Energy Market Reforms to Enable a Green Transition in Canada

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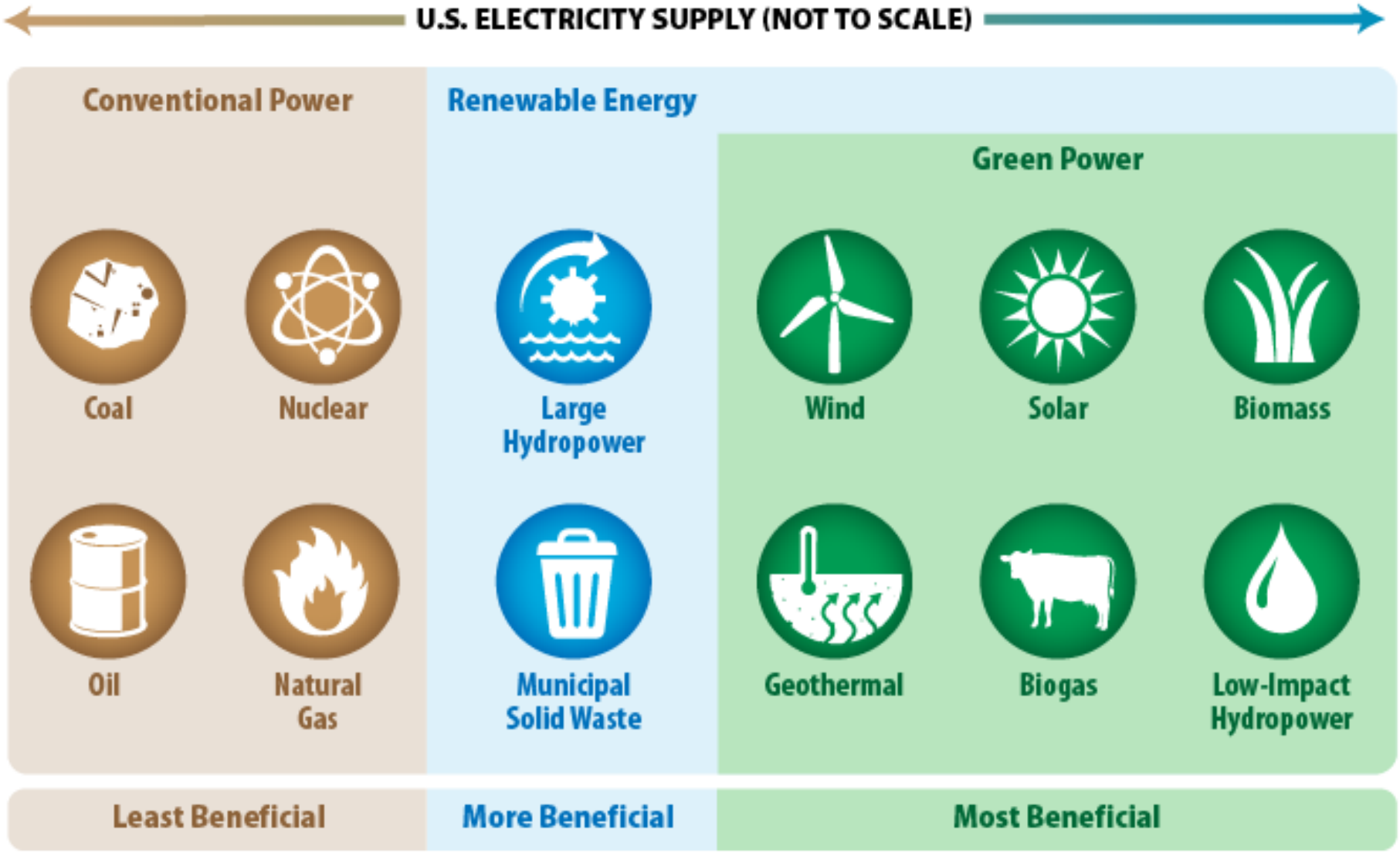
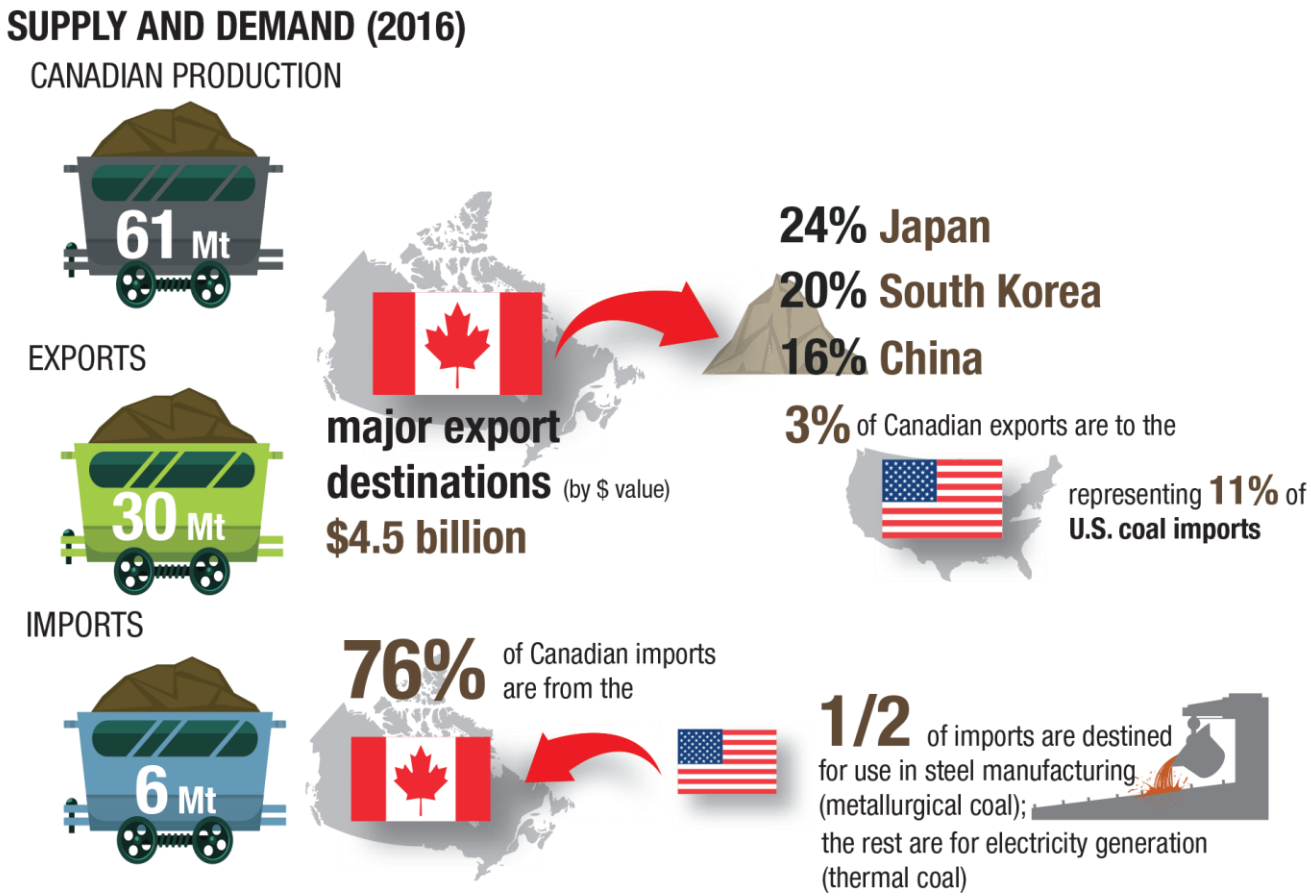

