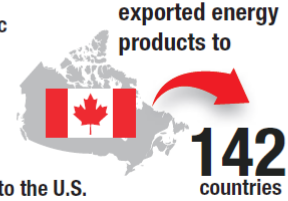
of total Canadian goods exports



Oil and gas domestic exports totalled

**\$140 billion**  
of which

**96%** were to the U.S.



exported energy products to

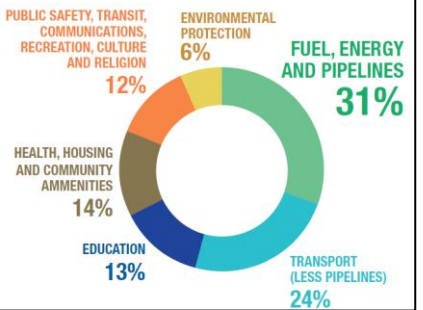
The U.S. accounts for



**91%**  
of energy exports  
by value  
(\$139.8 billion).

## CANADA'S ENERGY INFRASTRUCTURE

Fuel, energy and pipeline infrastructure made up the largest proportion of Canada's infrastructure at **31%** of net stock in 2021.



### Energy imports

**\$42.6 billion**  
representing



of total Canadian goods imports



imported energy products from

The U.S. accounts for



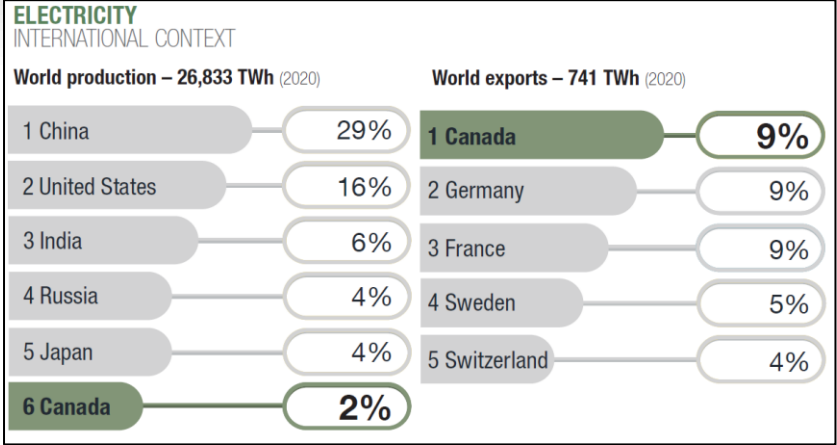
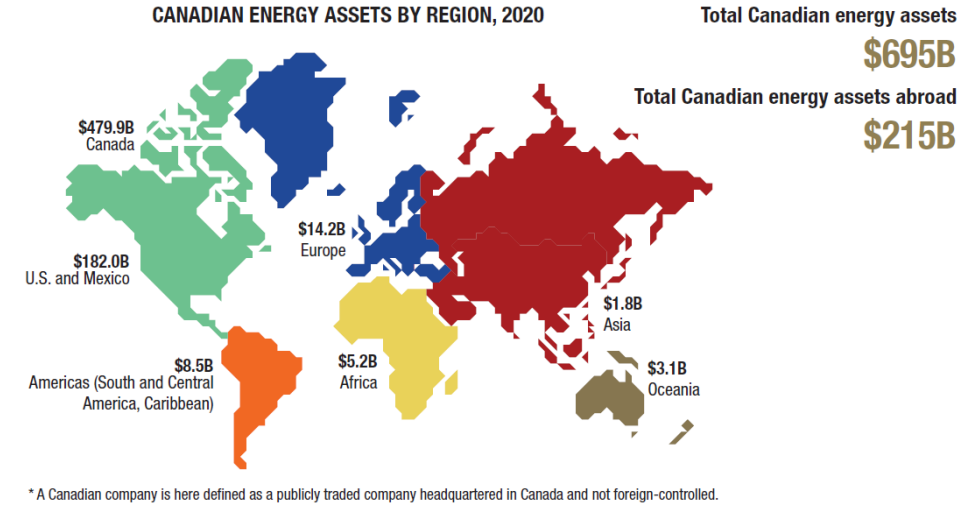
**73%**  
of energy imports  
by value  
(\$31 billion).

