

# Electricity 101

The following slide deck contains information about Electricity Canada and the Canadian electricity industry. Unless otherwise noted, charts were prepared by Electricity Canada based on data from third-party sources, such as Statistics Canada, Environment and Climate Change Canada, the International Energy Agency and the World Bank.





# Electricity Canada

**Our Vision:** Electricity Canada is the best trade association.

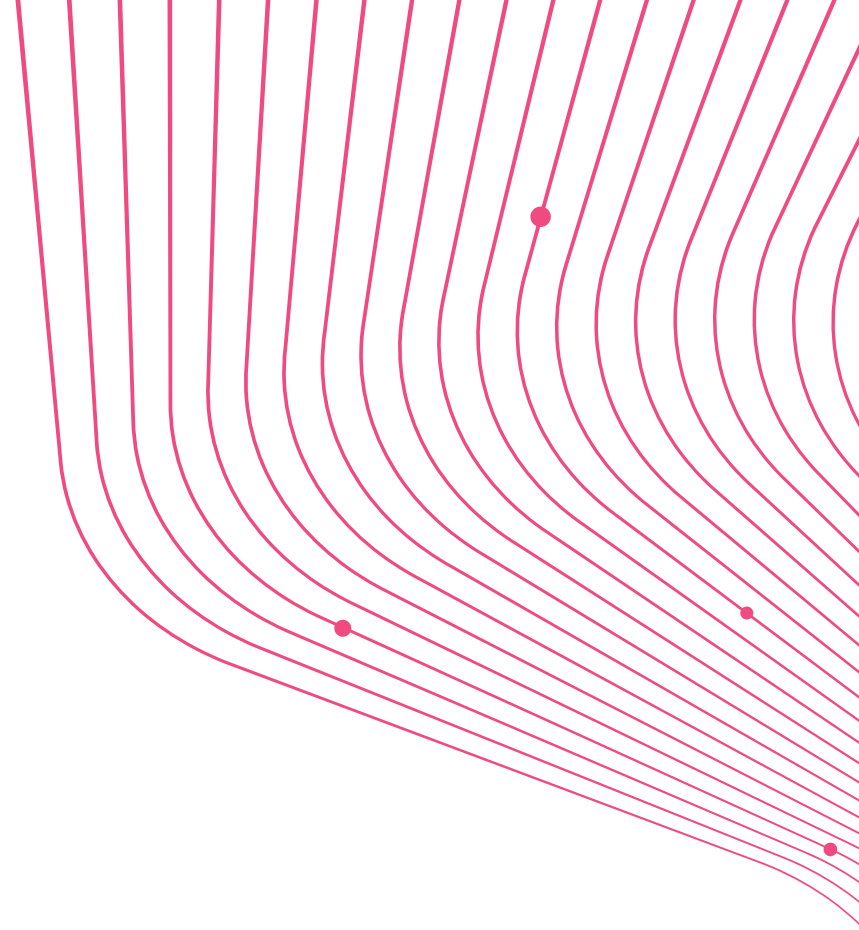
**Our Mission:** Electricity Canada is the national voice for sustainable electricity for its members and the customers they server.



# Regulatory

Canada has a strong regulatory environment.

- [Jurisdictional Environment](#)
- [Market Structure](#)
- [Regulatory Regime for Infrastructure Projects](#)
- [Integrated North American Grid](#)
- [North American Electric Reliability Corporation \(NERC\)](#)



# Canada's Multi-Jurisdictional Environment

Jurisdictional Division of Responsibility	
Provincial/Territorial Governments	Federal Government

- Resource management within provincial boundaries
- Intra-provincial trade and commerce
- Intra-provincial environmental impacts
- Generation and transmission of electrical energy
- Conservation and demand response policies

- Resource management on frontier lands
- Nuclear safety
- Inter-provincial and international trade
- Trans-boundary environmental impacts
- Environmental impacts where federal lands, investment or powers apply
- Codes, standards and labeling relating to conservation and demand
- Other policies of national interest



# Electricity Market Structure in Canada

## Alberta

- Mandatory Power Pool
- Wholesale & retail open access (2001)
- Fully competitive wholesale market

## BC

- Wholesale and industrial open access
- Vertically-integrated Crown Corporation serves 94% of customers

## Manitoba

- Wholesale open access
- Vertically-integrated Crown corporation

## New Brunswick

- Wholesale open access
- Vertically-integrated Crown corporation

## Newfoundland

- Vertically-integrated Crown Corporation and investor-owned distribution utility.

## Nova Scotia

- Wholesale open access
- Investor-owned utility regulated on cost-of-service

## Nunavut

- Vertically-integrated Crown Corporation.

## NWT

- Vertically-integrated Crown Corporation.
- Investor-owned distribution utility provides service in several communities.

## Ontario

- Industry unbundling (1998)
- Wholesale & retail open access (2002)
- Hybrid regulation and competition model

## PEI

- Procures electricity from New England market and long-term contracts with New Brunswick.

## Québec

- Wholesale open access
- Vertically-integrated Crown corporation
- Expanding IPP development

## Saskatchewan

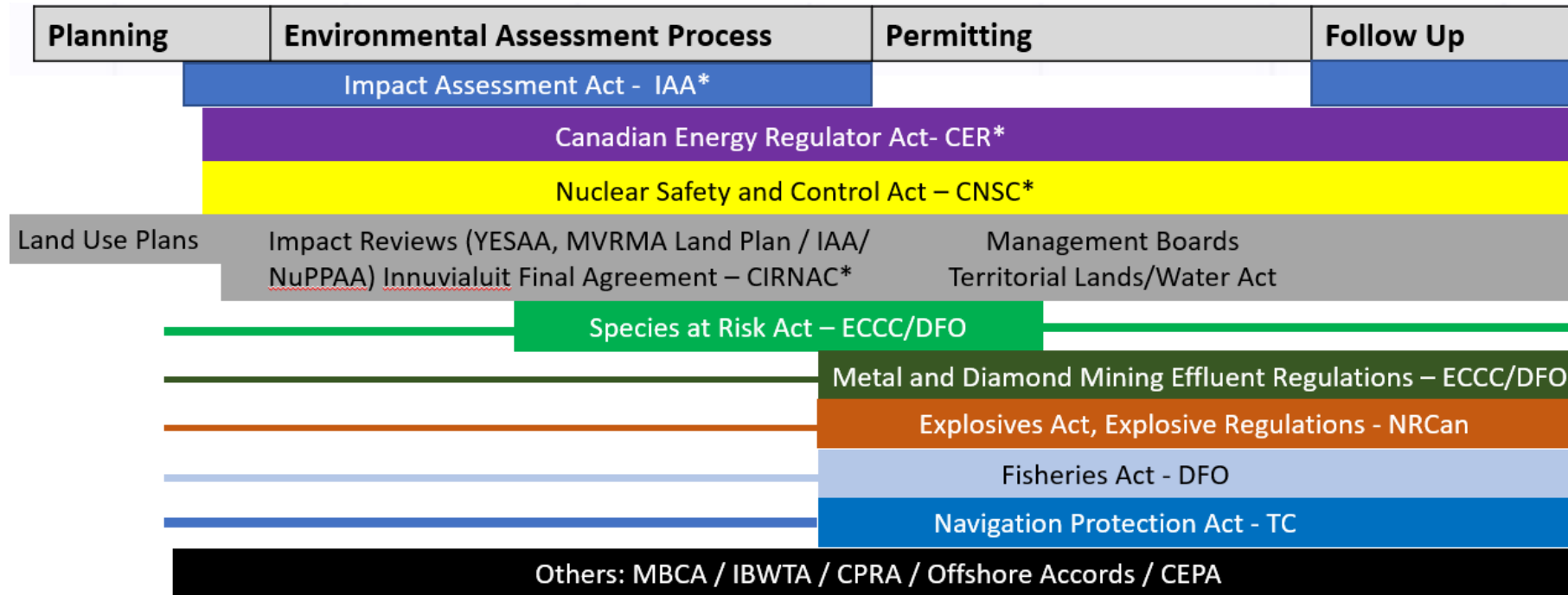
- Wholesale open access
- Vertically-integrated Crown corporation

## Yukon

- Vertically-integrated Crown Corporation.
- Investor-owned distribution utility provides service in several communities.



# Canada's Regulatory Regime for Large Energy Projects



\*Permits required under other Acts trigger IAA OGD participants | Illustrative – some components would not apply to same project

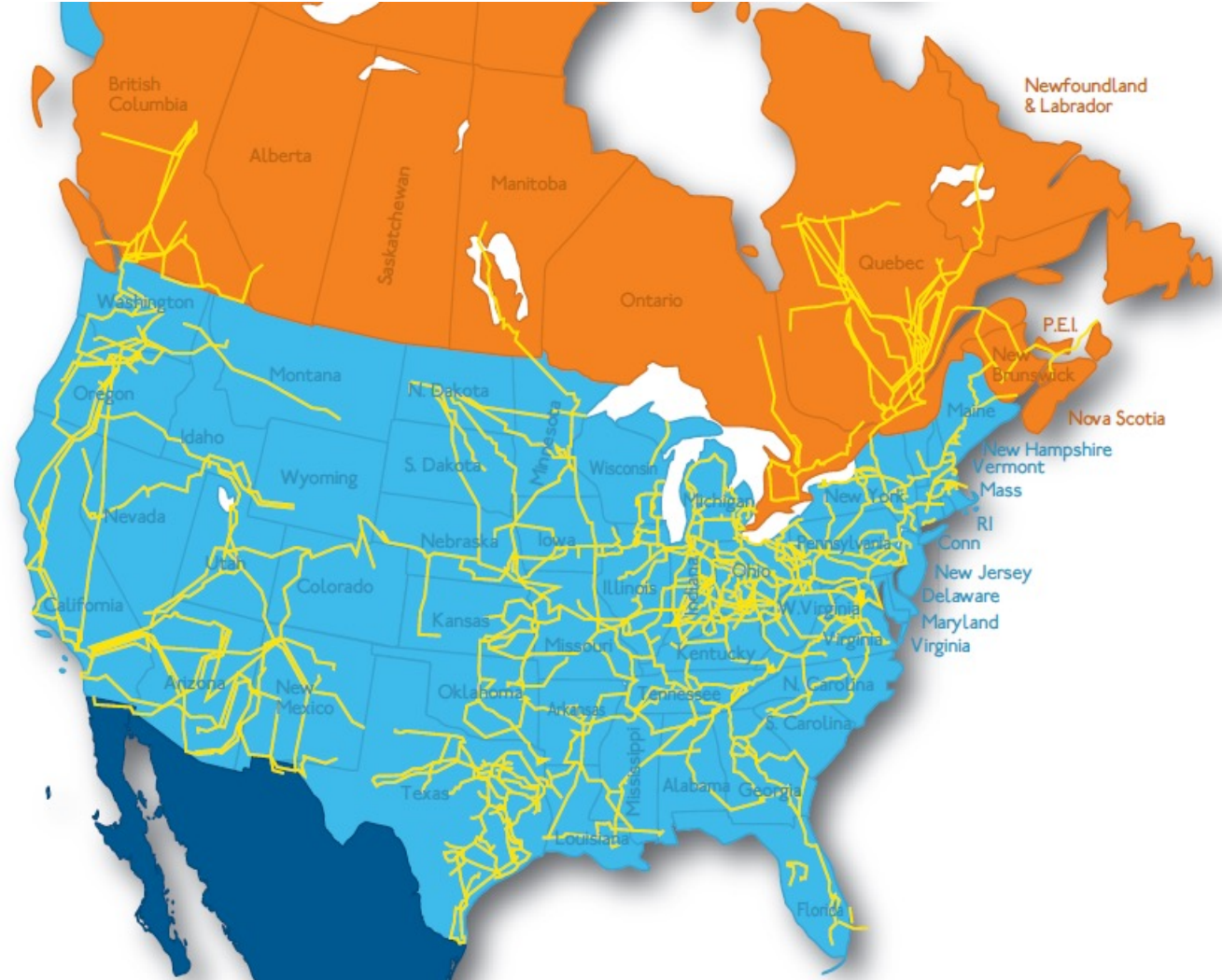
**YESAA** – Yukon Environmental and Socio-Economic Assessment Act / **MVRMA** – Mackenzie Valley Resource Management Act / **MBCA** – Migratory Birds Convention Act / **IBWTA** – International Boundary Waters Treaty Act / **CPRA** – Canadian Petroleum Resource Act / **Offshore Accords** – Canada – NS and NFD Offshore Accords / **CEPA** – Canadian Environmental Protection Act / **NuPPAA** – Nunavut Planning and Project Assessment Act (NuPPAA)

Source: Electricity Canada  
Updated: July 2021

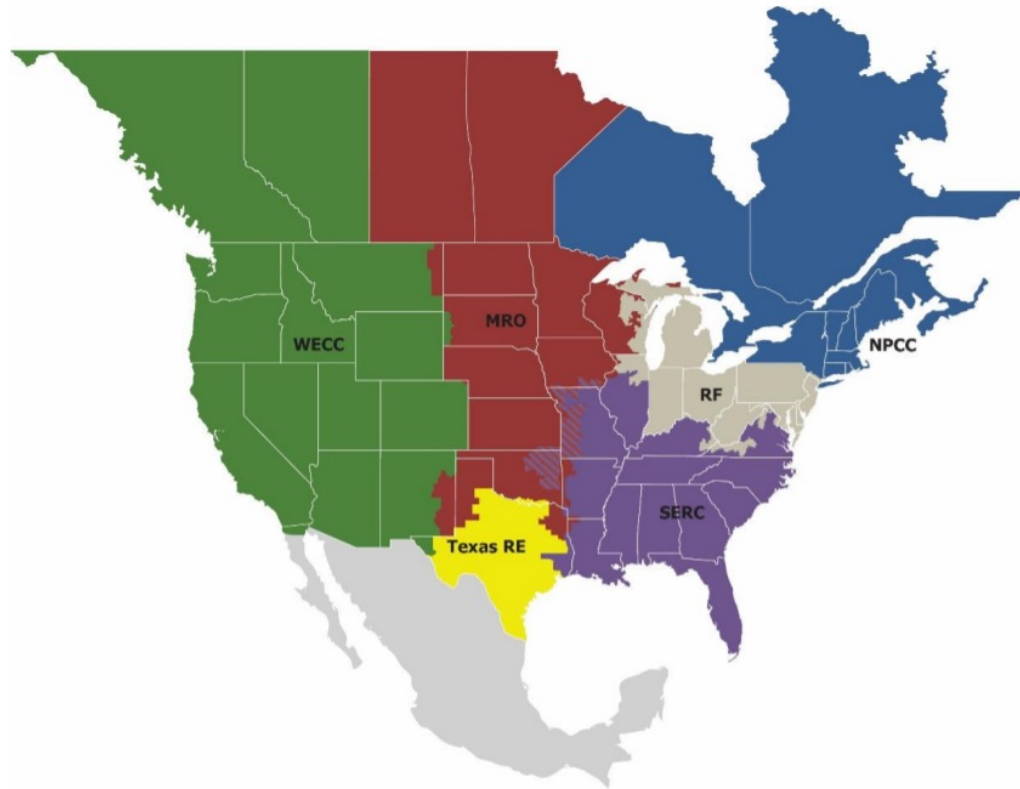


# The Integrated North American Grid

**Details:** Lines shown are 345kV and above. Transmission Lines under 345KV do not appear on this map.



# North American Electric Reliability Corporation Regions (NERC)



Acronym	Name
WECC	Western Electricity Coordinating Council
MRO	Midwest Reliability Organization
TRE	Texas Reliability Entity
SERC	Southeast Reliability Corporation
RFC	Reliability First Corporation
NPCC	Northeast Power Coordinating Council, Inc.



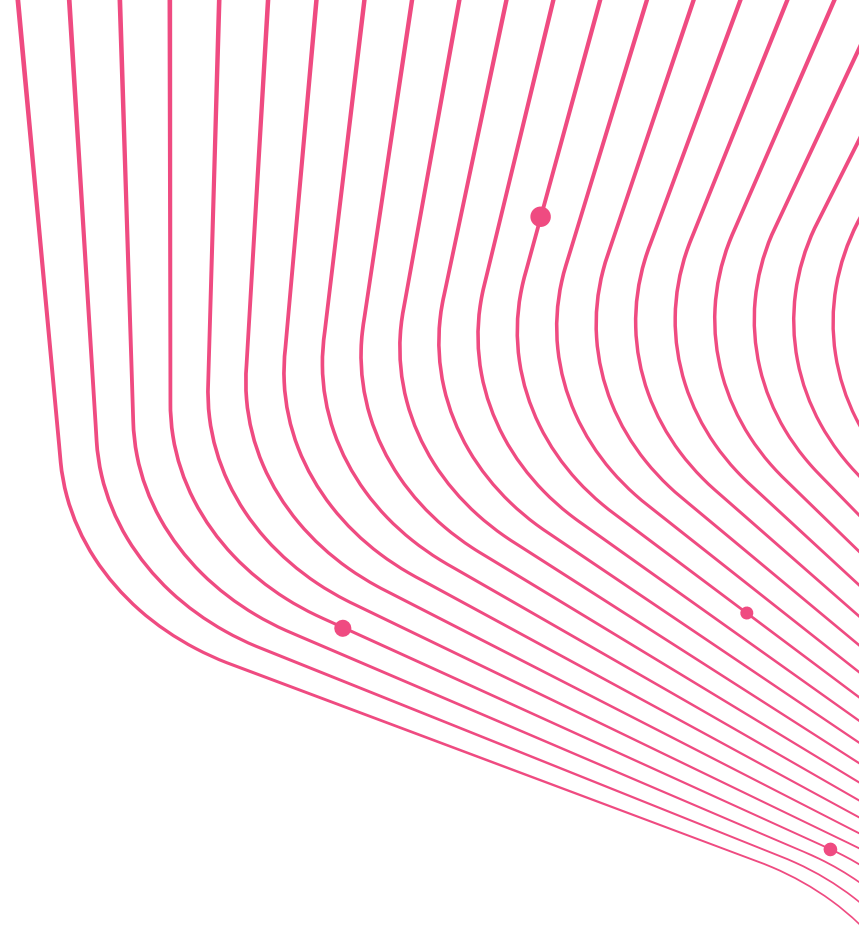
Source: NERC  
Updated: July 2021



# Industry

The industry employs over 90,000 people.

- [Industry Overview](#)
- [Top Electricity Projects](#)
- [Labour Statistics](#)
- [Index of Reliability](#)
- [Severe Weather, Growing Risk](#)
- [GDP Contribution](#)
- [Utility Investments](#)



# Industry Overview

## Electricity Industry Overview

Electricity supports quality of life, economic well-being, and a clean environment.