U.S. ELECTRICITY SUPPLY (NOT TO SCALE)
Conventional Power
Renewable Energy
Green Power
Coal
Nuclear
Large Hydropower
Wind
Solar
Biomass
Oil
Natural Gas
Municipal Solid Waste
Geothermal
Biogas
Low-Impact Hydropower
Least Beneficial
More Beneficial
Most Beneficial

SOURCE: EPA

The Coal Sector

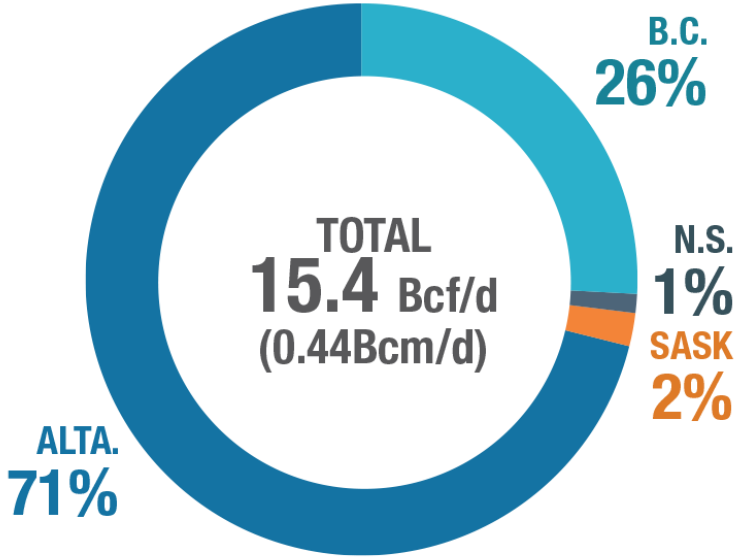


Source: NRCan

Canadian Energy Markets: Oil

- Alberta/Saskatchewan cannot bring resources to shore in quantities they like
- Pipe Dreams:
  - ~~Energy East~~
  - ~~Keystone XL~~??
  - ~~Northern Gateway~~
  - Kinder Morgan TransMountain????
- Trade wars: bitter grapes
- Global carbon budget: how will it affect the oil sands?