Source: Energy Fact Book 2022-2023, Natural Resources Canada

# Context – Canada’s energy sector

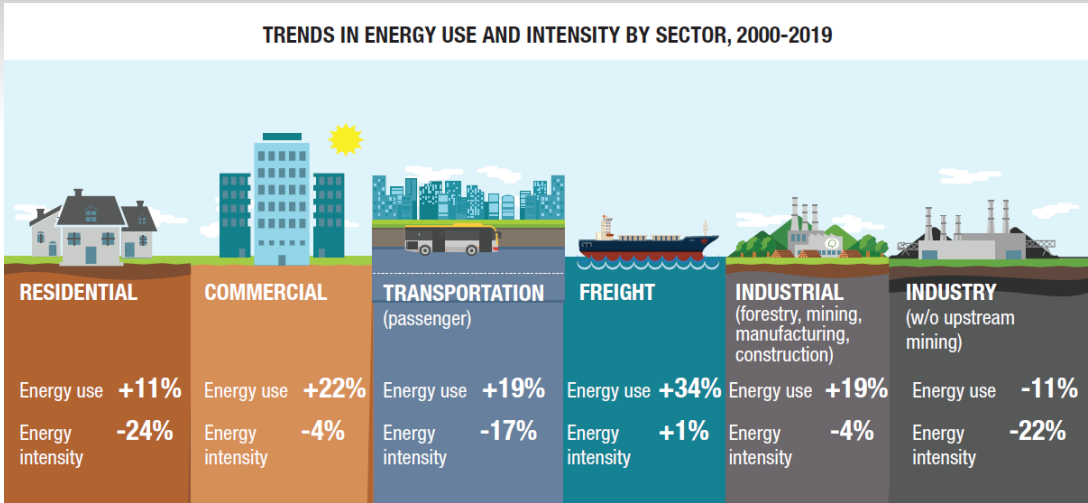
## CANADIAN ENERGY ASSETS

The total value of Canadian\* energy assets (CEA) went down in 2020 to **\$695 billion**, a slight decrease of **2.5%** from **\$712 billion** in 2019. In 2020, domestic CEA totaled **\$480 billion**, down **4.0%** from 2019, while CEA abroad totaled **\$215 billion**, up from **\$213 billion**.

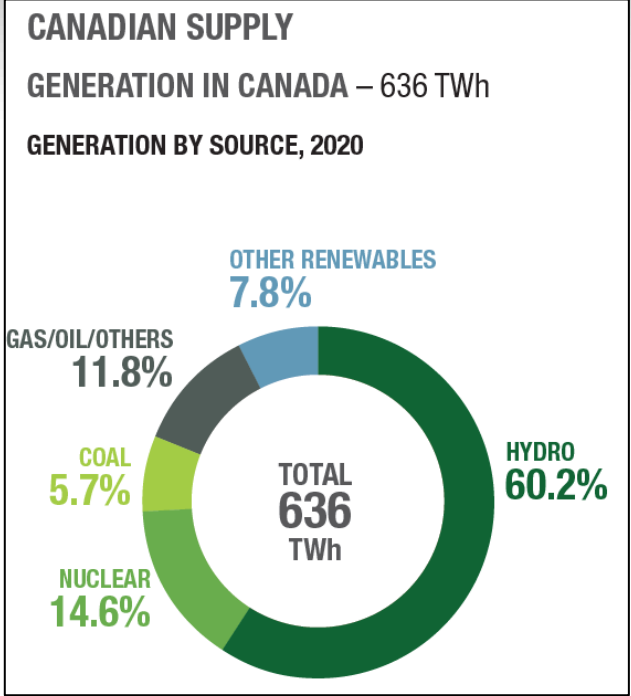


Source: Energy Fact Book 2022-2023, Natural Resources Canada

# Context – Canada’s energy sector



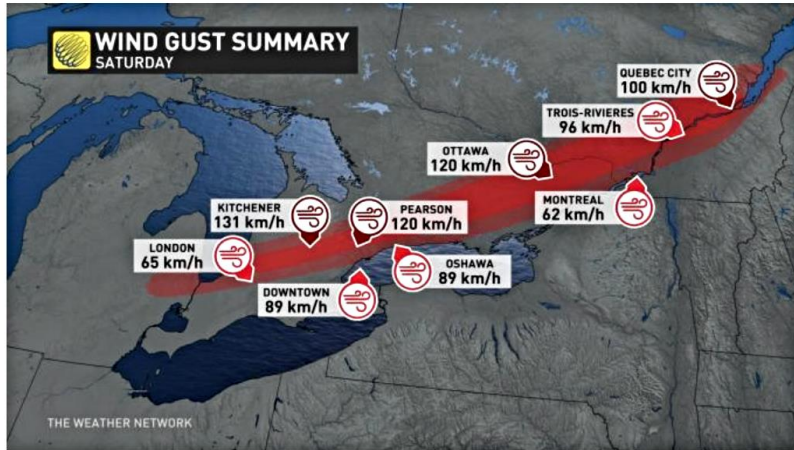
Source: Energy Fact Book 2022-2023, Natural Resources Canada