- + **91,840**  
Employed
- + **626 TW.h**  
Generation
- + **47.3 TW.h**  
Net Exports
- + **Over 80%**  
Non-Emitting
- + **\$33.5 Billion**  
GDP
- + **99.93%**  
Customer Reliability
- + **2.51 Billion**  
Net Trade Revenue
- + **57%**  
GHG Emissions  
Reduction Since  
2000



# Top 10 Electricity Infrastructure Projects

**4 of the largest  
10 Infrastructure  
Projects are  
Electricity Based  
and values at  
\$49B**

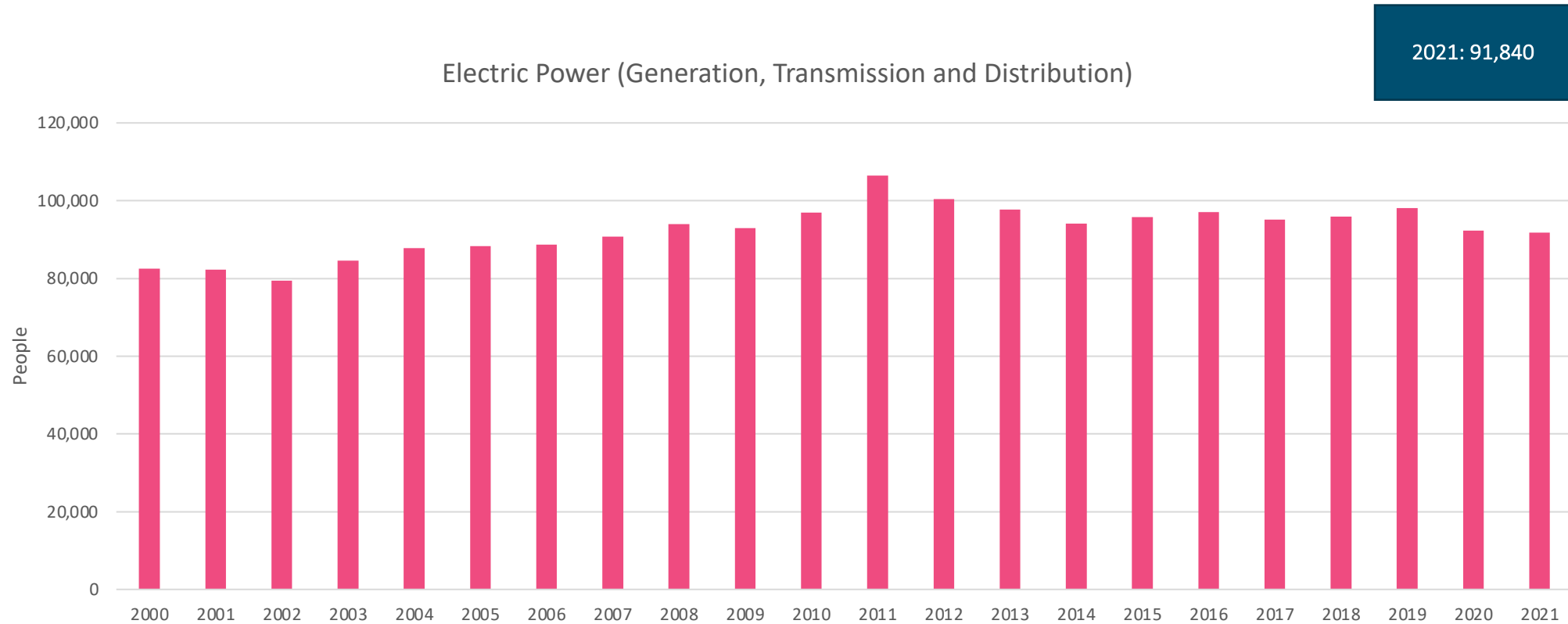
**15 of the largest  
100  
infrastructure  
projects in  
Canada are  
electricity Based  
and valued at  
\$59.9B**

Project Name	Description	Project Owner	Project Type	Location	Value (\$)	Estimated Completion
Site C Clean Energy Project	1,100 MW	BCHYDRO	Hydro	BC	16B	2025
Bruce Power Refurbishment	Refurbishment	Bruce Power	Nuclear	ON	13B	2030
Darlington Nuclear Refurbishment	Refurbishment	OPG/Nalcor Energy	Nuclear	ON	12.8B	2026
Romaine Complex	1,550 MW	Hydro-Québec	Hydro	PQ	7.2B	2022
Wataynikaneyap Transmission Project	1,800 km	Wataynikaneyap Power	Transmission	ON	1.9B	2023
Beauharnois Generating Station	Refurbishment	Hydro-Québec	Hydro	PQ	1.6B	2022
Cascade Power Project	900 MW	Kinetor Resource Corp.	Natural Gas	AB	1.5B	2023
Micoua-Saguenay Transmission Project	262 km	Hydro-Québec	Transmission	PQ	1B	2022
East-West Tie Transmission Project	447 km	NextBridge/NextEra	Transmission	ON	0.78B	2022
Great Plains Power Station	250 MW	SaskPower	Natural Gas	SK	0.76B	2024



Data Source: Renew Magazine Top 100  
Projects List - 2022  
Data Retrieved: August 2022; visual  
created by Electricity Canada

# Industry Labour Statistics in Canada



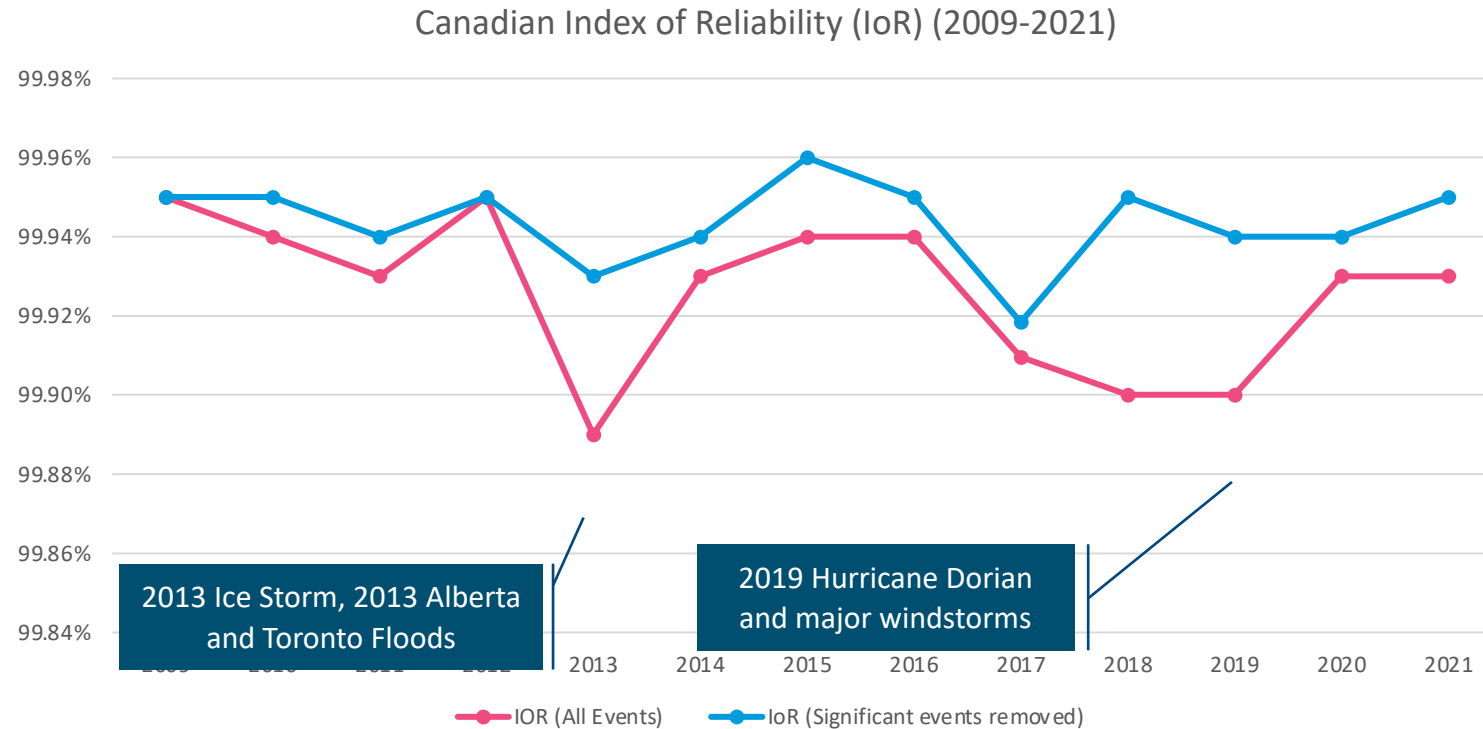
Excludes consultants, vendors and related manufacturers dedicated to the industry.

Staffing at its lowest point since 2007.



Source: Statistics Canada. [Table 36-10-0489-01 Labour statistics consistent with the System of National Accounts \(SNA\), by job category and industry](#)  
Data Retrieved: August 2022; visual created by the Electricity Canada

# Customer Reliability in Canada

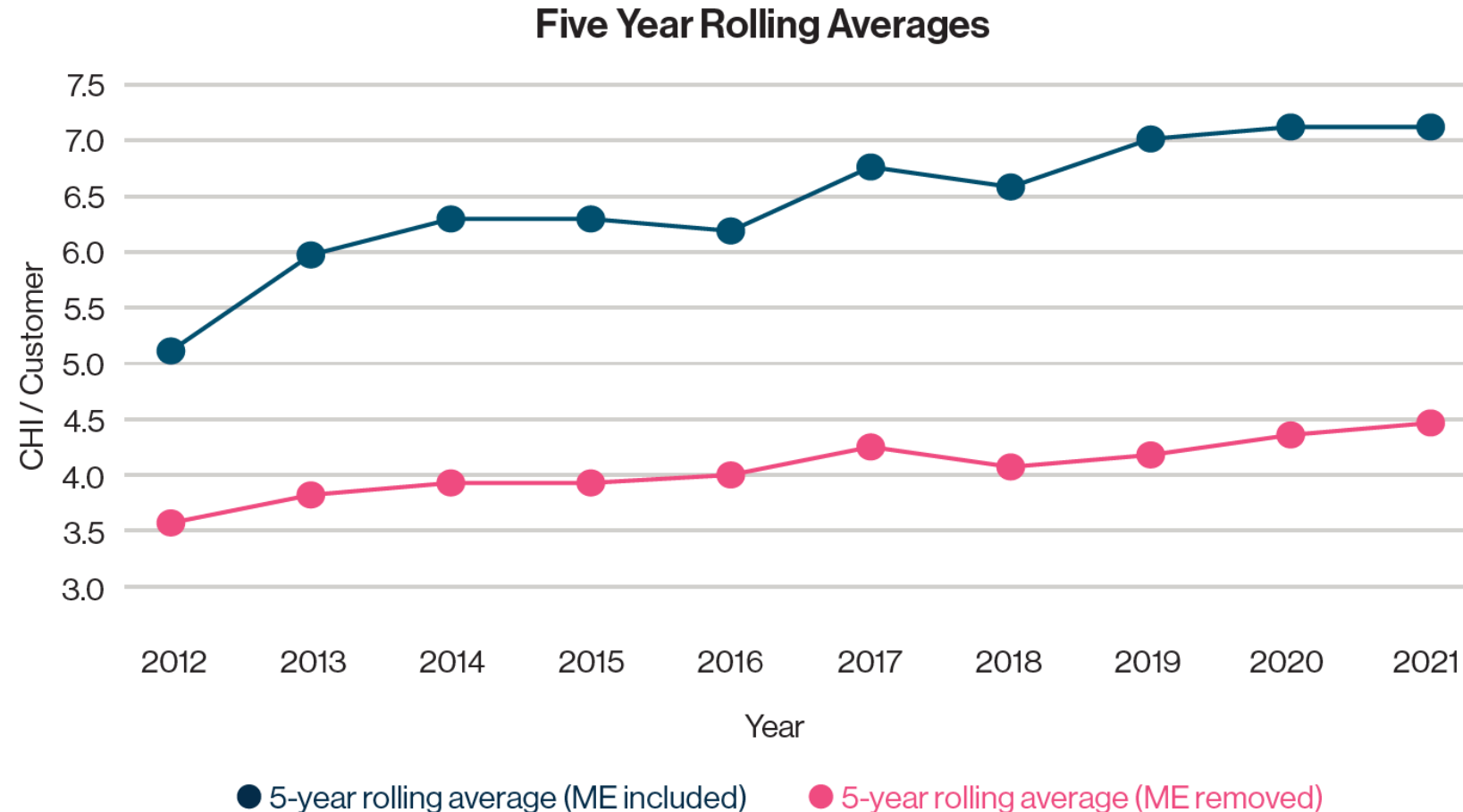


Significant Events are catastrophic events that are outside the control of the utility and impact the Canadian Index.



Source: Electricity Canada, Service Continuity Committee  
Data Retrieved: Aug. 2022; visual created by Electricity Canada

# Severe Weather = Growing Risk



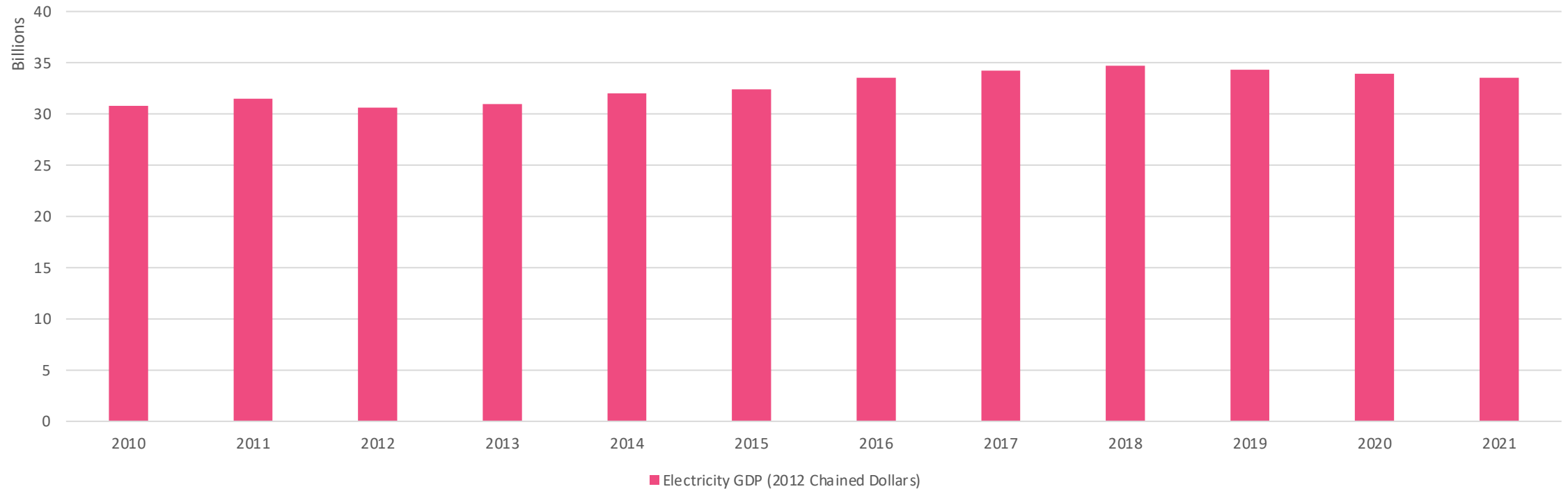
As more and more severe weather events occur, major event interruptions are on the rise. As identified by the growing gap between customer hours of interruption (CHI) for all events and events without major events.



Source: Electricity Canada, Service Continuity Committee  
Data Retrieved: Aug. 2022; visual created by Electricity Canada

# GDP Contribution

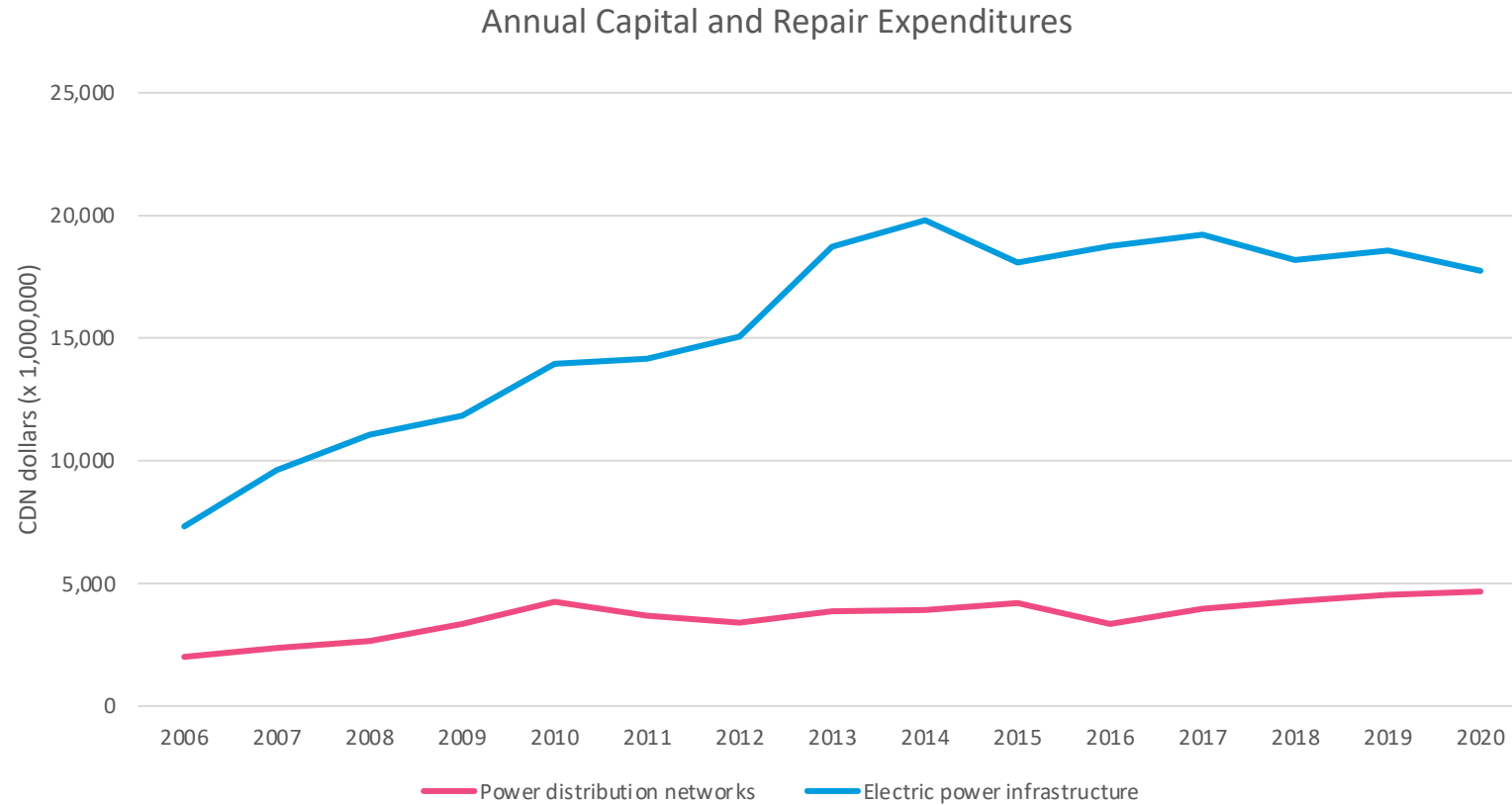
Electric Power(Generation, Transmission, Distribution) to Canada's GDP (2010-2021)