Canadian Energy Markets: Natural gas



Source: NRCan

LNG Projects in Canada

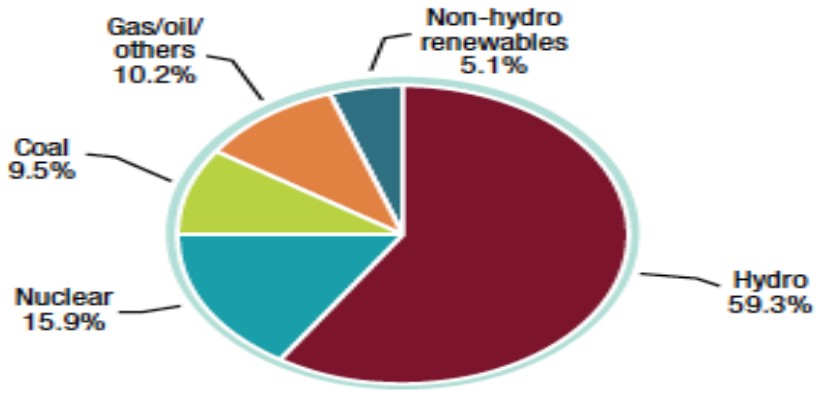
WEST COAST – British Columbia	
Douglas Channel LNG (Cancelled)	25 Years
Kitimat LNG	20 Years
LNG Canada	40 Years
Cedar LNG Project	25 Years
Pacific NorthWest LNG (Cancelled)	40 Years
Prince Rupert LNG (Cancelled)	25 Years
Aurora LNG (Cancelled)	25 Years
Grassy Point LNG	25 Years
WCC LNG	40 Years
Orca LNG	25 Years
New Times Energy	25 Years
Watson Island LNG	
Kitsault Energy Project	20 Years
Stewart LNG Export Project	25 Years
Triton LNG	25 Years
Woodfibre LNG	25 Years
WesPac LNG Marine Terminal	25 Years
Discovery LNG	25 Years
Steelhead LNG	25 Years
Nisga'a LNG	
EAST COAST	
Goldboro LNG (Nova Scotia)	20 Years
Bear Head LNG (Nova Scotia)	25 Years
A C LNG (Nova Scotia)	25 Years
Saint John LNG (New Brunswick)	25 Years
Energie Saguenay (Quebec)	25 Years
Stolt LNGaz (Quebec)	25 Years
TUGLIQ Gaz Naturel Quubec Inc. (Quebec)	Applying

Source: NRCan

Electricity Generation

Generation in Canada – 639 TWh (2014)