# Context – Climate-related disruptions

Example: May 21, 2022 Derecho



Insurance Industry Loss Estimates: > CAD \$ 1.1 Billion (insured losses)

Source: CatIQ and Insurance Bureau of Canada

# Context – Climate-related disruptions

Example: September 21, 2018 – National Capital Region – Tornadoes

6 tornadoes touched down in and near the National Capital Region. The strongest was an EF-3 that touched down near the City of Ottawa's rural neighbourhoods

Estimated total loss: CAD \$ 334 Million

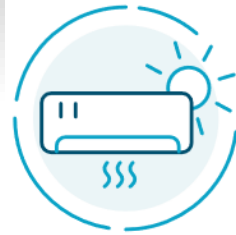


Sources:

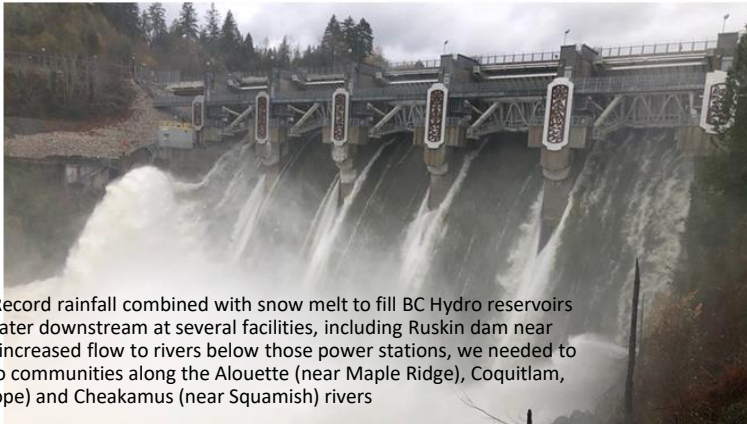
- Public Safety Canada - Disaster database
- CBC
- Hydro One
- Hydro Ottawa
- <https://pievc.ca/2019/09/11/distribution-system-climate-risk-and-vulnerability-assessment-hydro-ottawa/>

# Context – Climate-related disruptions

Example: BC Hydro –  
2021 record-breaking  
year for demand and  
extreme weather



On June 28, 2021 BC Hydro broke its all-time summer peak demand record at 8,568 megawatts – breaking the previous record by 600 megawatts – the equivalent of turning on 600,000 portable air conditioners.

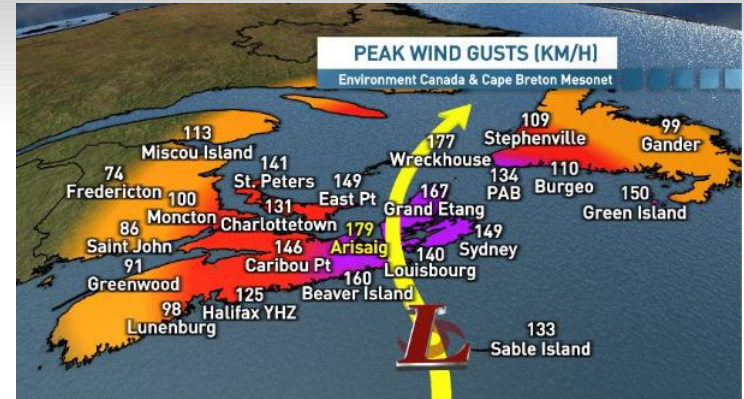


November 2021 - Record rainfall combined with snow melt to fill BC Hydro reservoirs forced us to spill water downstream at several facilities, including Ruskin dam near Maple Ridge. That increased flow to rivers below those power stations, we needed to issue flood alerts to communities along the Alouette (near Maple Ridge), Coquitlam, Wahleach (near Hope) and Cheakamus (near Squamish) rivers  
Source: BC Hydro



# Context – Climate-related disruptions

Example: Sept. 2022 –  
Hurricane Fiona –  
Atlantic Canada



Hurricane Fiona is estimated to have caused \$660 million in insured damage, according to initial estimates from Catastrophe Indices and Quantification Inc. (CatiQ).



## Sources:

- Nova Scotia Power <https://s3.documentcloud.org/documents/23490286/nova-scotia-power-storm-report-fiona.pdf>
- CBC and Radio Canada
- Insurance Bureau of Canada

# Context – Cyber-risks

Recent example:  
Suncor Energy /  
Petro-Canada (June  
2023)



CYBERSECURITY **DIVE**

**Suncor Energy continues probe of  
cyber incident disrupting gas station  
payments**

Published June 28, 2023



**News Release**

**FOR IMMEDIATE RELEASE**

**Update on Suncor Energy response to cybersecurity incident**

**Calgary, Alberta (July 6, 2023)** – As previously announced on June 25, 2023, Suncor (TSX: SU) (NYSE: SU) experienced a cybersecurity incident. We immediately activated our business continuity plans, engaged leading IT and cybersecurity experts and notified relevant authorities. Based on our investigation to date, we determined that our IT network was accessed by an unauthorized party on or about June 21, 2023.