Data Source: Statistics Canada. [Table 36-10-0434-06 Gross domestic product \(GDP\) at basic prices, by industry, annual average, industry detail \(x 1,000,000\)](#)

Data Retrieved: Aug. 2022; visual created by Electricity Canada

# Utility Investments



Data Source: Statistics Canada. [Table 34-10-0063-01 Capital expenditures, non-residential tangible assets, by type of asset and geography \(x 1,000,000\)](#)

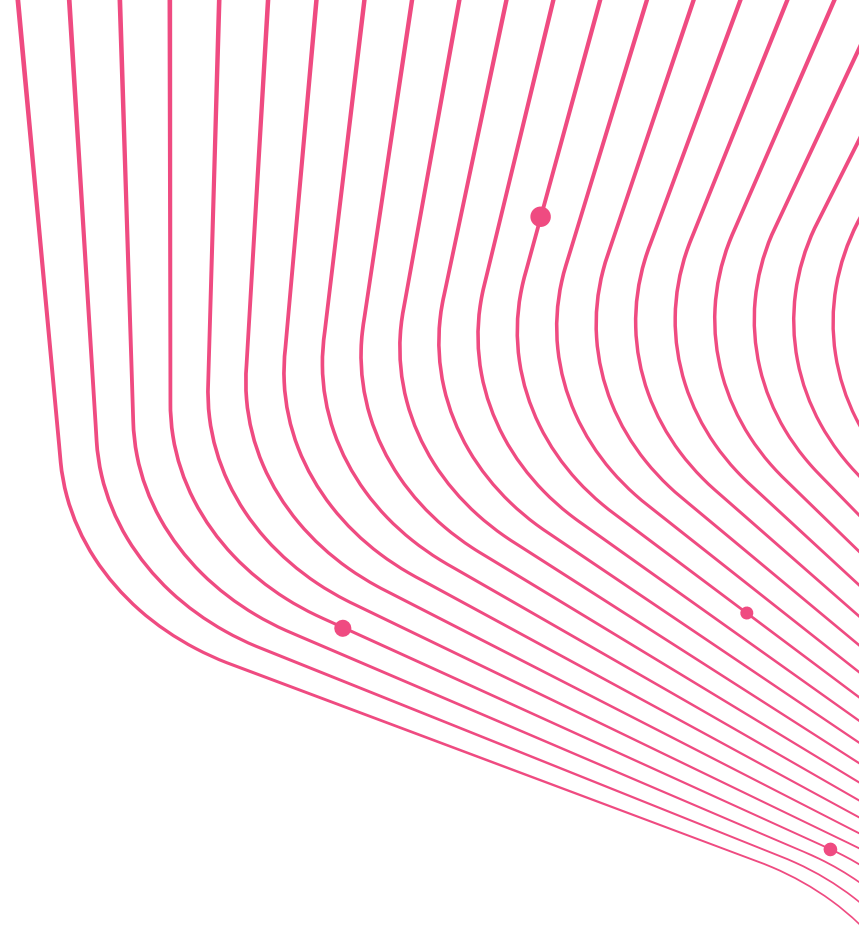
Data Retrieved: Aug. 2022; visual created by Electricity Canada



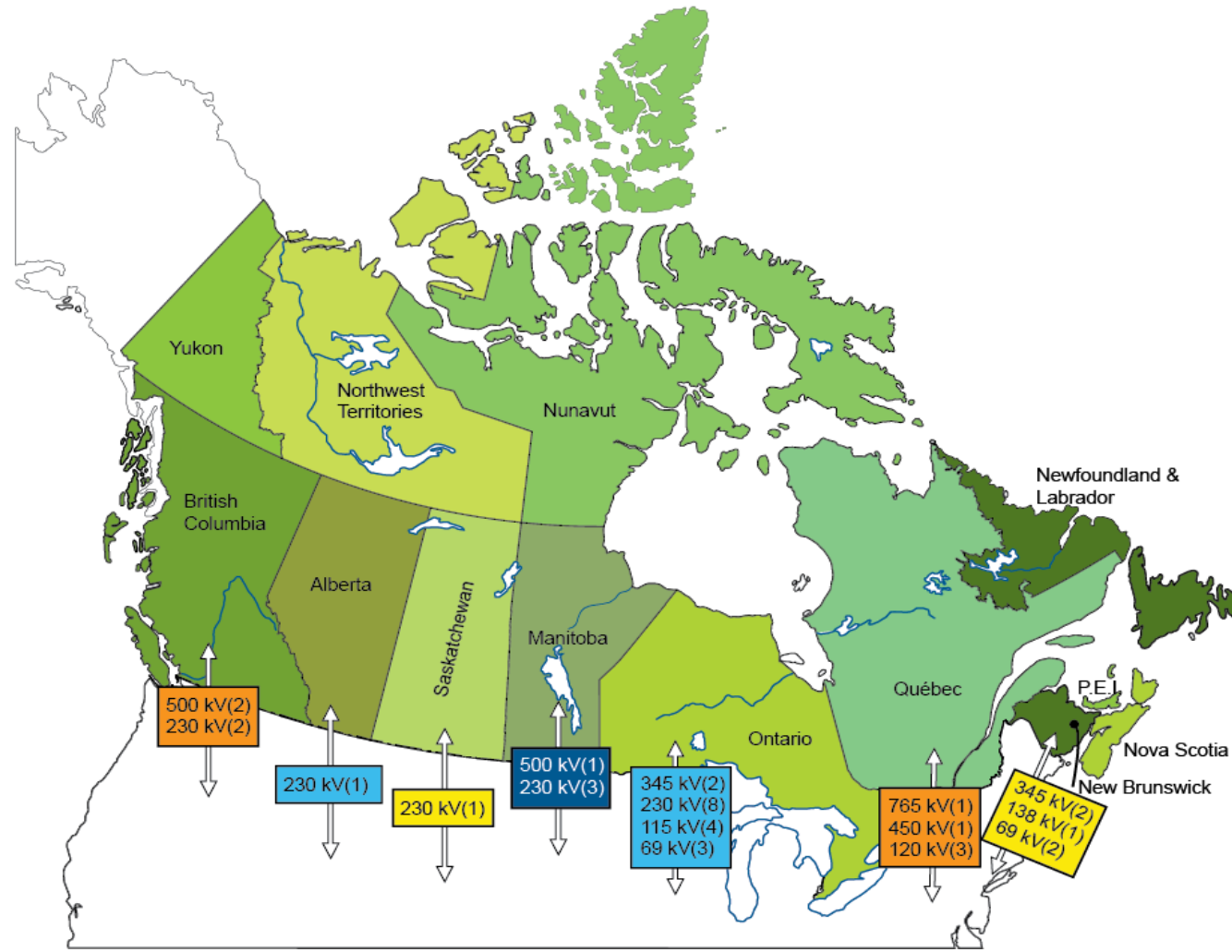
# Trade

Canada and the USA began electricity trading in 1901.

- [Major Canada-U.S. Transmission Connections](#)
- [Canadian Exports-Imports by Region](#)
- [Trade Volume](#)
- [Trade Prices](#)
- [Trade Revenue](#)

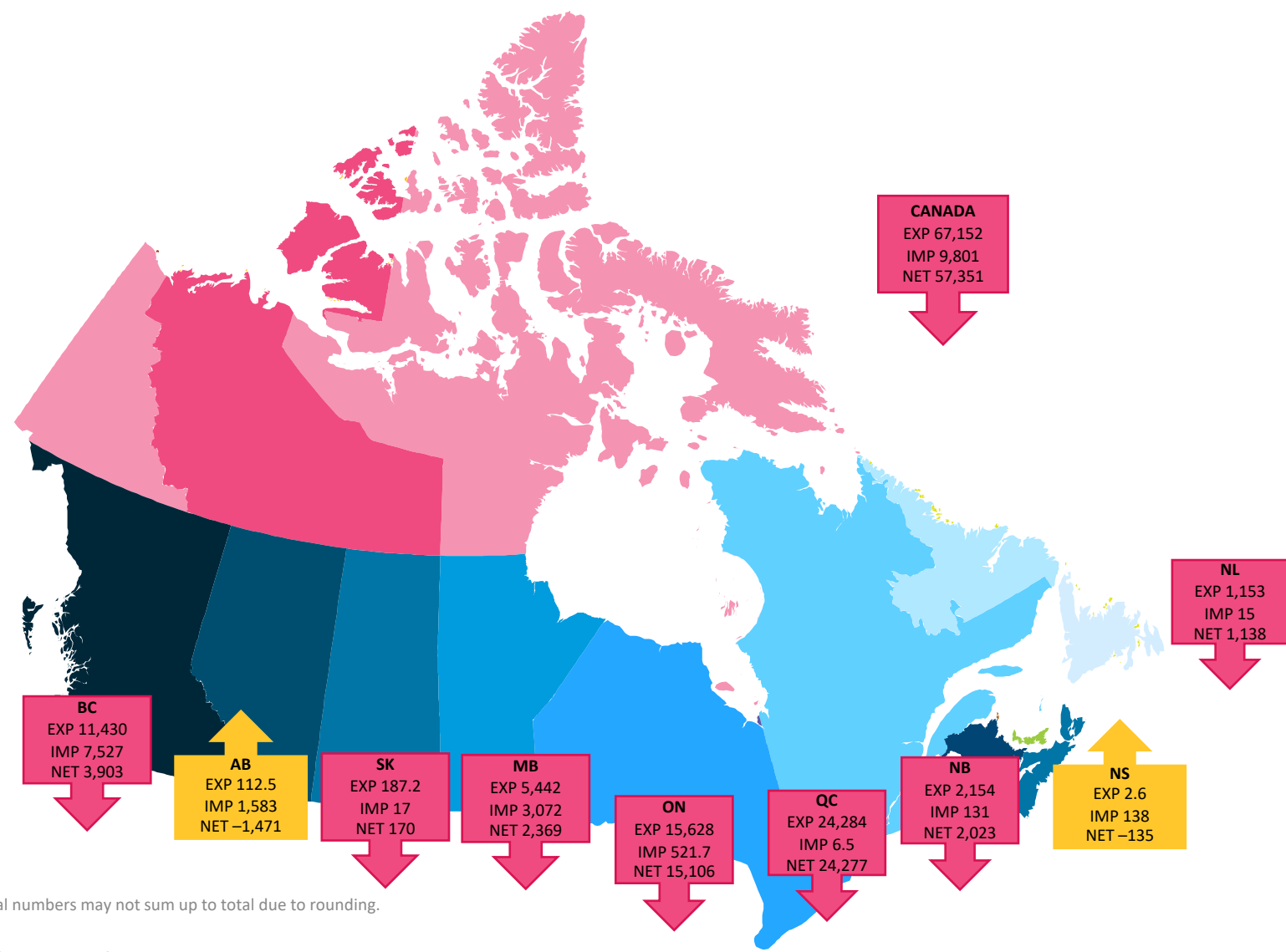


# Major Canada-U.S. Transmission Connections



Data Source: Canada Energy Regulator (CER).  
Data Retrieved: July 2016.

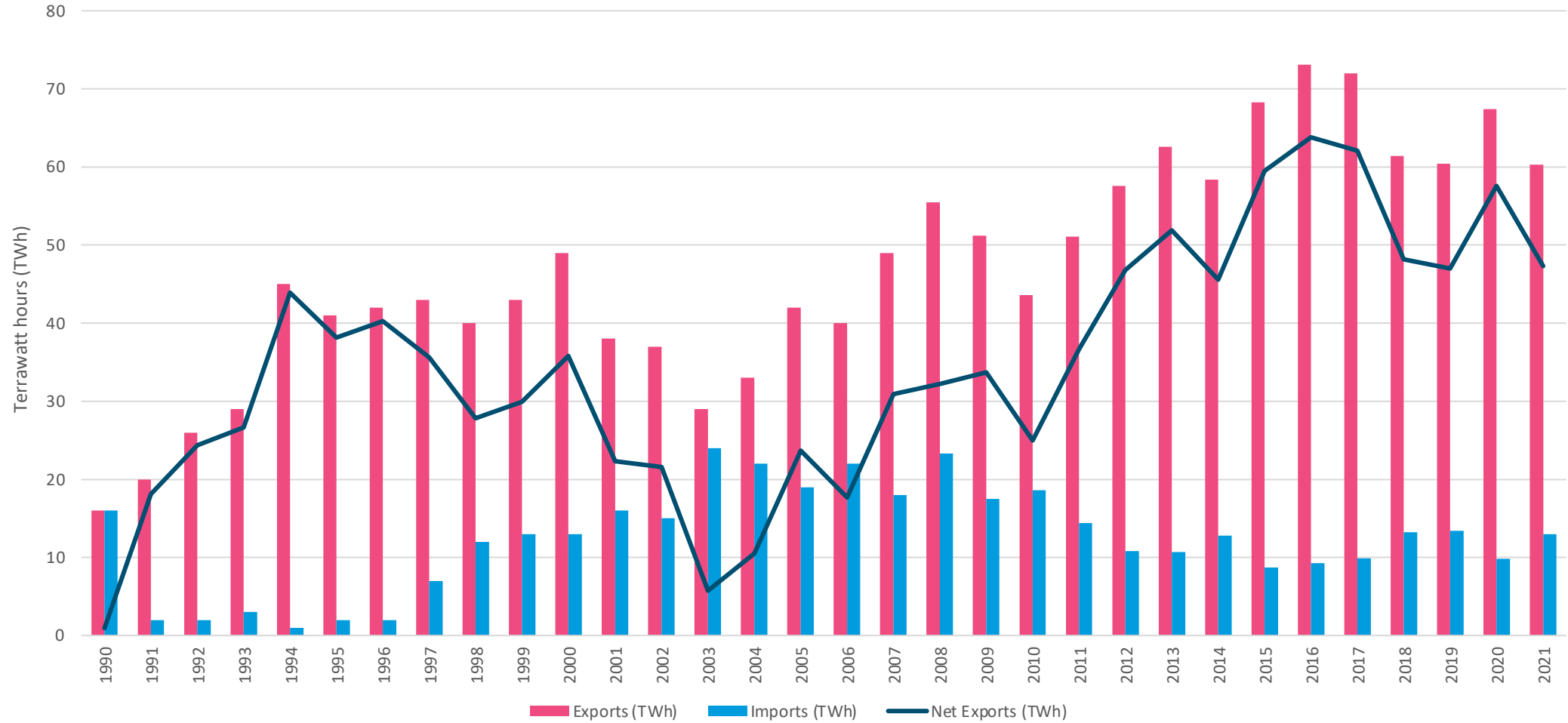
# Canadian Electricity Imports and Exports by Region (GW.h) (2021)



Notes: (1) Data in gigawatt-hours; (2) Provincial numbers may not sum up to total due to rounding.  
Data Source: Canada Energy Regulator (CER).  
Data Retrieved: Aug. 2022; visual created by Electricity Canada.

# Trade Volume

Canada-U.S. Electricity Trade Volume (1990-2021)

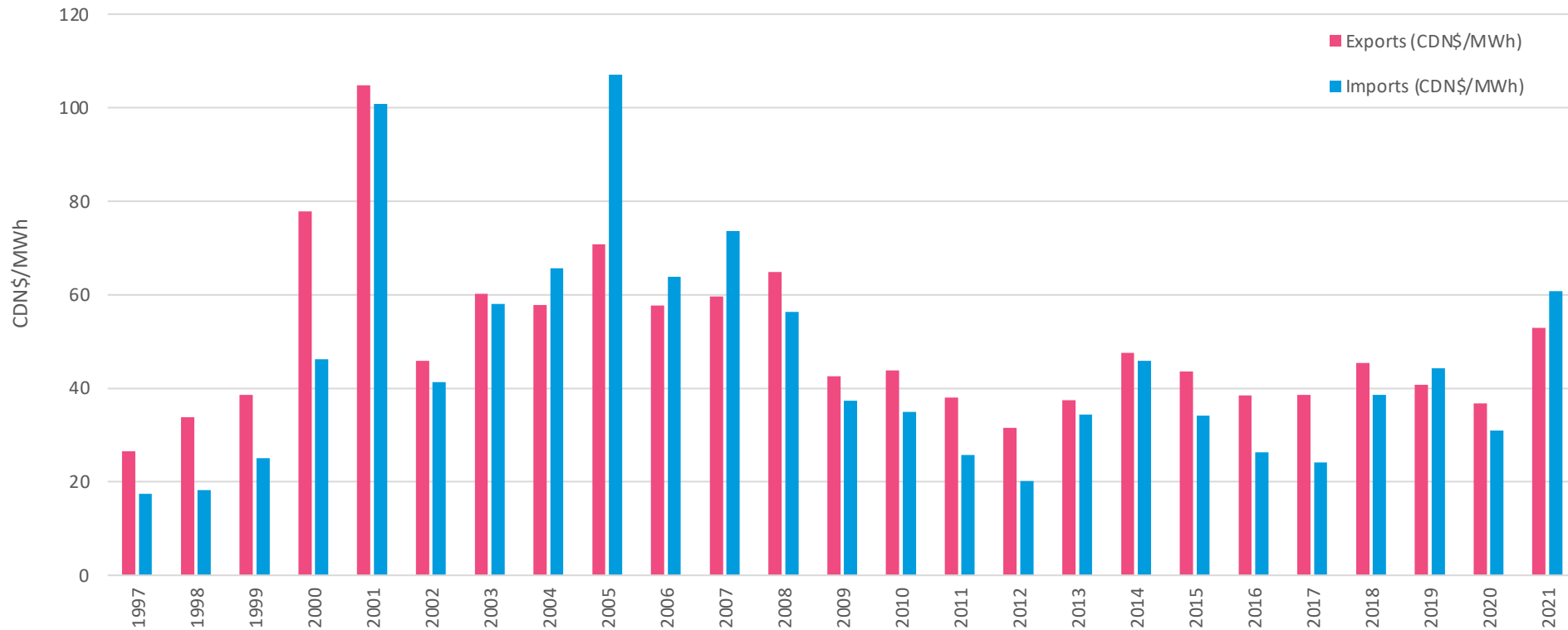


Data Source: Canada Energy Regulator (CER).

Data Retrieved: Aug. 2022; visual created by Electricity Canada.