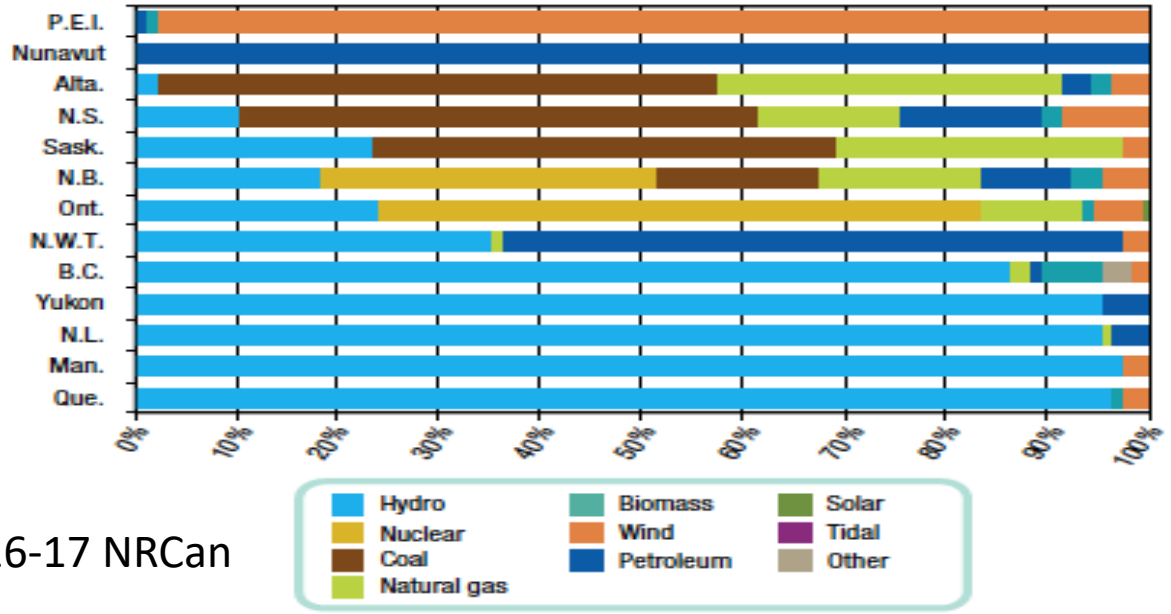
Generation by source, 2014



Generation from renewable sources: 64%, first in the G7

Generation from non-GHG emitting sources: 80%, second in the G7 after France

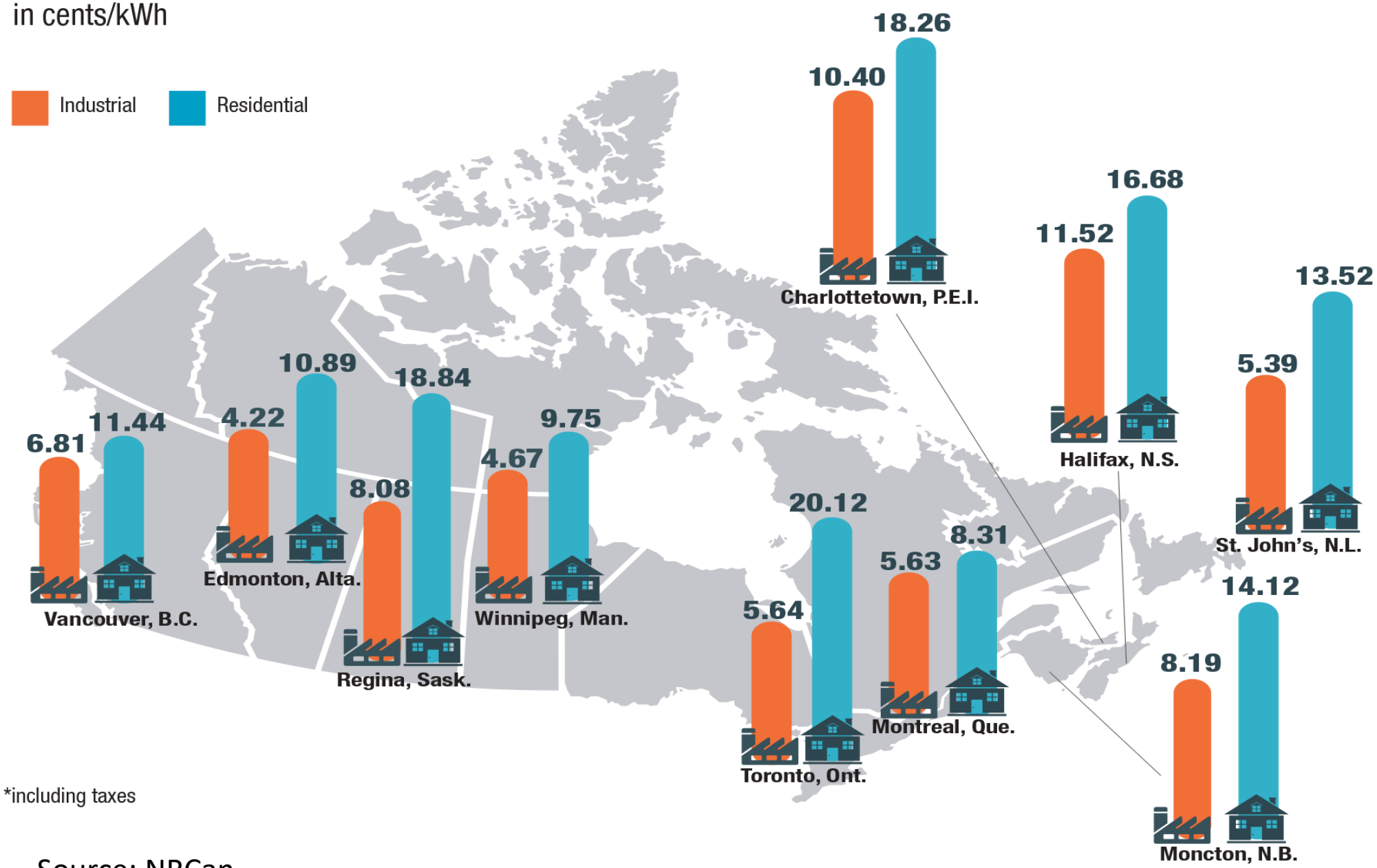
Provincial characteristics



Source: Energy Fact Book 2016-17 NRCan