# Context – Operations and Maintenance Risks

## August 2003 US and Canada Blackout

August 14 and 15, 2003 - The northeastern U.S. and southern Canada suffered the worst power blackout in history. Areas affected extended from New York, Massachusetts, and New Jersey west to Michigan, and from Ohio north to Toronto and Ottawa, Ontario. Approximately 50 million customers were impacted.



The causes for the blackout are attributed to deficiencies in operations and procedures in the state of Ohio. Specifically, there was a lack of adequate vegetation, or tree, management, poor communications between various utilities in the area, compounded by lack of training and tools for local operators to effectively deal with the emergency.

Due to these degraded conditions in Ohio, a series of large power swings ranging between 2,000 and 4,000 megawatts pulsed through New York and Ontario and into Michigan, overloading the system.

### Sources:

- Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations. US-Canada Power Outage Task Force (2004)
- Independent Electricity System Operator (Ontario) – Looking back at the 2003 blackout



# Risks



# Critical functions and risks

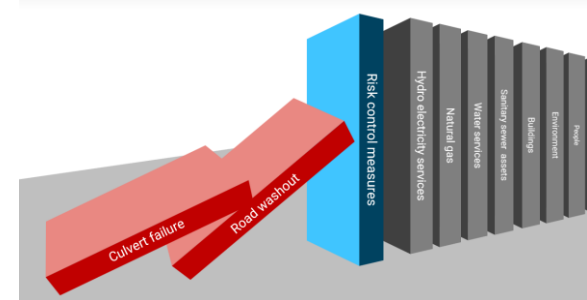
## Critical functions to the economy and their vulnerability to hazards

1. Transport cargo and passengers by air and land (rail, roads)
2. Provide information technology products and services
3. Public health and wellness
4. Produce and distribute energy products (electricity, natural gas, fuel)
5. Provide public safety and security (includes law enforcement)

## Top risks

1. Coastal, fluvial and overland (ponding) floods
2. Supply Chain Failure
3. IT failures

## Importance of interdependencies and risk controls



Source: Guy Félio unpublished research study (2023)



# Climate change impacts and challenges in different regions across Canada



Source: Canada's National Adaptation Strategy (2023)

# Canada's Top Climate-related Risks

## CLIMATE CHANGE TODAY



### HYDROPOWER

Changes in temperatures and rainfall have impacted surface water levels in Canada, which can have a direct impact on the capacity of hydroelectric power generation.



### STORMS

Severe storms, hurricanes and floods have caused major power outages and substantial damage to energy infrastructure, for example Post Tropical Storm Arthur in 2014, the USA Canada ice storm of 2013 and the 2013 flash flood in Toronto.