# Trade Prices

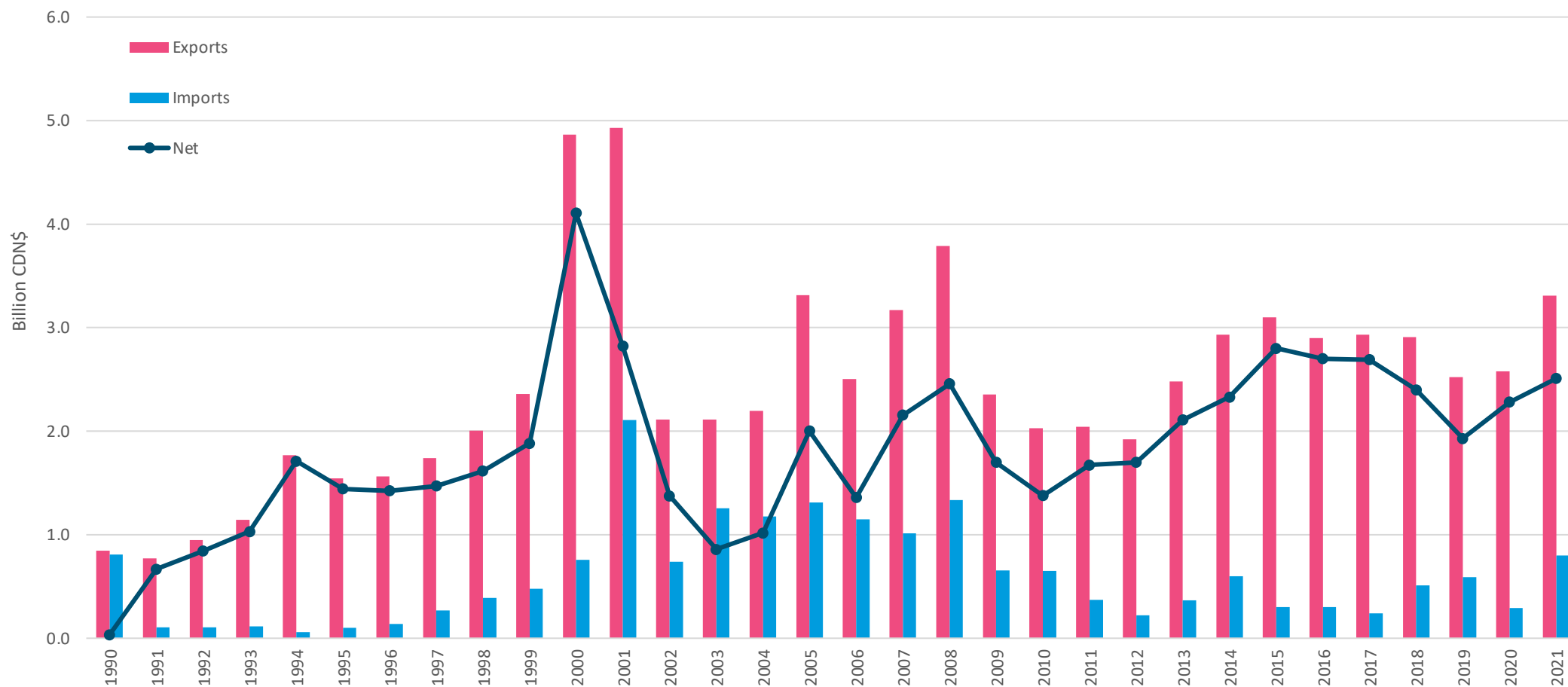
Canada - U.S. Electricity Trade Prices (1997-2021)



Data Source: Canada Energy Regulator (CER).  
Data Retrieved: Aug. 2022; visual created by Electricity Canada.

# Trade Revenue

Canada - U.S. Trade Revenue (1990 -2021)



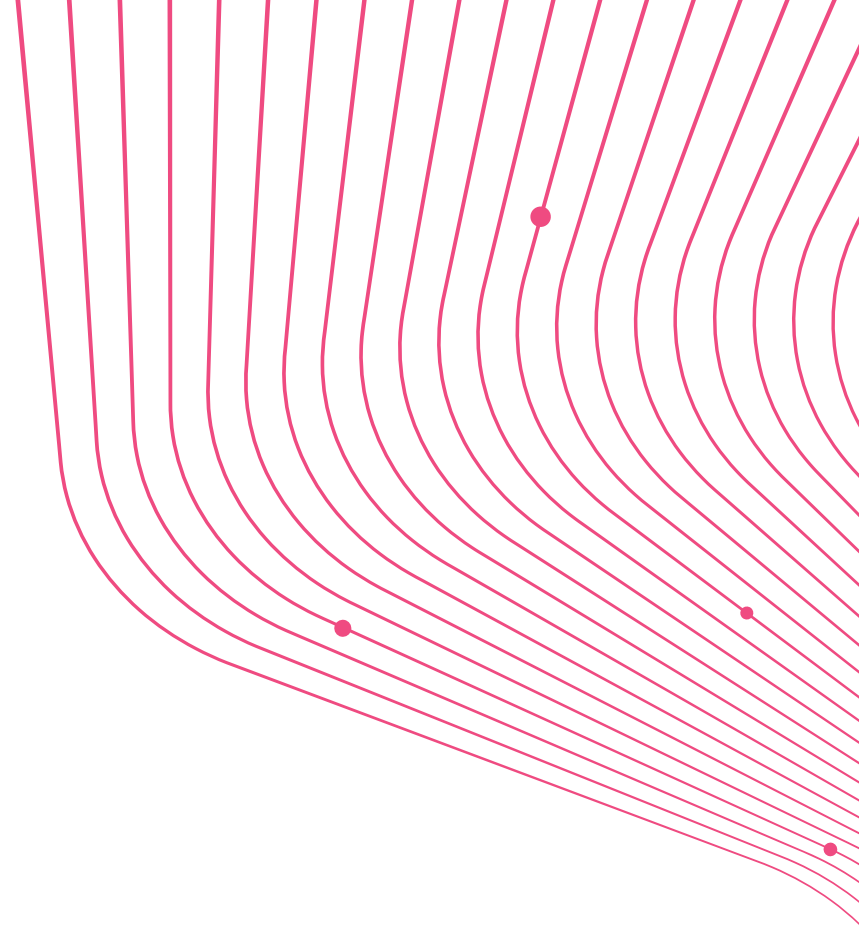
Data Source: Canada Energy Regulator (CER).

Data Retrieved: August 2022; visual created by Electricity Canada

# Supply and Demand

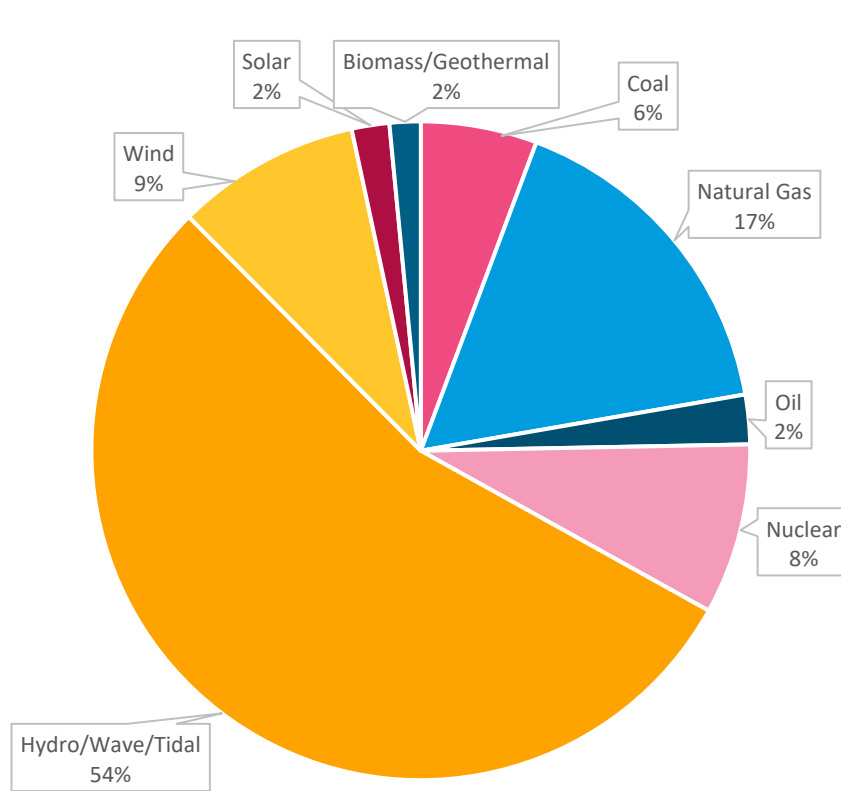
The electricity industry is over 80% non-emitting.

- [Generation Capacity \(Canada vs. United States\)](#)
- [Electricity Demand by Sector in Canada, \(1990-2020 Trend\)](#)
- [Electricity Demand by Sector in Canada \(Stacked % bar chart\)](#)
- [Electricity Generation by Fuel Type, \(1995-2020 Trend\)](#)
- [Supply, Industry and Utilities by Province in TWh \(2020\)](#)



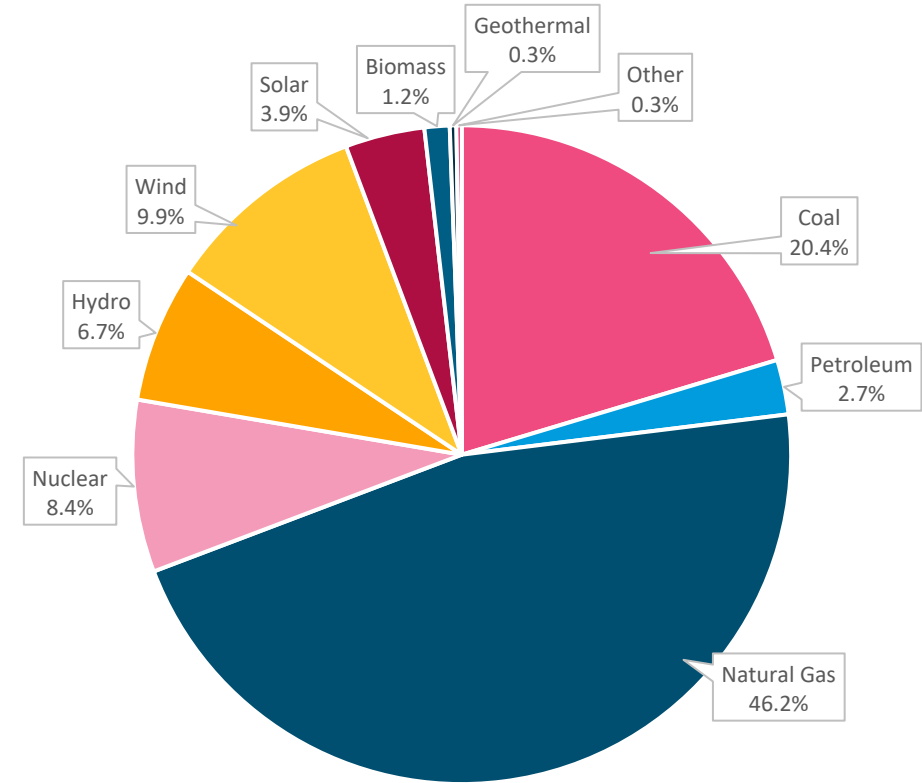
# Generating Capacity

Canada, 2020



Generating Capacity  
147 GW

United States, 2020



Generating Capacity  
1,194 GW

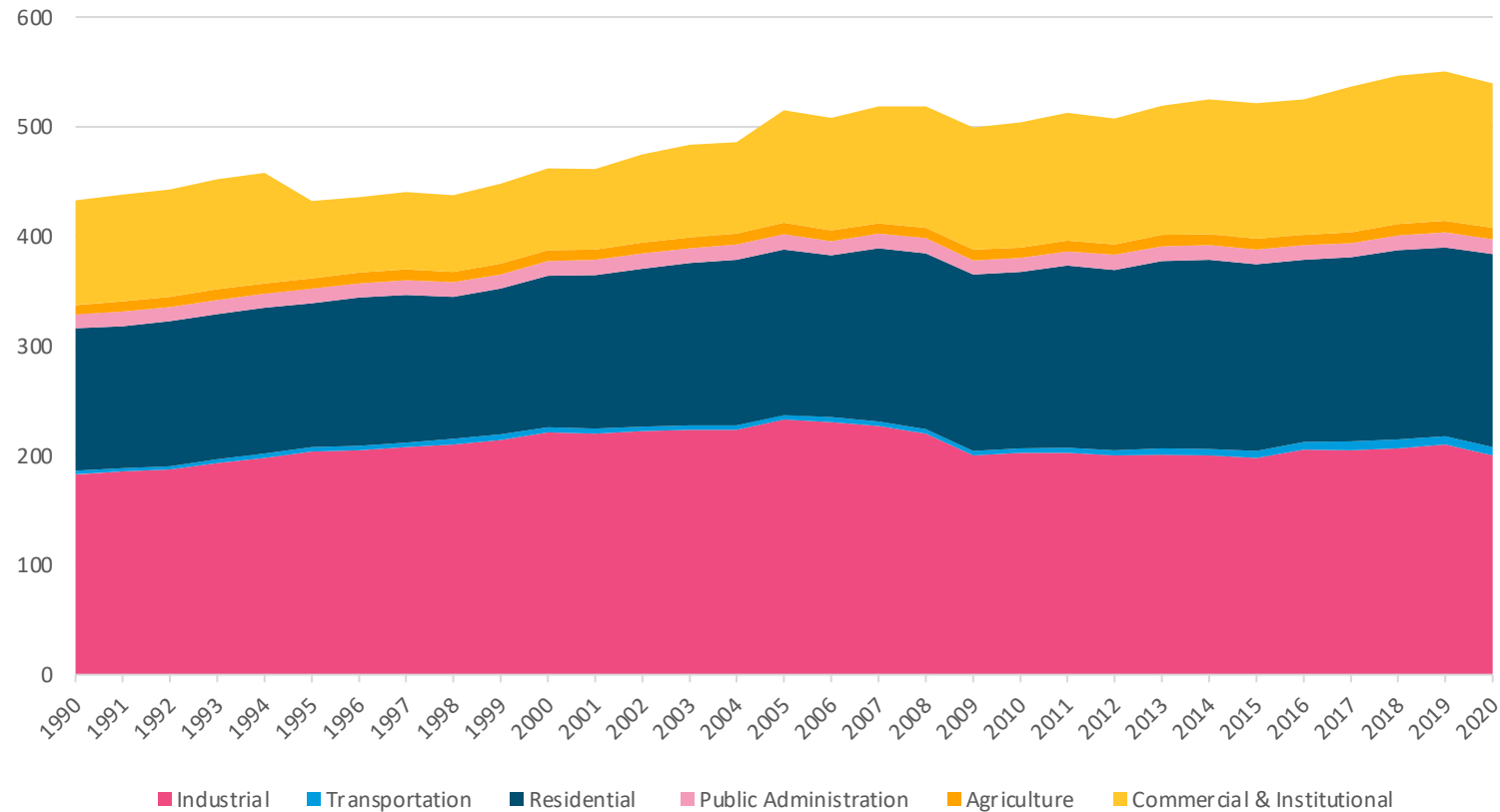


Data Source: Canadian data from Statistics Canada, Table 25-10-0022-01; U.S. data from the U.S. Energy Information Administration.  
Data Retrieved: Aug. 2022.; Visual created by Electricity Canada



# Electricity Demand by Sector in Canada, 1990 -2020

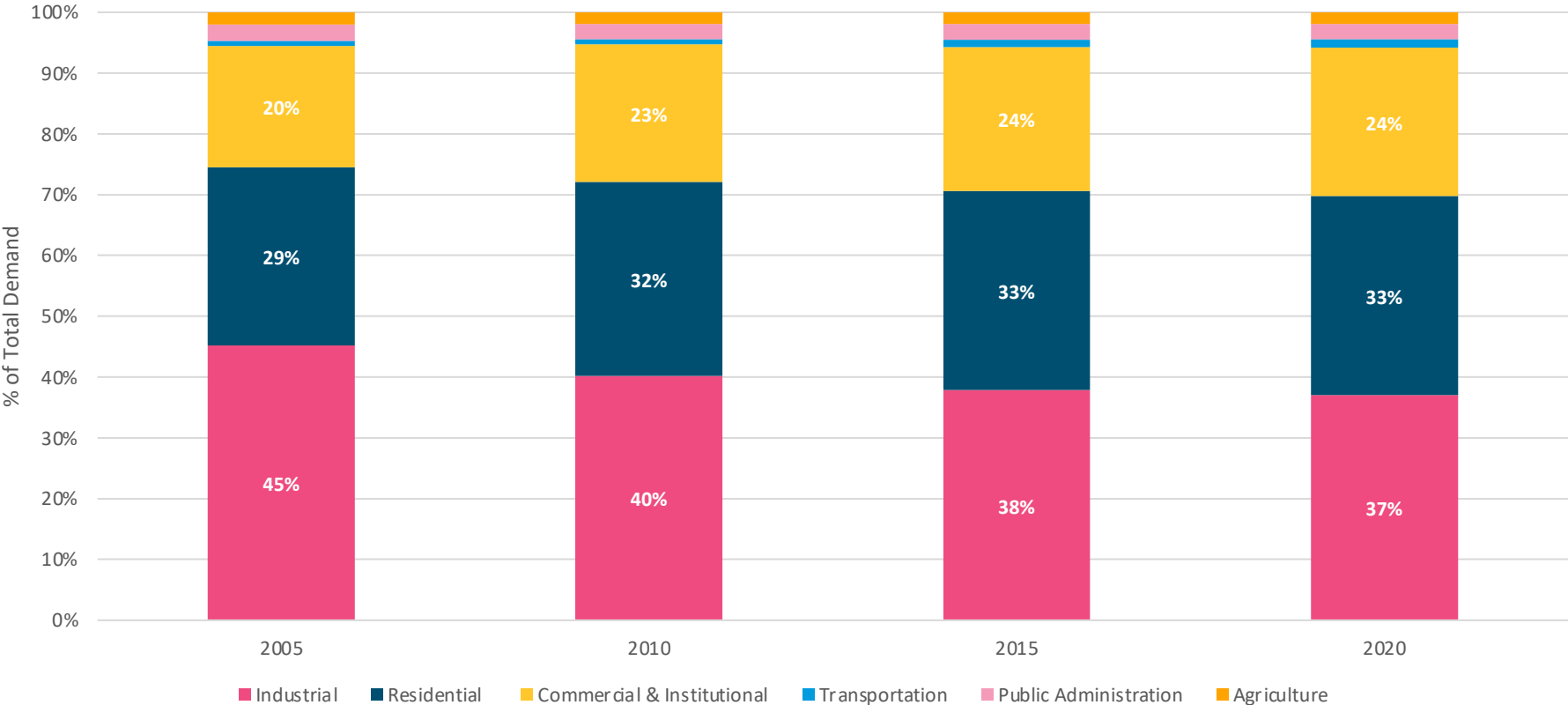
Total Electricity Demand in Canada for 2020 = 539.19 TWh



Data Source: Statistics Canada, Table 25-10-0030-01.  
Data Retrieved: Aug. 2022; Visual created by Electricity Canada.