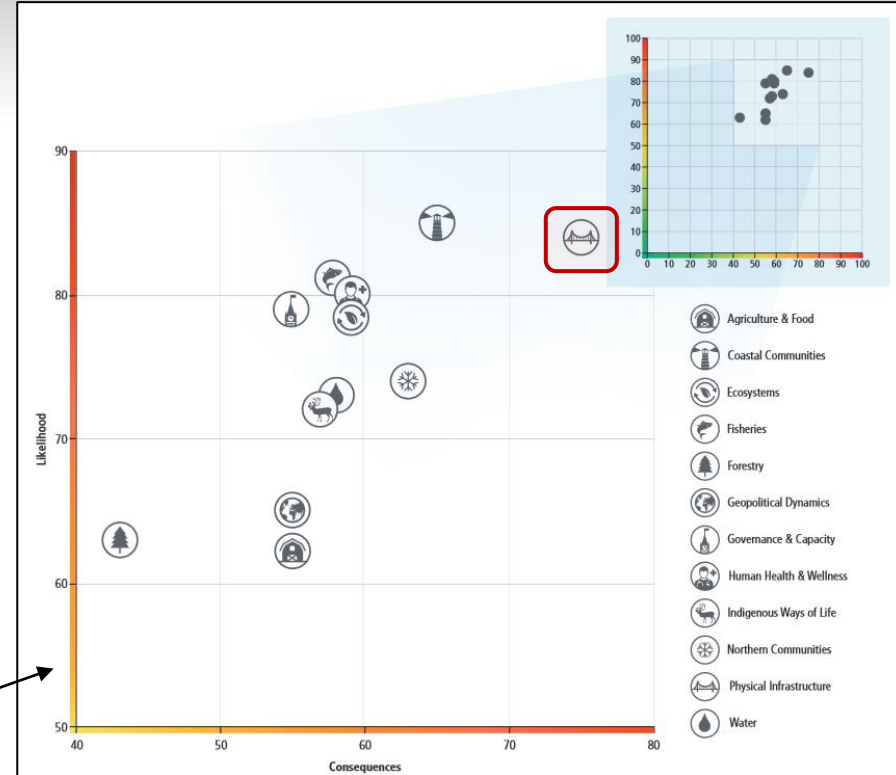
### VULNERABILITY

The energy infrastructure in Canada is ageing and a large proportion will need replacement or updating by 2050. Much of the infrastructure is highly vulnerable to climate risks, as it was designed based on outdated weather-related assumptions.

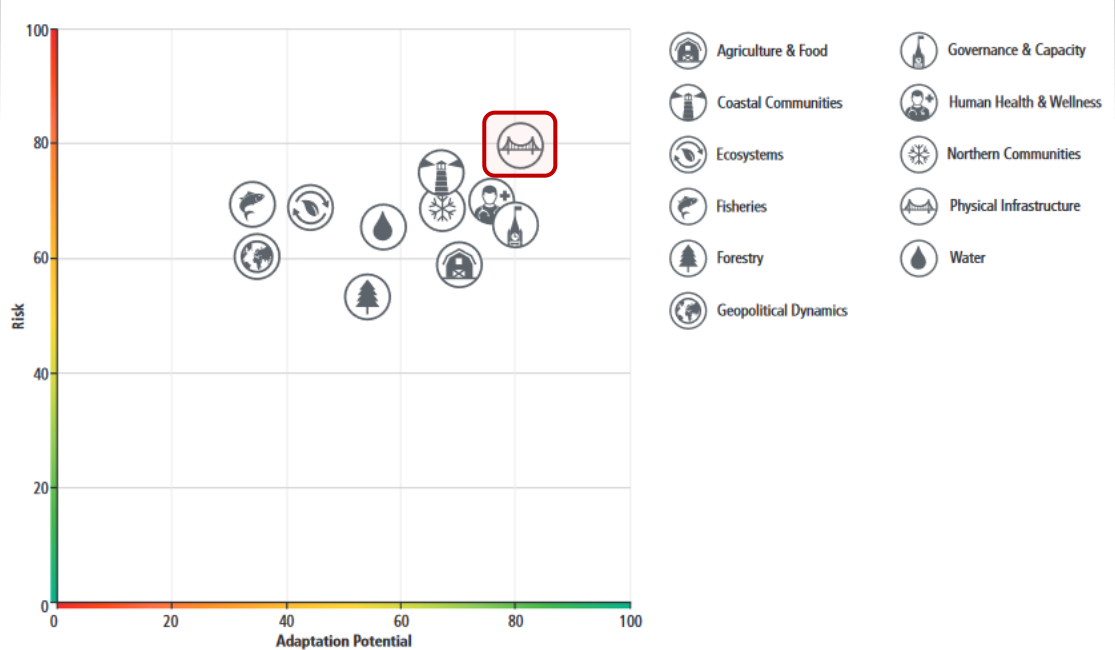
Source: G20 Climate Risk Atlas – Canada (2021)

Source: Council of Canadian Academies, 2019. Canada's Top Climate Change Risks, Ottawa (ON): The Expert Panel on Climate Change Risks and Adaptation Potential, Council of Canadian Academies.

<https://cca-reports.ca/wp-content/uploads/2019/07/Report-Canada-top-climate-change-risks.pdf>



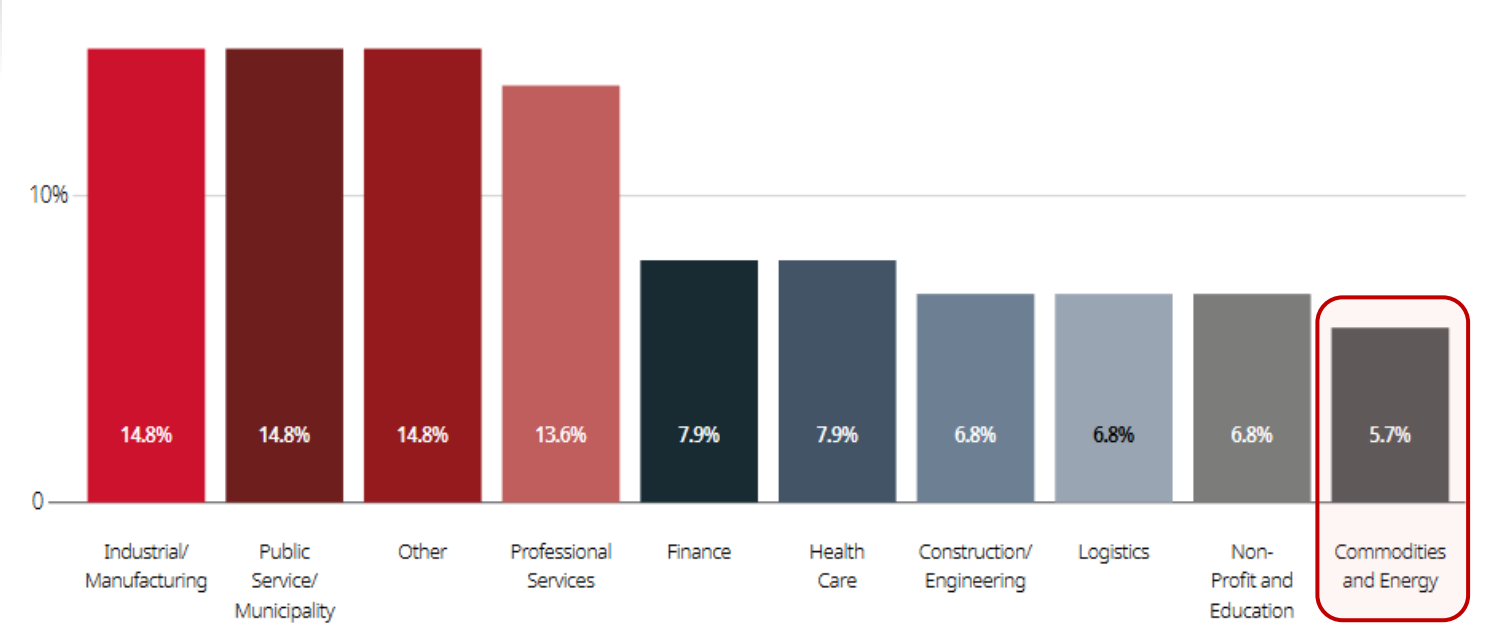
# Canada's Top Climate Change Risks



Source: Council of Canadian Academies, 2019. Canada's Top Climate Change Risks, Ottawa (ON): The Expert Panel on Climate Change Risks and Adaptation Potential, Council of Canadian Academies.

<https://cca-reports.ca/wp-content/uploads/2019/07/Report-Canada-top-climate-change-risks.pdf>

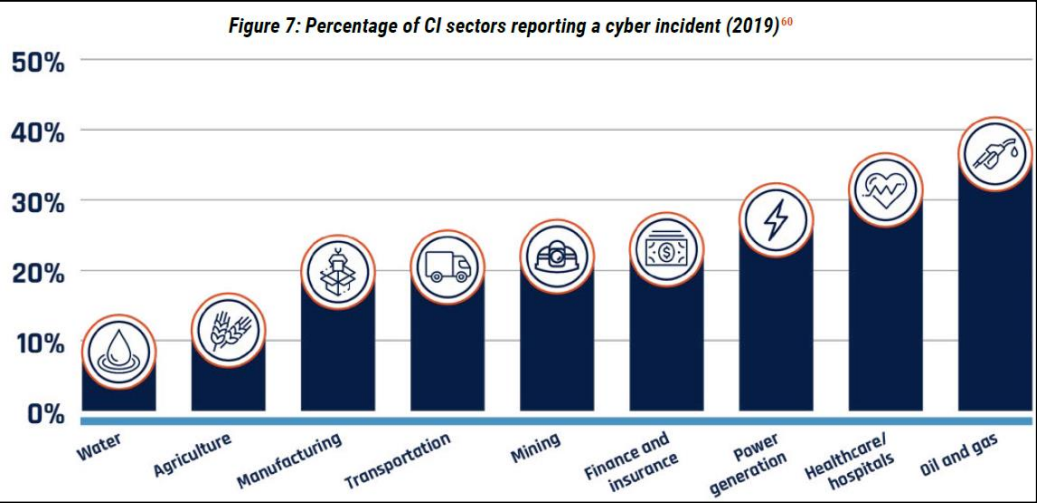
# Cybersecurity Incidents – by Industry (2021)