# Electricity Demand in Canada by Sector

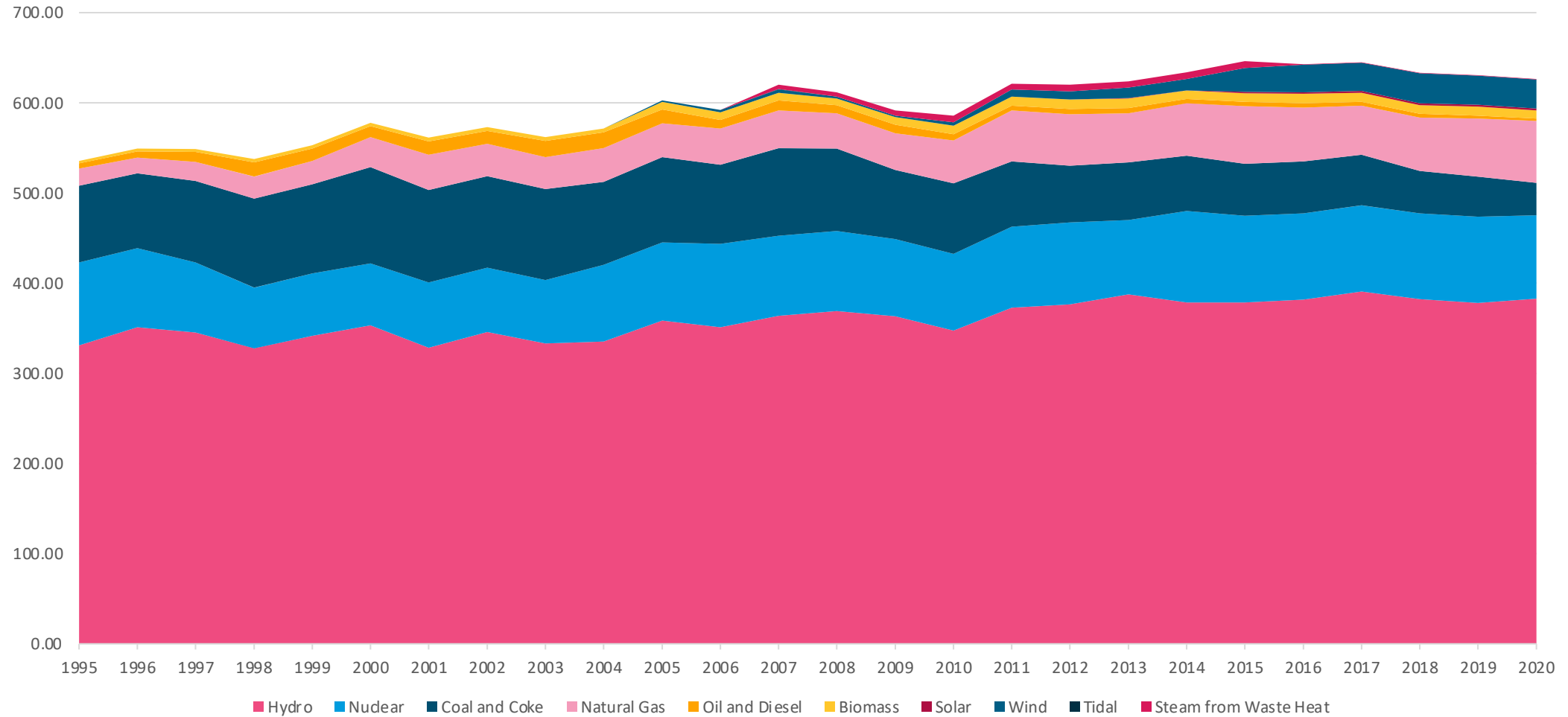
(sectoral demand as a share of total demand)



Data Source: CEA calculations based on Statistics Canada data, Table 25-10-0030-01.  
Data Retrieved: Aug. 2022; Visual created by Electricity Canada.

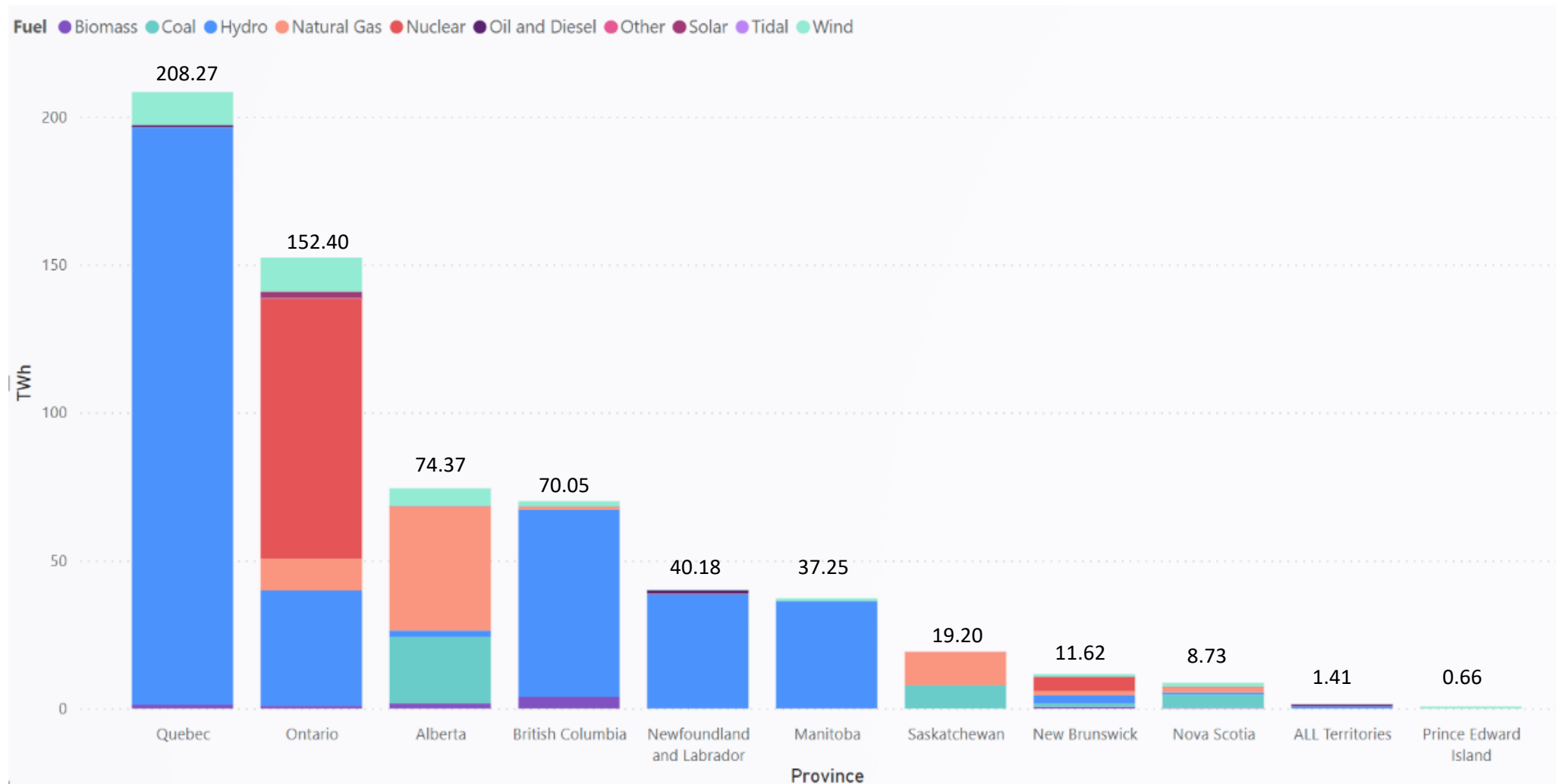
# Electricity Generation by Fuel Type, 1995-2020

(Electric Utilities and Industry)



Data Source: Statistics Canada, Tables 25-10-0020-01 and 25-10-0028-01  
Data Retrieved: Aug. 2022.; visual created by Electricity Canada

# Supply Industries and Utilities by Province

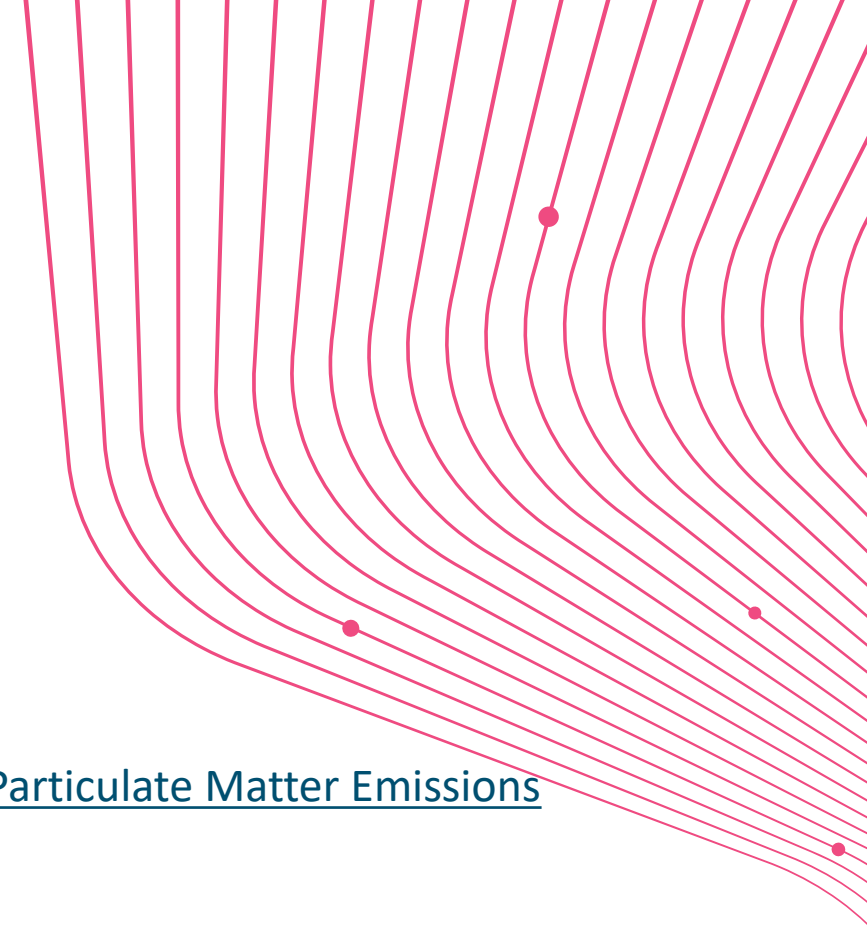


Data Source: StatsCan CANSIM Table 127-0001, 128-0014, 127-0007  
Data Retrieved: Aug 2022; visual created by Electricity Canada

# Environmental Sustainability

The environment is **everything** that isn't me.  
Albert Einstein

- [Low Emissions Technologies](#)
- [Nitrogen Oxide Emissions, Sulphur Oxide Emissions, Mercury Emissions, Particulate Matter Emissions](#)
- [GHG Equivalent Emissions from the Electricity Industry](#)
- [Emissions by Economic Sector](#)
- [Emission by Economic Sector, Trend](#)
- [Canadian Coal Fleet Profile by 2040](#)
- [U.S. Greenhouse Gas Emissions](#)

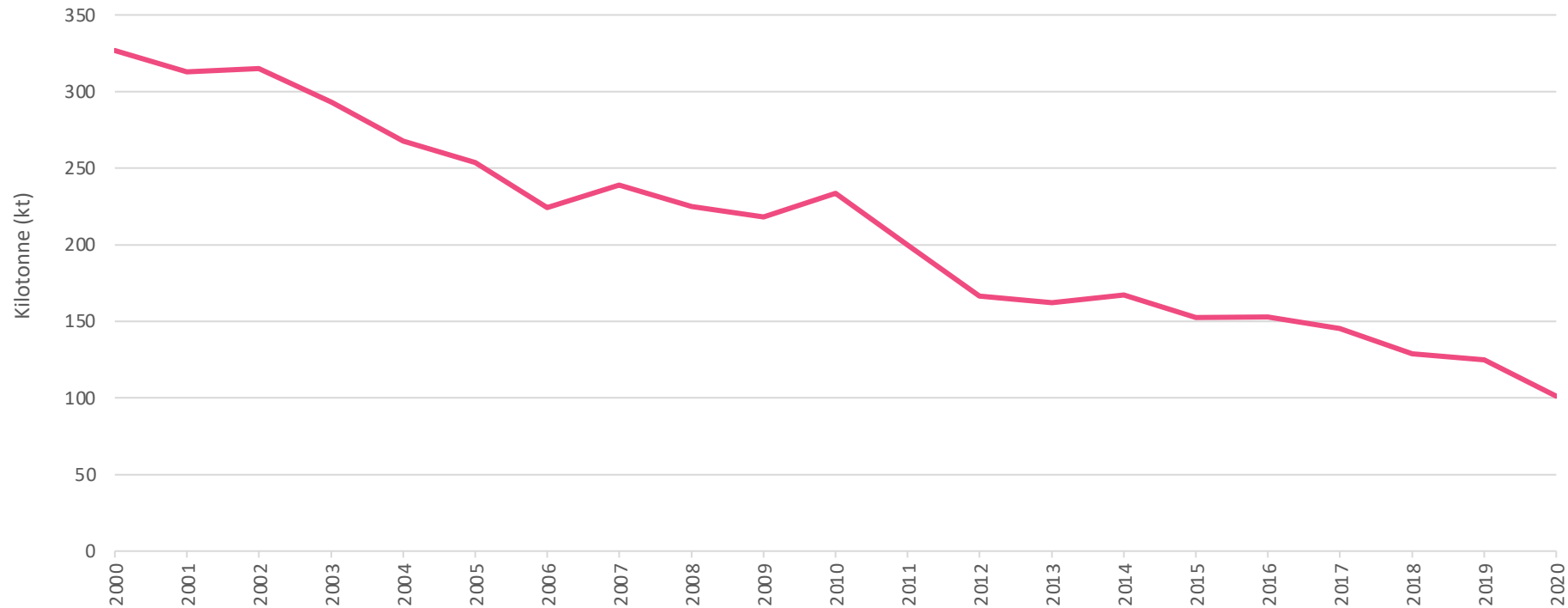


# Low Emission and Sustainable Technologies

Resource	Advantages	Challenges
Wind Power	Needing no fuel, after the initial capital investment wind has a near-zero marginal cost of energy and essentially zero emissions or waste products from operation.	Electricity production from wind is variable and requires additional equipment to manage power quality. Potential impacts on avian populations, as well as noise, visual and land use concerns.
Small Hydro	There are relatively low capital costs, many potential sites in Canada, well established technology. Small hydro is able to meet small incremental capacity needs, with near-zero GHG emissions and good reliability characteristics.	Regulatory approval and gaining access to the grid can be costly, time consuming and uncertain. There can be significant opposition to new development, and there are impacts on fish, wildlife and local water systems.
Biomass	Biomass fuel – including landfill gas, wood pellets, forestry slash and various waste products – can be burned to create electricity. Where fuel sources are renewable, the GHG emissions can be negligible, and there is potential for negative (below-zero) GHG emissions where carbon capture, utilization and sequestration are employed.	High capital equipment and fuel costs. Significant investments may be needed to build infrastructure to supply sufficient biomass. Large biomass generators require a large land area to supply enough biomass for continuous operation.
Geothermal Energy	Reliable source of power, low fuel and operating costs, clean and renewable source of energy. Very low land requirements, and feasibility studies have shown promising sites in many provinces and territories.	Geothermal is relatively new in Canada, with few projects under development. Technical challenges remain. Depending on where the resource is located, connecting to the grid can be difficult.
Solar Photovoltaic (PV)	Needing no fuel, after the initial capital investment solar PV has a near-zero marginal cost of energy and essentially zero emissions or waste products from operation. Costs for the equipment continue to decline.	Times of peak sunshine often do not correspond with times of peak electricity demand, especially in winter. Grid connections can be problematic, and additional equipment is needed to mitigate power quality problems when connecting to a grid.
Ocean Energy	Tides and wave energy can provide predictable energy with little to no associated greenhouse gas emissions. Canada has a large coastline with many potential sites.	The technology has not yet reached commercial scale. There is the potential to impact marine ecosystems. While the energy is predictable, it is not available on-demand.
Fossil Fuel	Modern fuel-based combustion technologies (such as natural gas, coal, and oil) are well suited for on-demand electricity generation, and complement variable renewables like wind and solar. Fuel supply chains are secure.  For high-utilization (“baseload”) units, carbon capture, utilization and sequestration (CCUS) can be added to prevent climate change-inducing carbon dioxide emissions from entering the atmosphere.	Fossil fuel development, extraction and use has environmental consequences, including contributing to climate change.  CCUS is not feasible for every type of thermal generating unit. CCUS projects can have high up-front costs and require infrastructure to transport and sequester CO <sub>2</sub> in products or in appropriate geological formations.
Fission	Existing units provide large amounts of safe, reliable baseload electricity with little to no carbon emissions. New designs for small modular reactors (SMRs) promise greater flexibility and lower cost. Fuel supply chains are secure.	High up-front capital costs for existing large units. Spent fuel requires storage and eventual disposal.



# Nitrogen Oxide (NOx) Emissions Canadian Electricity Sector, 2000-2020

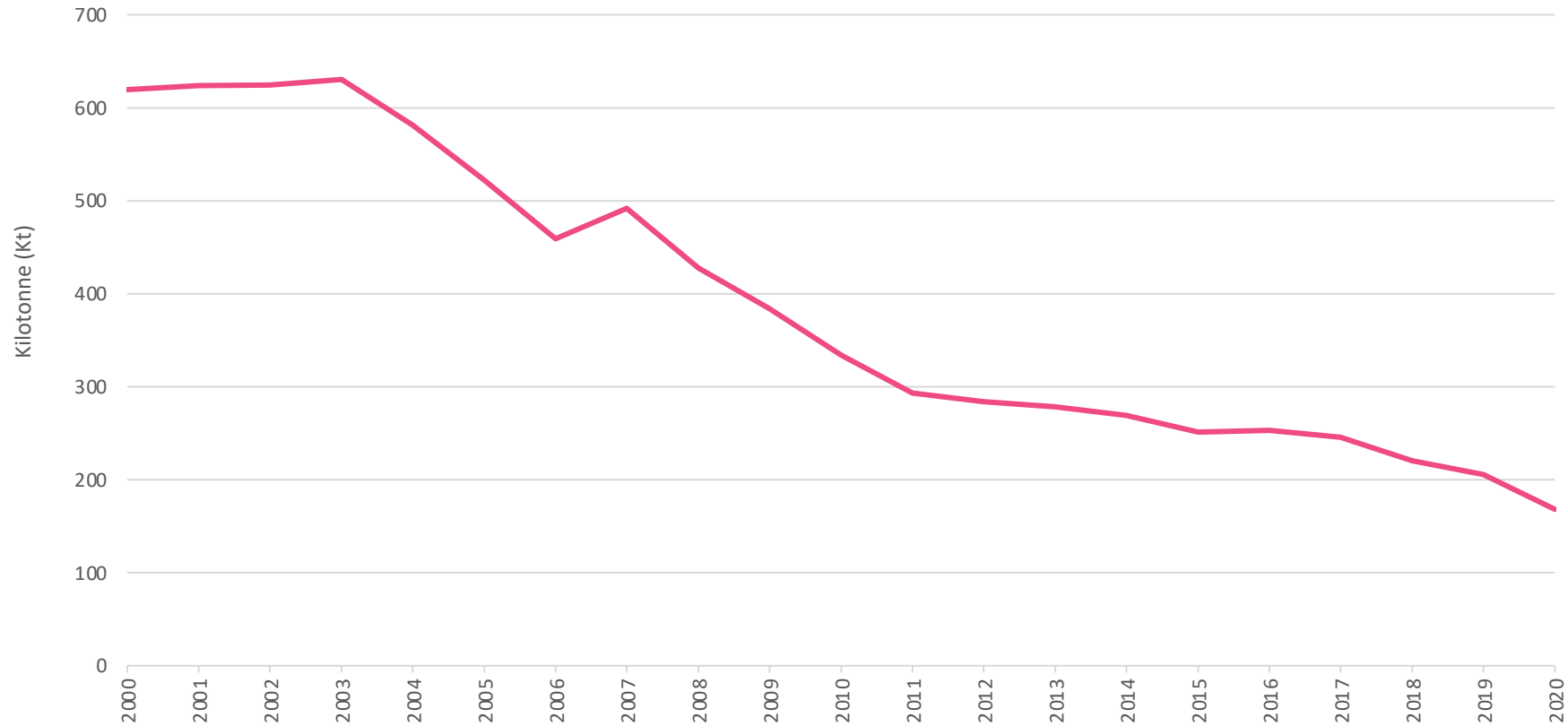


Since 2000, the Canadian electricity industry has reduced its NOx emissions by 69%.