Source:  
- Blakes Cybersecurity - Canadian Cybersecurity Trends Study 2021

# Cyber-risks

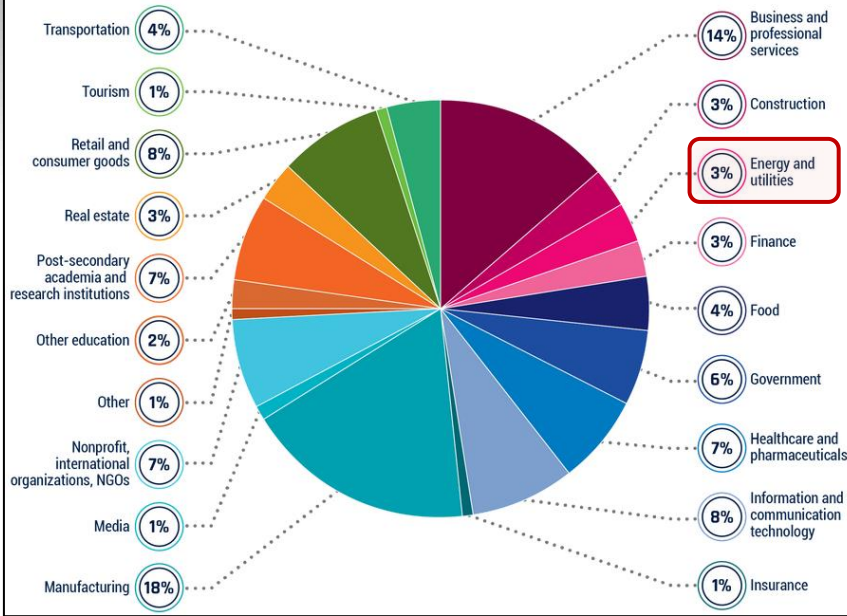
Figure 7: Percentage of CI sectors reporting a cyber incident (2019)<sup>60</sup>



Source: Canadian Centre for Cyber Security

Figure 4: Canadian victims of ransomware in 2022 (by sector)

Ransomware has victimized a wide assortment of Canadian organizations with no discernible pattern based on sector.



# Cyber-risks

## Smart Cities and National Security

### Smart Cities:

“Environments where digital technologies are used to enhance the quality and efficiency of municipal services. A ‘smart’ city collects and analyses data interactions with, and usage of, public infrastructure in order to improve service delivery and user experience. This data is collected through connected sensors and individual devices which are part of centralized networks that manage service delivery.”

### /// WHAT ARE THE NATIONAL SECURITY CONCERNS?

Smart cities represent the next generation of critical infrastructure, underpinning nearly all aspects of daily life. This integrated centrality means that smart cities will be attractive targets of hostile state actors and criminals for espionage and sabotage/disruption.

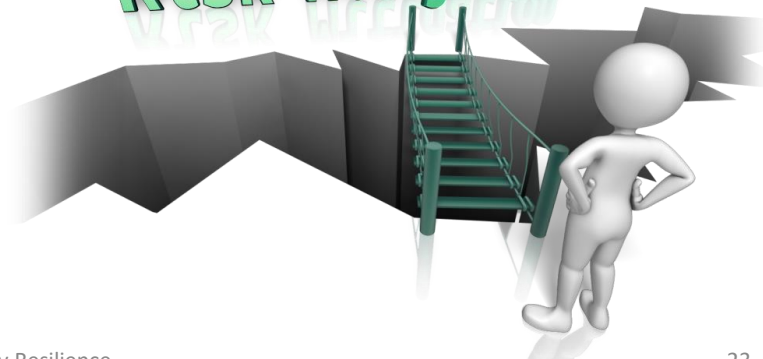
Source: Canadian Security Intelligence Service

**Risk Assessment**



# Resilience Measures

**Risk Mitigation**



# State of Play (some examples)

Codes, Standards and Related Instruments (CSRI) - options include:

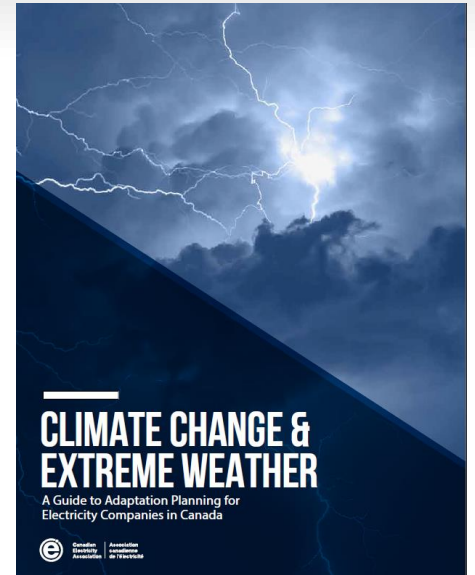
- Codes
  - Note: Canadian energy Code for buildings focused on energy efficiency
- Legislation, e.g.:
  - Bill C-26: New Cybersecurity Requirements in Critical Infrastructure (2022)
- Standards:
  - Canadian Standards Association (CSA), Bureau des normes du Québec (BNQ)
  - ISO



# State of Play (some examples)

Codes, Standards and Related Instruments (CSRI)  
- options include:

- Industry specific practices, e.g.:
  - Canadian Electricity Association: Climate Change and Extreme Weather – A Guide to Adaptation Planning for Electricity Companies in Canada (2020)

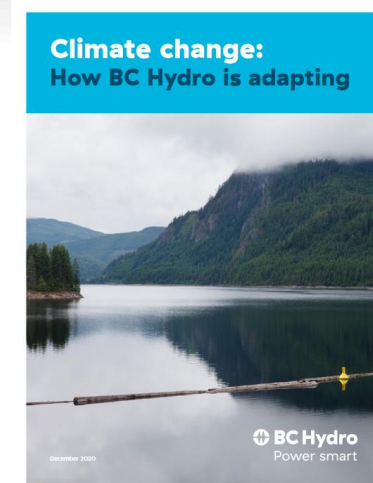
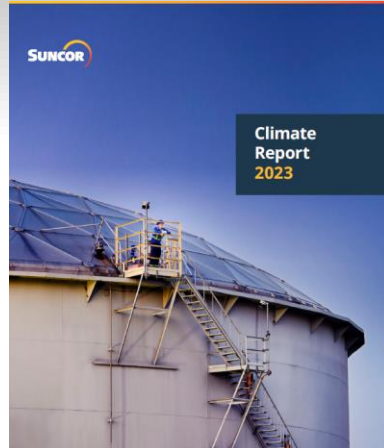
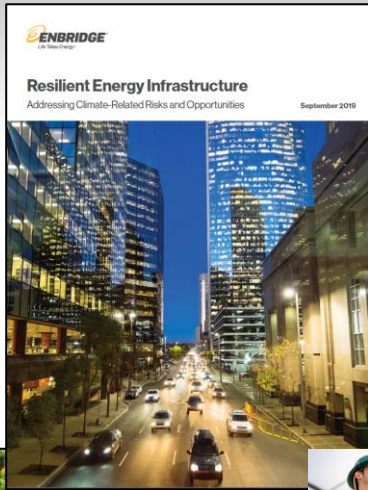


# Examples of Federal Government Initiatives

- Updating Codes for climate change
  - National Building Code
  - Canadian Electric Code
  - National Fire Code
  - National Energy Code for Buildings
- Standards Council of Canada
- Infrastructure Canada – Climate Resilience assessment for infrastructure
- Climate services: ClimateData.ca
- Canada's National Adaptation Strategy (2023)




# Examples of Energy Utilities strategies and plans



# Climate risk assessments of energy assets and systems

- Example: using the PIEVC Protocol assessment tool (Public Infrastructure Engineering Vulnerability Committee) developed in 2007
- See: <https://pievc.ca/>

 Stantec

Distribution System Climate Risk and Vulnerability Assessment

Final Report

September 11, 2019

Prepared for:

Hydro Ottawa Limited  
2711 Hunt Club Road  
Ottawa, ON K1G 5Z9


Prepared by:



Stantec Consulting Ltd.  
400-1331 Clyde Avenue  
Ottawa, ON K2C 3G4

CITY OF SUMMERSIDE  
**SUMMERSIDE SOLAR AND STORAGE INTEGRATION PROJECT**  
CLIMATE LENS ASSESSMENT – CLIMATE CHANGE RESILIENCE  
SUMMERSIDE, PRINCE EDWARD ISLAND, CANADA

WSP REF: 191-11112-00  
DATE: 28 OCTOBER 2019

CONFIDENTIAL







**Climate Change Vulnerability Assessment of Ontario's Electrical Transmission Sector**



Public Technical Report

July, 2015



Prepared By:

 Conservation Ontario  
 ONTARIO CLIMATE CONSORTIUM  
 ieso  
Independent Electricity System Operator

# Observations



Source: Allianz Risk Barometer 2022: Top concerns around the world

# Observations – Climate Risks and Resilience

- Past emphasis on mitigation (GHG emissions reduction) now being matched by adaptation (risk assessment and resilience)
- Updating codes and standards to account for climate changes is underway ... but a long process – other instruments may result in faster outputs
- Build-up of climate risks and resilience specialists

# Observations – Cyber Risks

- **Ransomware is a persistent threat to Canadian organizations**
- **Critical infrastructure is increasingly at risk from cyber threat activity**
  - However, state-sponsored cyber threat actors will very likely refrain from intentionally disrupting or destroying Canadian critical infrastructure in the absence of direct hostilities.
- **State-sponsored cyber threat activity is impacting Canadians.** State-sponsored cyber programs pose the greatest strategic cyber threats to Canada
- **Disruptive technologies bring new opportunities and new threats.**

Source: Canada - National Cyber Threat Assessment 2023-2024

# Thank You !

## Questions ?

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