Data Source: Environment and Climate Change Canada, Air Pollutant Emissions Database.  
Data Retrieved: August 2022; visual created by Electricity Canada.

# Sulphur Oxide (SOx) Emissions Canadian Electricity Sector, 2000-2020



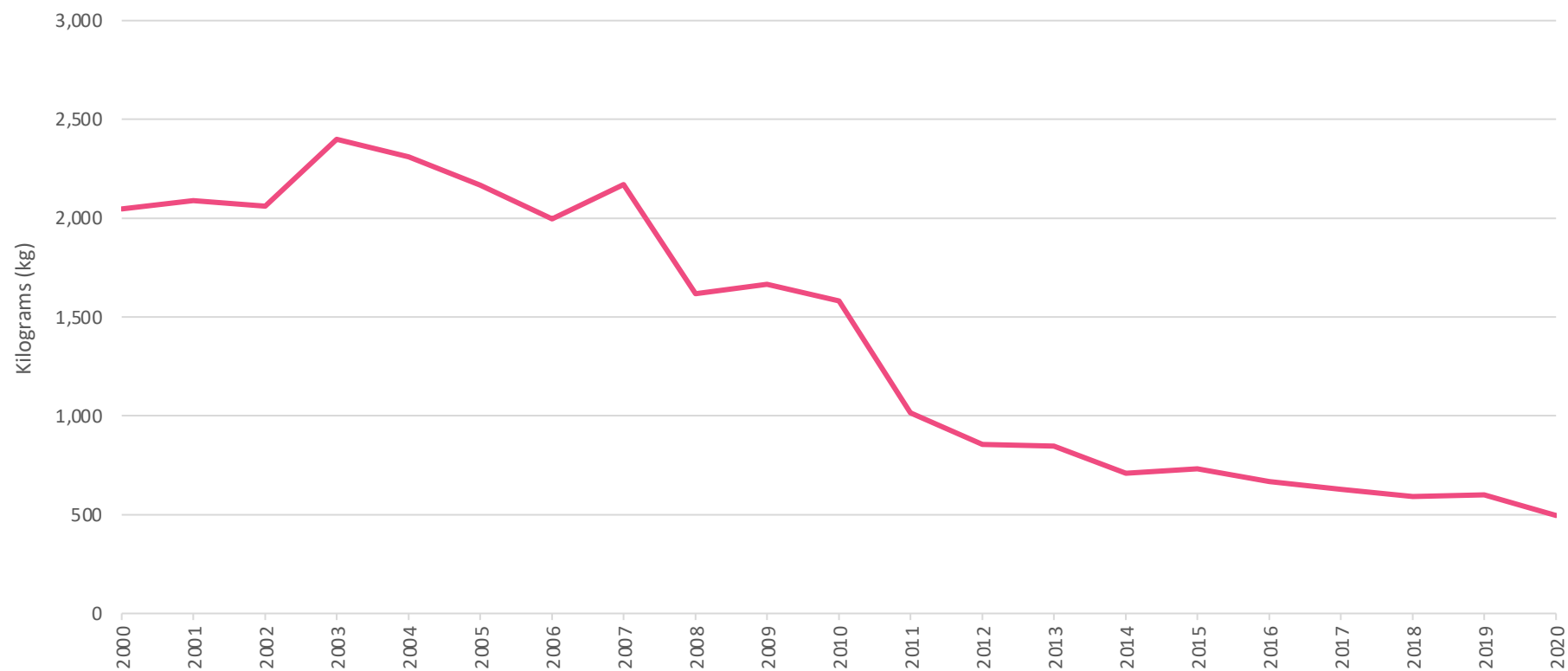
Since 2000, the Canadian electricity industry has reduced its SOx emissions by 73%.



Data Source: Environment and Climate Change Canada, Air Pollutant Emissions Database.  
Data Retrieved: August 2022.; visual created by Electricity Canada.



# Mercury (Hg) Emissions Canadian Electricity Sector, 2000-2020

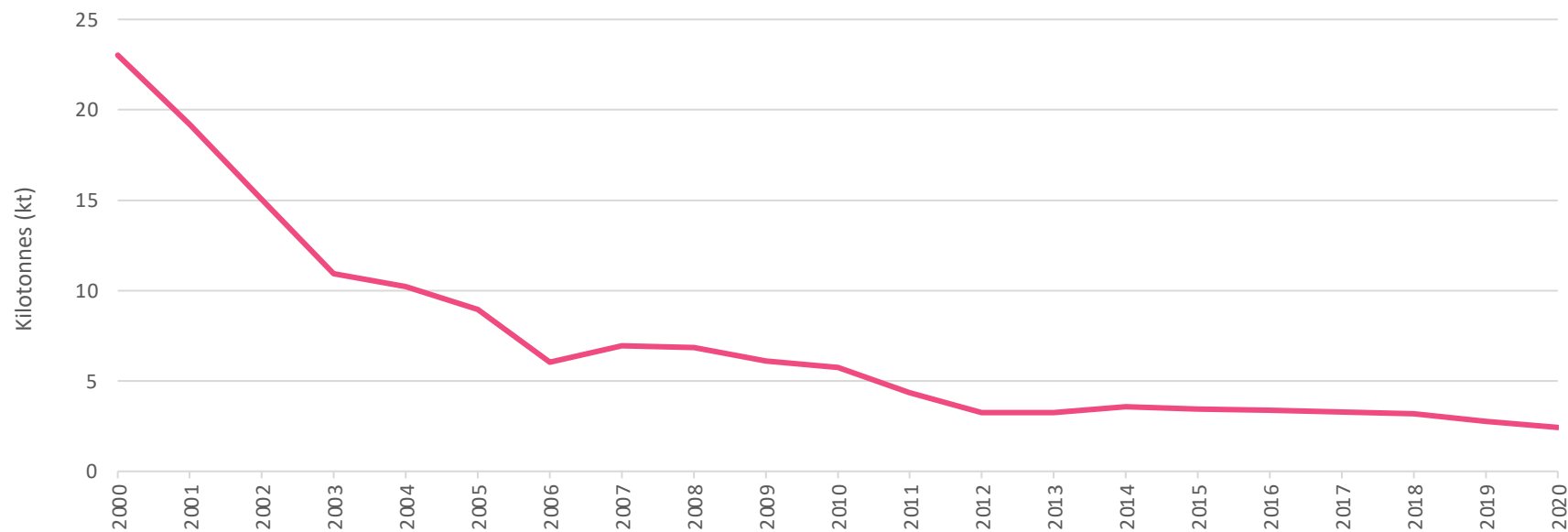


Since 2000, the Canadian electricity industry has reduced its Hg emissions by 76%.



Data Source: Environment and Climate Change Canada, Air Pollutant Emissions Database.  
Data Retrieved: August 2022; visual created by Electricity Canada.

# Particulate Matter<sub>2.5</sub> Emissions Canadian Electricity Sector, 2000-2020

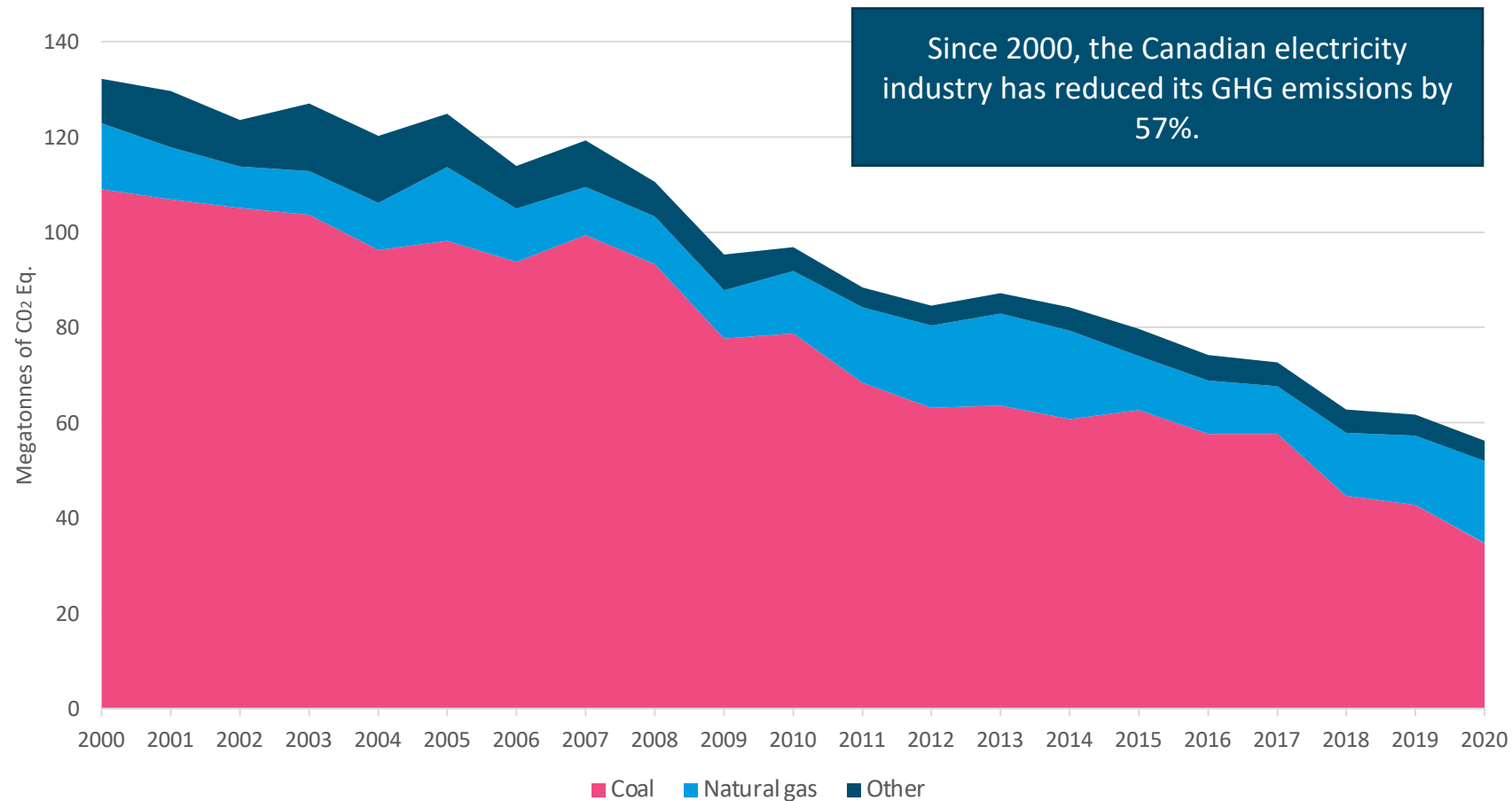


Since 2000, the Canadian electricity industry has reduced its particulate matter emissions by 89%.



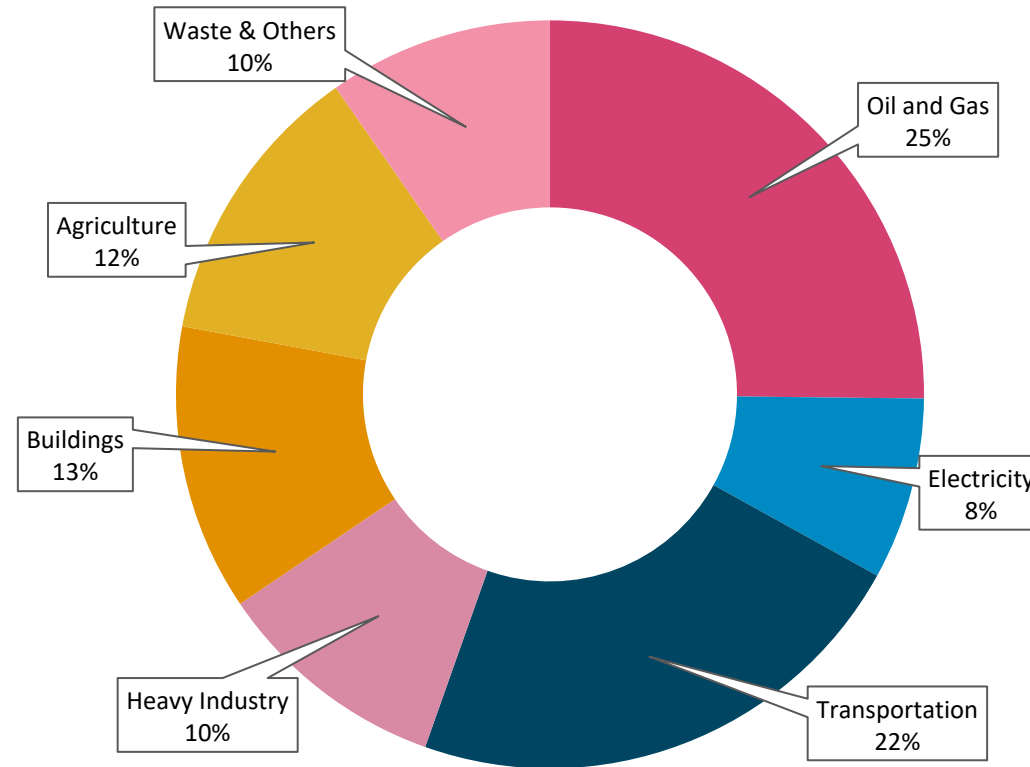
Source: Environment and Climate Change Canada, Air Pollutant Emissions Database  
Data Retrieved: August 2022; visual created by Electricity Canada.

# Greenhouse Gas (GHG) Emissions Canadian Electricity Sector, 2000-2020



Data Source: Environment and Climate Change Canada, Air Pollutant Emissions Database.  
Data Retrieved: Aug. 2022; visual created by Electricity Canada.

# Greenhouse Gas (GHG) Emissions by Economic Sector in Canada, 2020

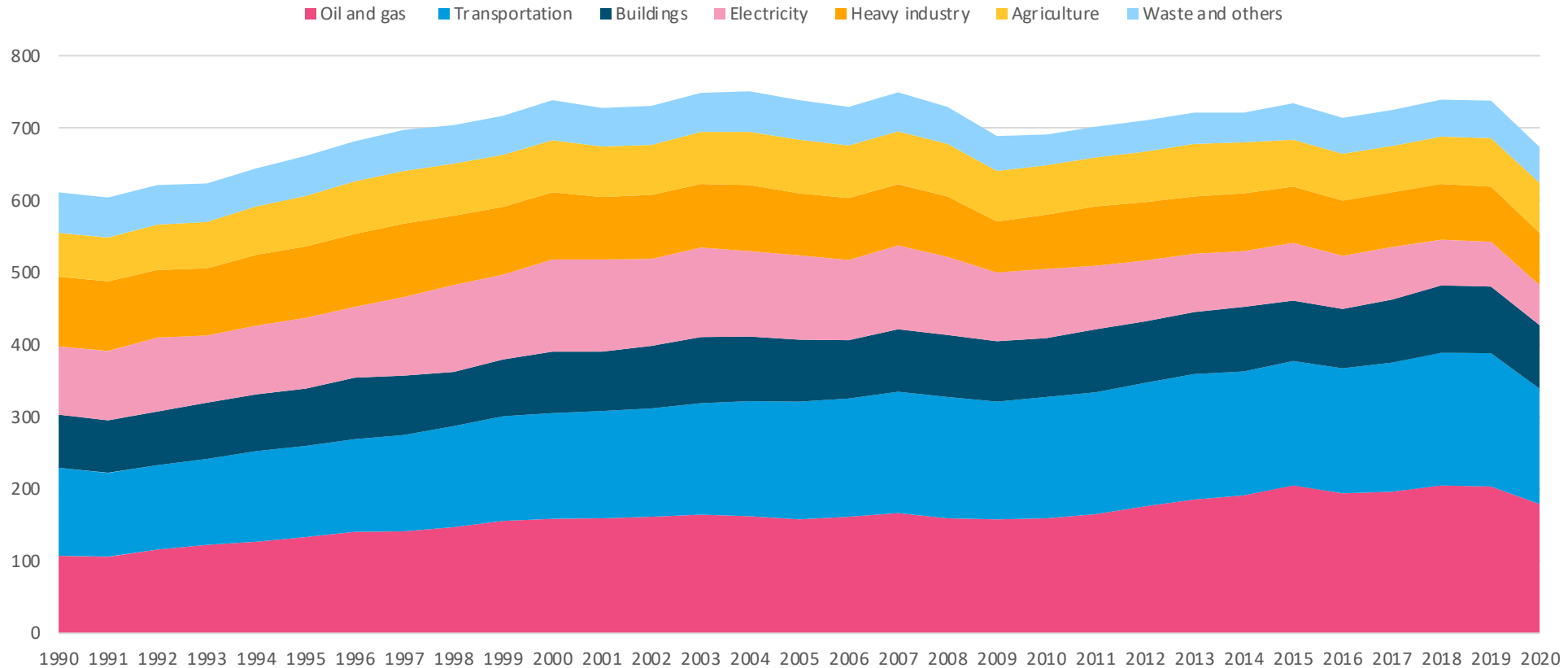


In 2020, GHG emissions in Canada totaled 711 million tonnes.



Data Source: Environment and Climate Change Canada, Air Pollutant Emissions Database.  
Data Retrieved: August 2022; visual created by Electricity Canada.

# Greenhouse Gas Emissions by Canadian Economic Sector (1990 – 2020)



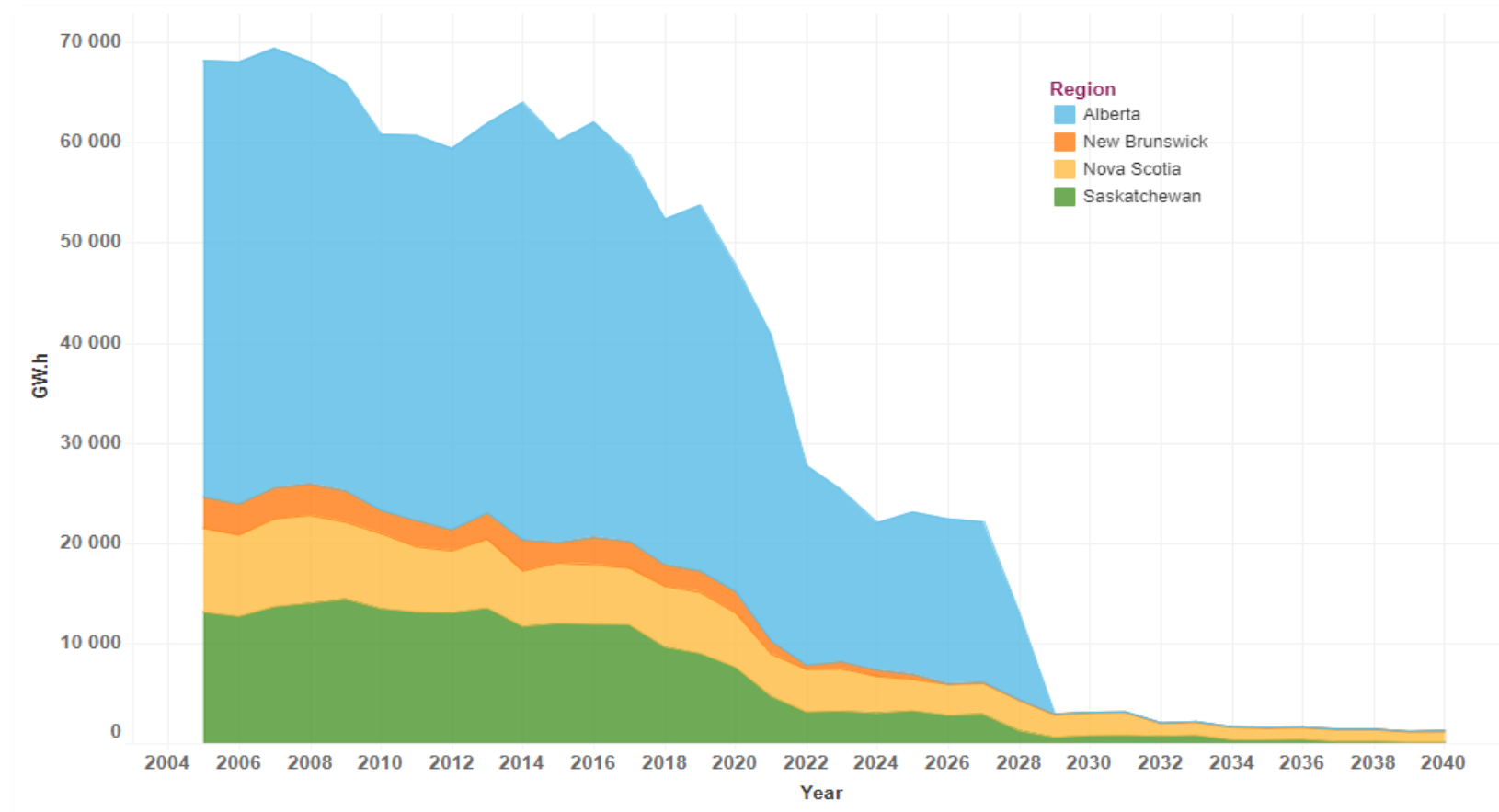
In 2020, GHG Emissions by Sector totaled 673 Mt CO<sub>2</sub> eq.



Data Source: Environment and Climate Change Canada. 2022. National Inventory Report.  
Data Retrieved: August 2022; visual created by Electricity Canada.

# Coal Fleet Profile (MW)

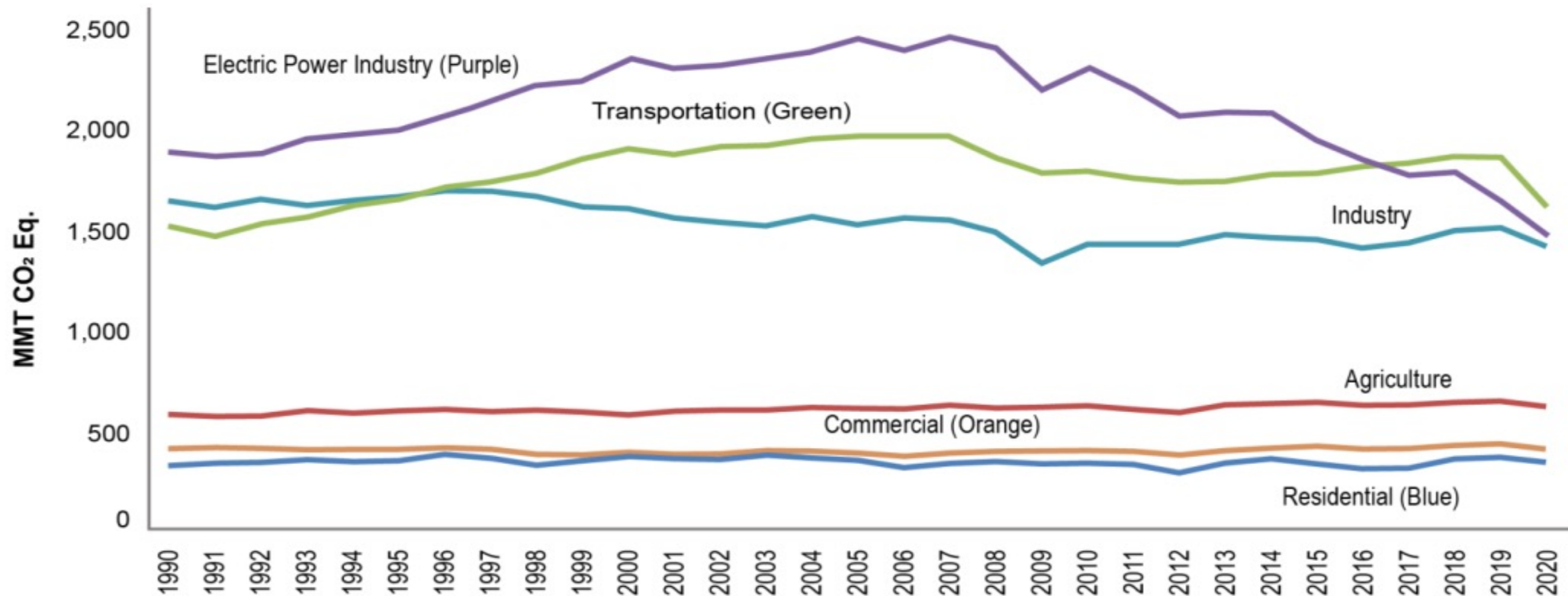
## Canadian coal electricity generation by region to 2040



Source: CER (Canada Energy Regulator)

Data Retrieved February 2020; visual created by CER, <https://www.cer-rec.gc.ca/nrg/ntgrtd/mrkt/snpst/2020/01-05cndtrngcfpp-eng.html>

# U.S. Greenhouse Gas Emissions Trends (1990-2020)



\*Land use sinks and U.S. Territories are excluded from this figure.



Source: U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions Allocated to Economic Sectors (1990-2019), Figure ES-14.  
Data Retrieved: August 2022..

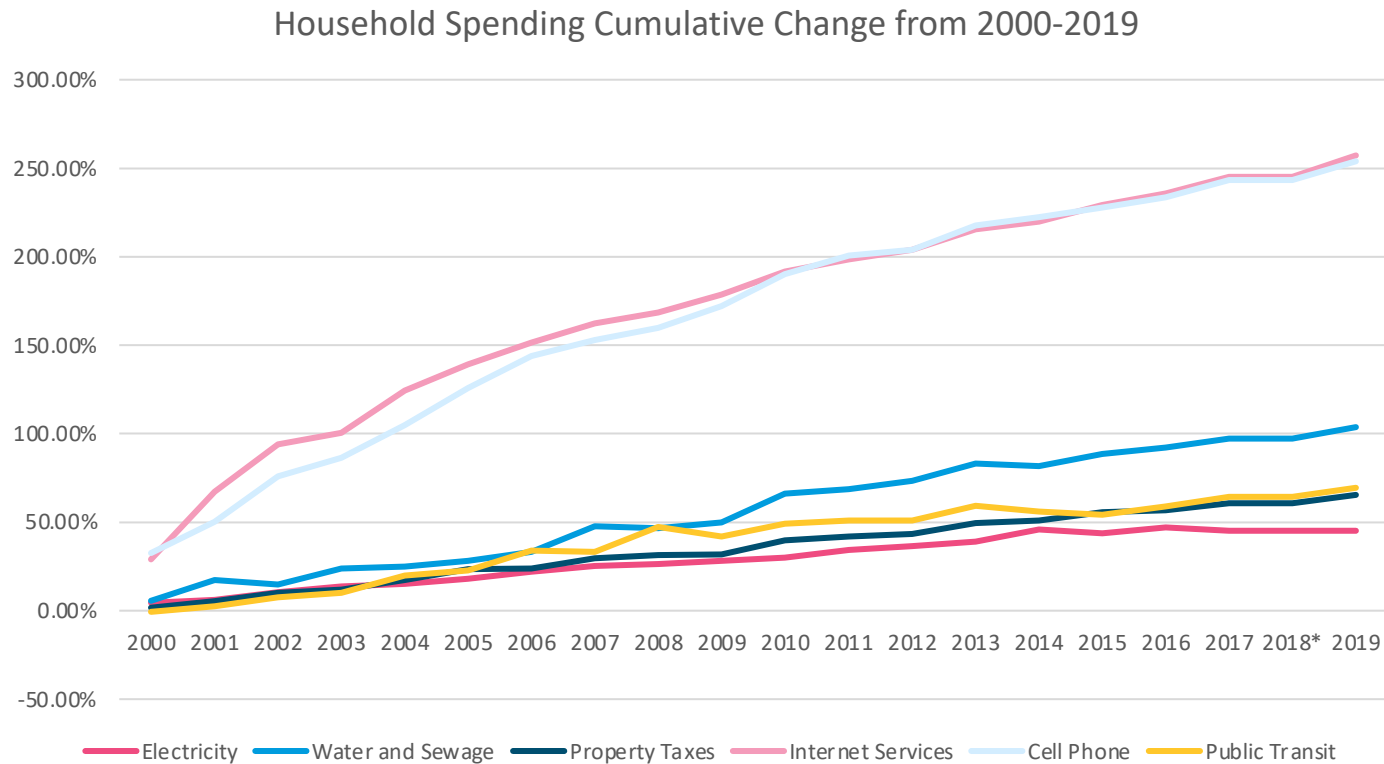
# Price and Customers

- [Household Spending, 1999-2019](#)
- [Household Spending, 1999 vs. 2019](#)
- [Household Spending, 2010 vs. 2019](#)
- [Multinational Residential Pricing \(bar chart\); Multinational Residential Pricing \(scatterplot chart\)](#)
- [Canadian Urban Centre Prices](#)
- [Multinational Industrial Pricing \(bar chart\); Multinational Industrial Pricing \(scatterplot chart\)](#)
- [Electric Vehicle Sales](#)





# Household Spending (1999 - 2019)



**Direct Change  
per Household  
from 1999-2019.**

Internet  
Services  
955%

Electricity  
55.6%

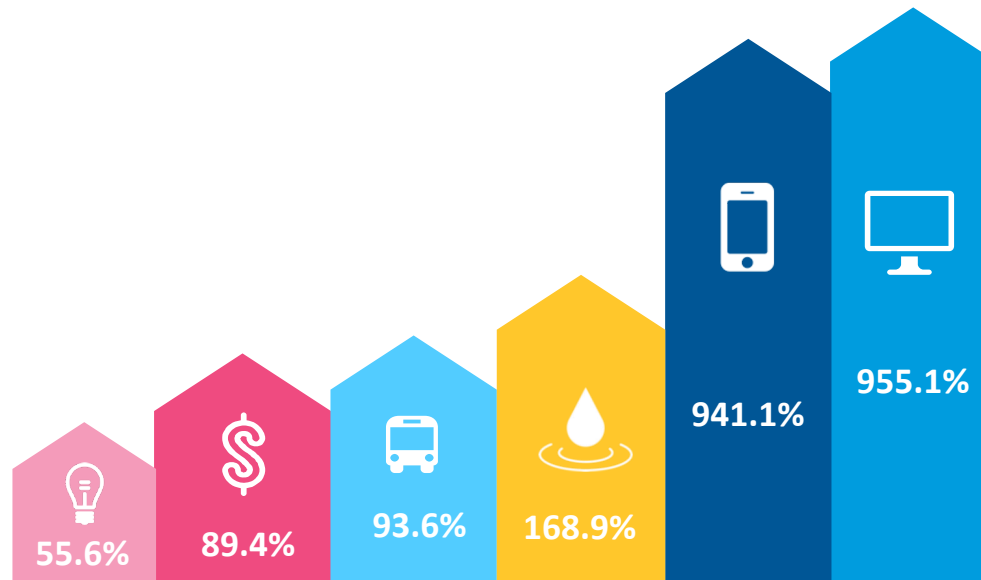


Data Source: StatsCan, Table: 11-10-0222-01 (formerly CANSIM 203-0021)

\* No data available from Statscan in 2018, marked as unchanged from 2017 in chart.

Retrieved: July 2021; Visual Created by Electricity Canada.

# Household Spending (1999 vs. 2019)



## Data Description

Percentage increase in 2019 comparing against 1999 household spending levels.



133.5 TW.h

Residential Demand in 1999



172.3 TW.h

Residential Demand in 2019



Data Source: StatsCan, CANSIM Table 203-0021  
Data Retrieved: July 2021; Visual Created by Electricity Canada

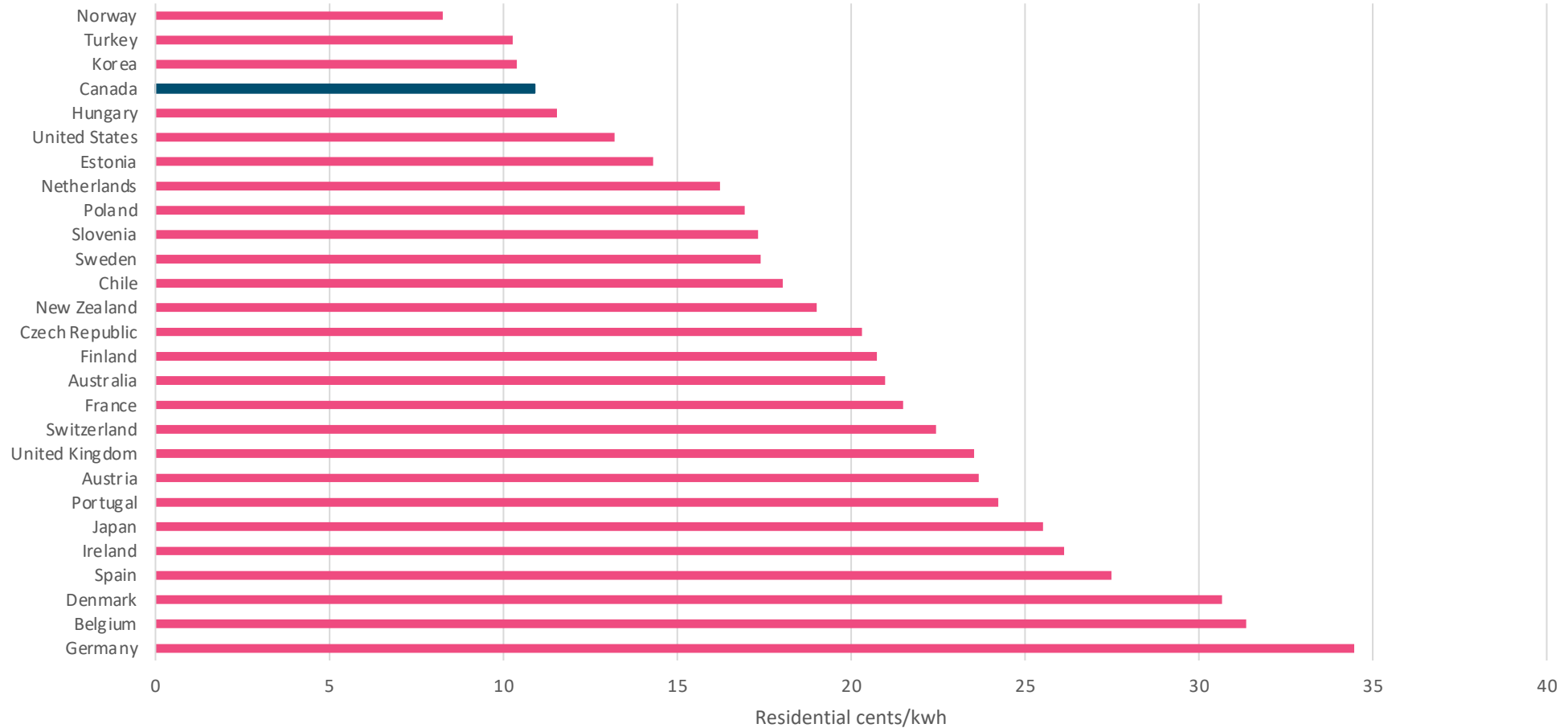
# Household Spending (2010 vs. 2019)



Data Source: StatsCan, CANSIM Table 203-0021

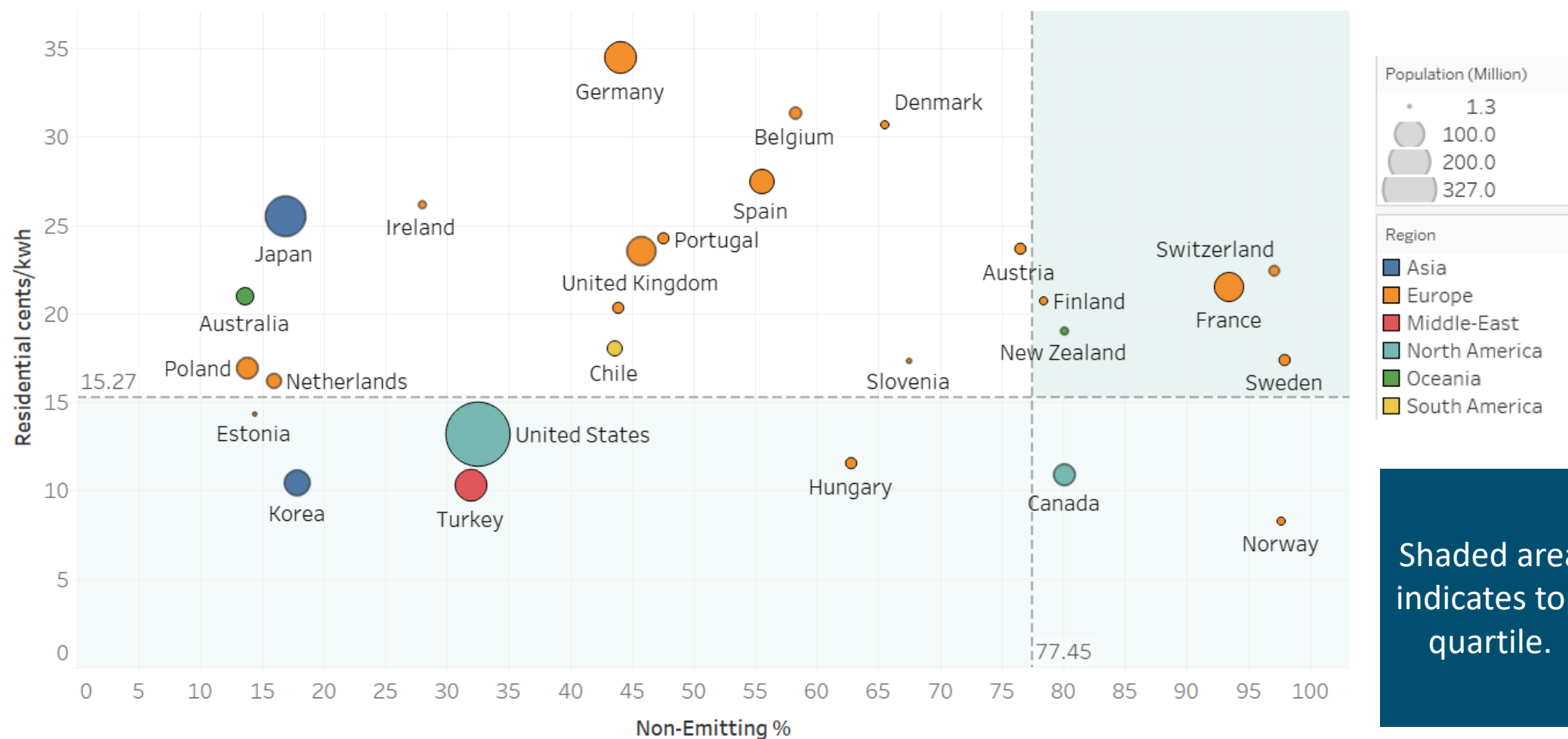
Data Retrieved: July 2021; Visual Created by Electricity Canada

# Multinational Comparison (Residential Pricing)



Data Source: World Energy Statistics 2020, IEA  
Data Retrieved: August 2022; Visual Created by Electricity Canada.

# Multinational Comparison (Residential Pricing -2020)



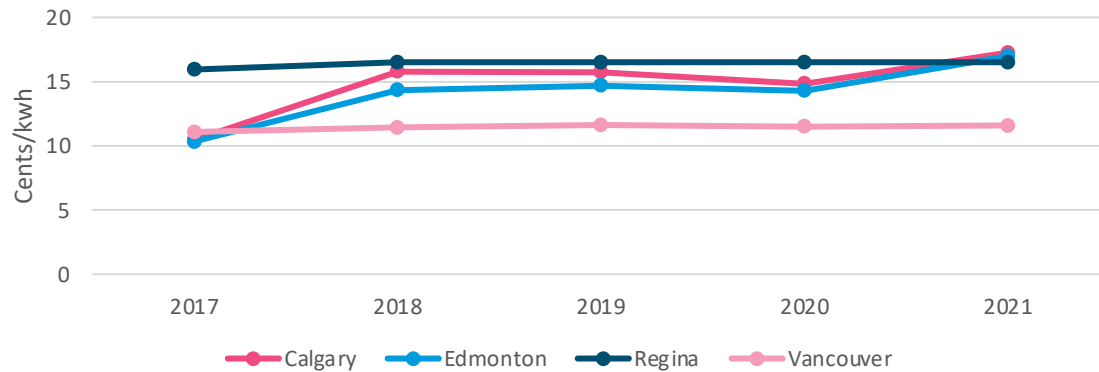
Shaded area  
indicates top  
quartile.



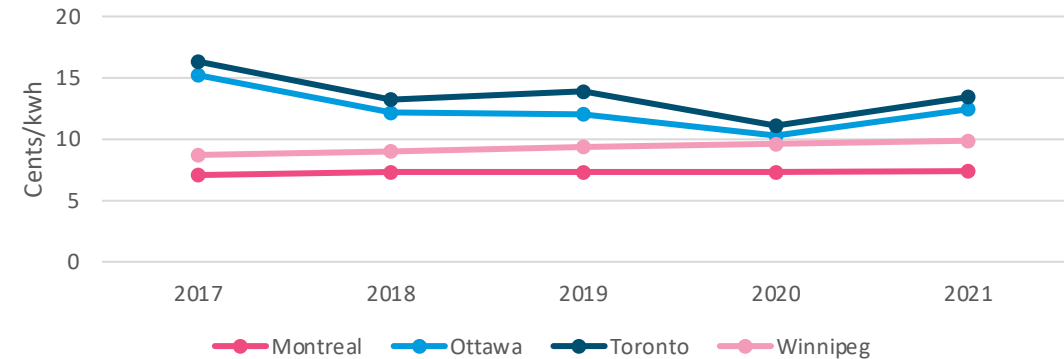
Data Source: World Energy Statistics 2020, IEA, and Open Data Portal, World Bank  
Data Retrieved: August 2022; visual created by Electricity Canada.

# Canadian Urban Centres Comparison (Residential Pricing)

## Western Urban Centre Electricity Prices (1000 kwh consumption)

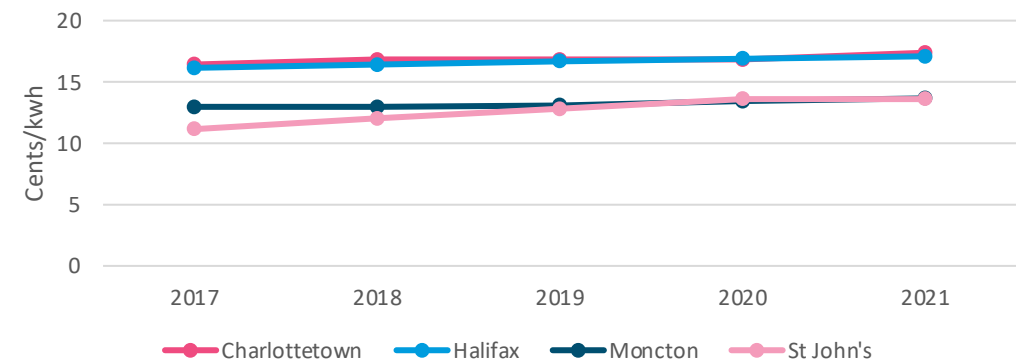


## Central Urban Centre Electricity Prices (1000 kwh consumption)



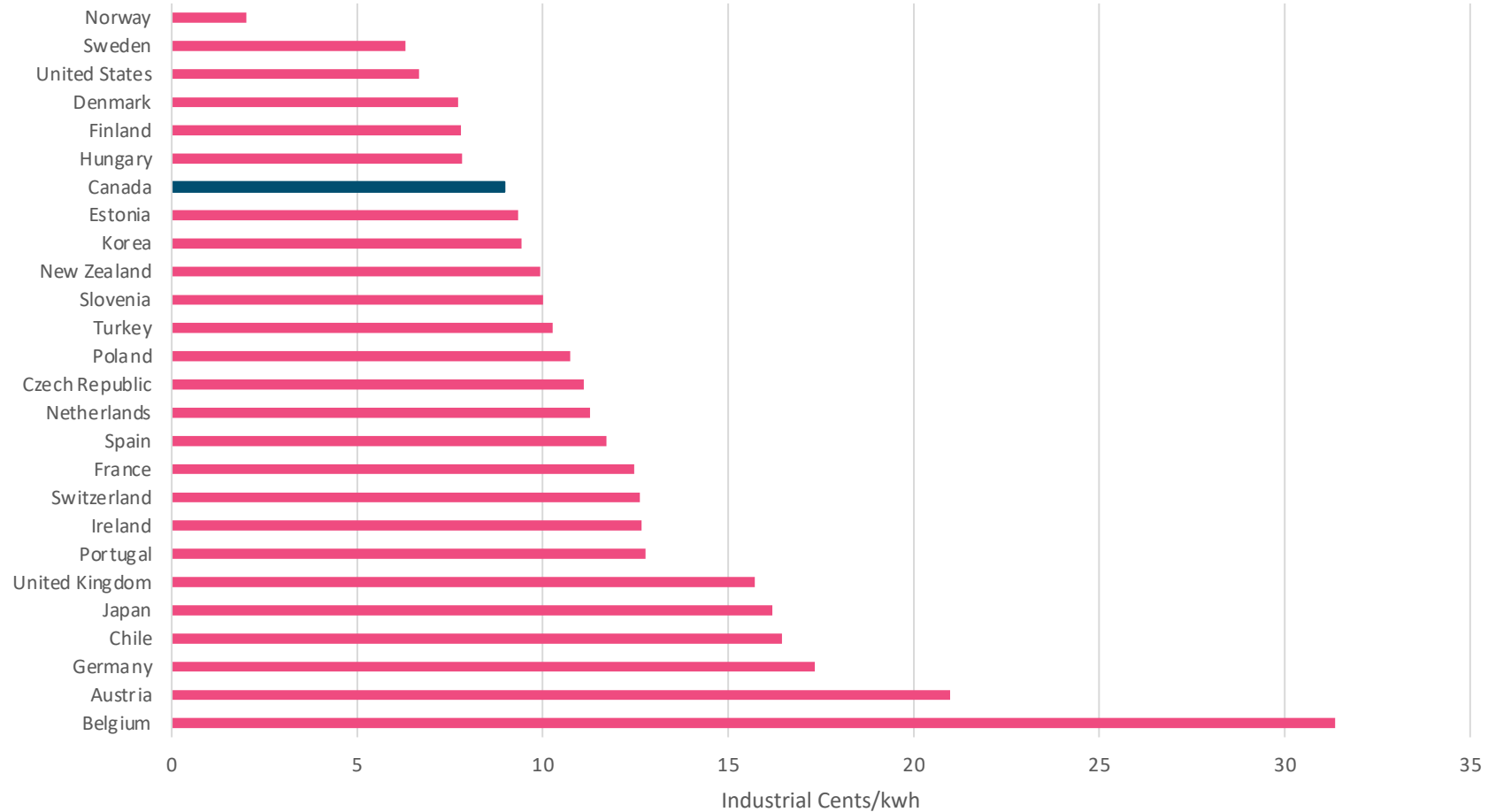
Pricing is impacted by time-of-use rates, consumption patterns, adjustment clauses. This data is taken from the Hydro-Québec price comparison study and is calculated according to base rates.

## Eastern Urban Centre Electricity Prices (1000 kwh consumption)



Data Source: 2021 Edition Comparison of Electricity Prices in North America in Major North American Cities, Hydro-Québec  
Data Retrieved: July 2022; Visual Created by Electricity Canada.

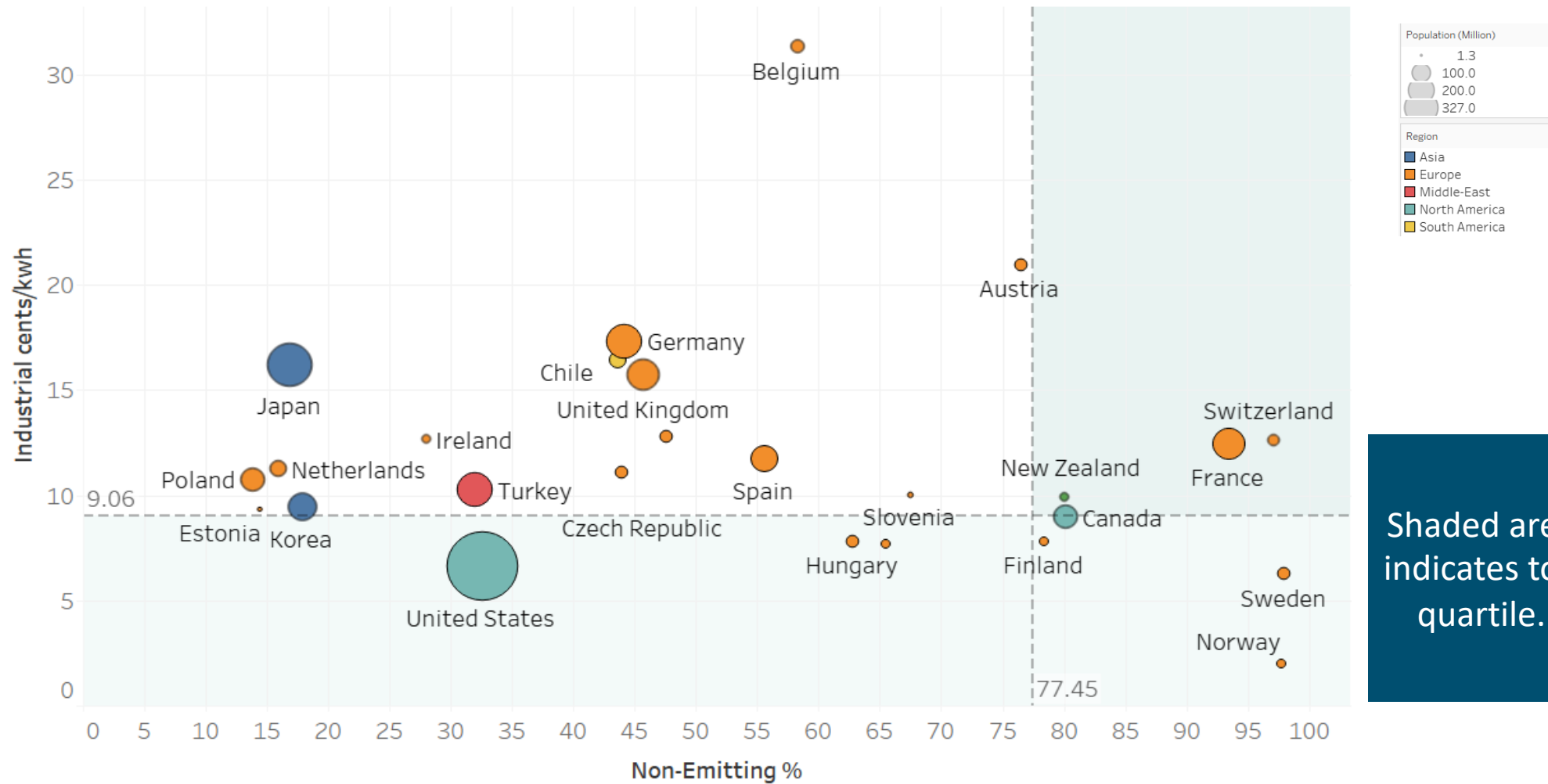
# Multinational Comparison (Industrial Pricing)



Data Source: World Energy Statistics 2020, IEA

Data Retrieved: August 2022; Visual Created by Electricity Canada.

# Multinational Comparison (Industrial Pricing)

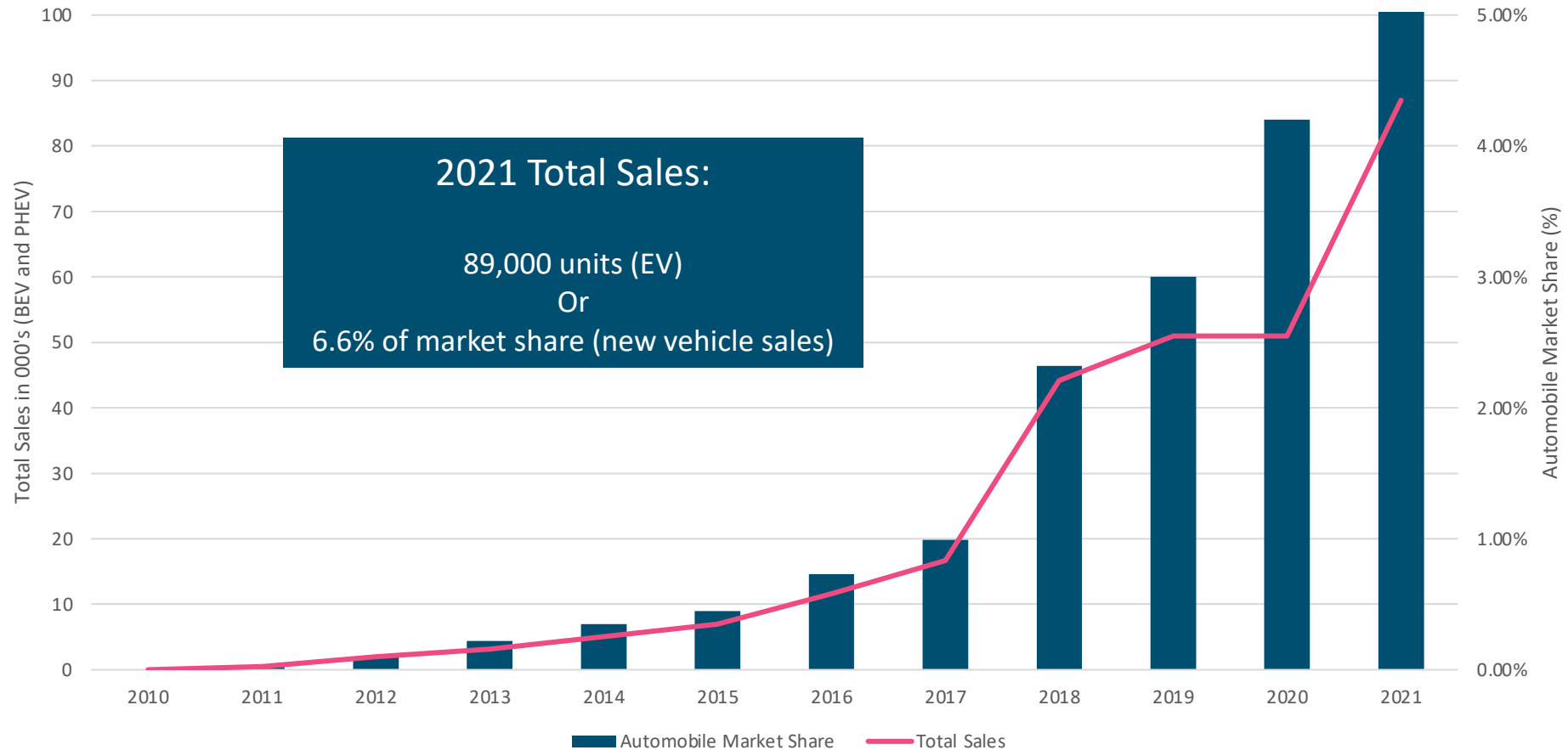


Data Source: World Energy Statistics 2020, IEA, and Open Data Portal, World Bank  
Data Retrieved: July 2022; visual created by Electricity Canada.



# Electric Vehicle Sales (Canada)

Electric Vehicle Market Share and Sales Growth (2010-2021)



Data Source: Electric Mobility Canada. Electric Vehicle Sales in Canada.  
Data Retrieved: August 2022; visual created by Electricity Canada

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