AVERAGE LARGE INDUSTRIAL AND RESIDENTIAL ELECTRICITY PRICES*, APRIL 2016

in cents/kWh



*including taxes

Source: NRCan

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

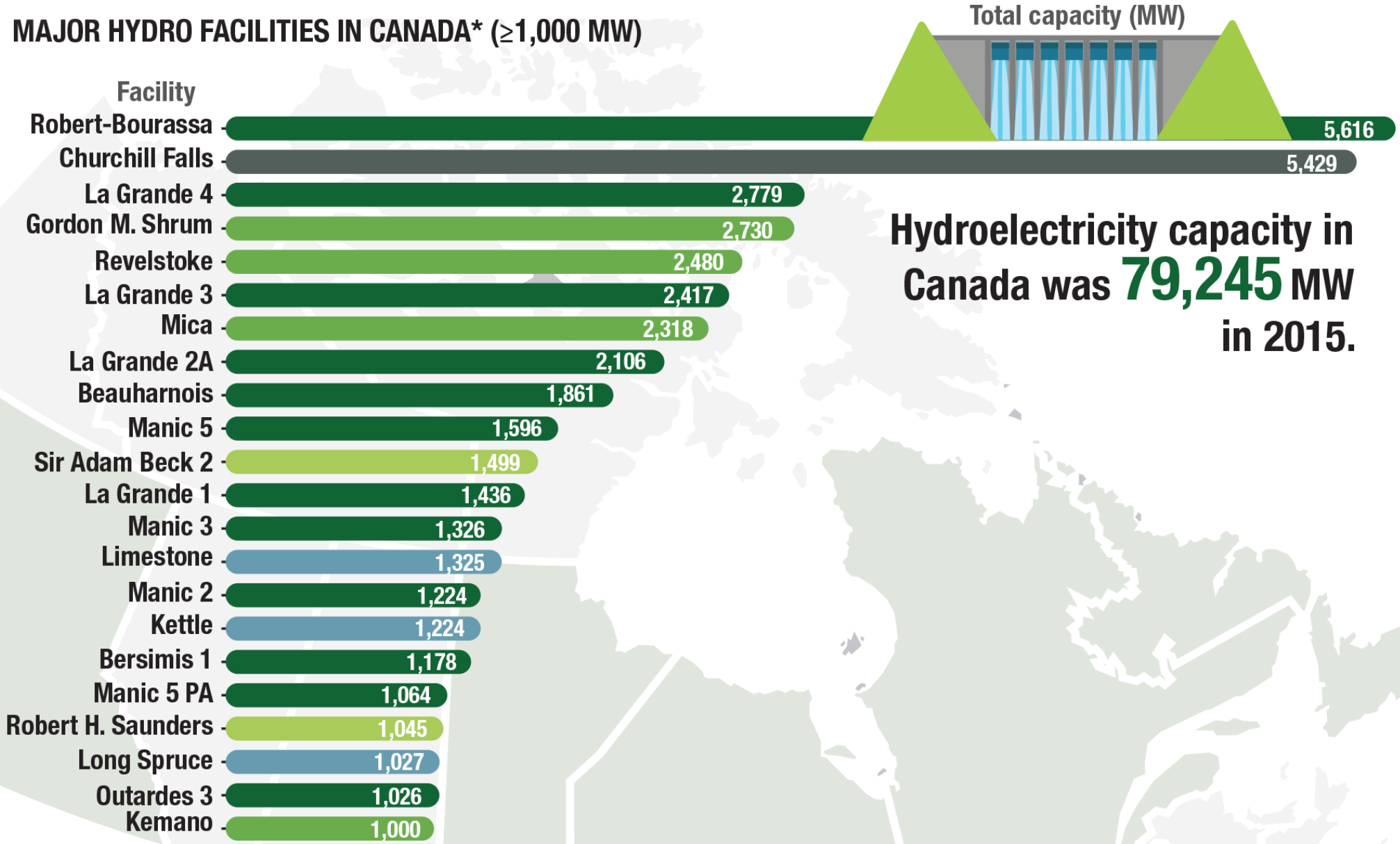
Saskatchewan

- Wholesale open access
- Vertically-integrated Crown corporation

Yukon

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

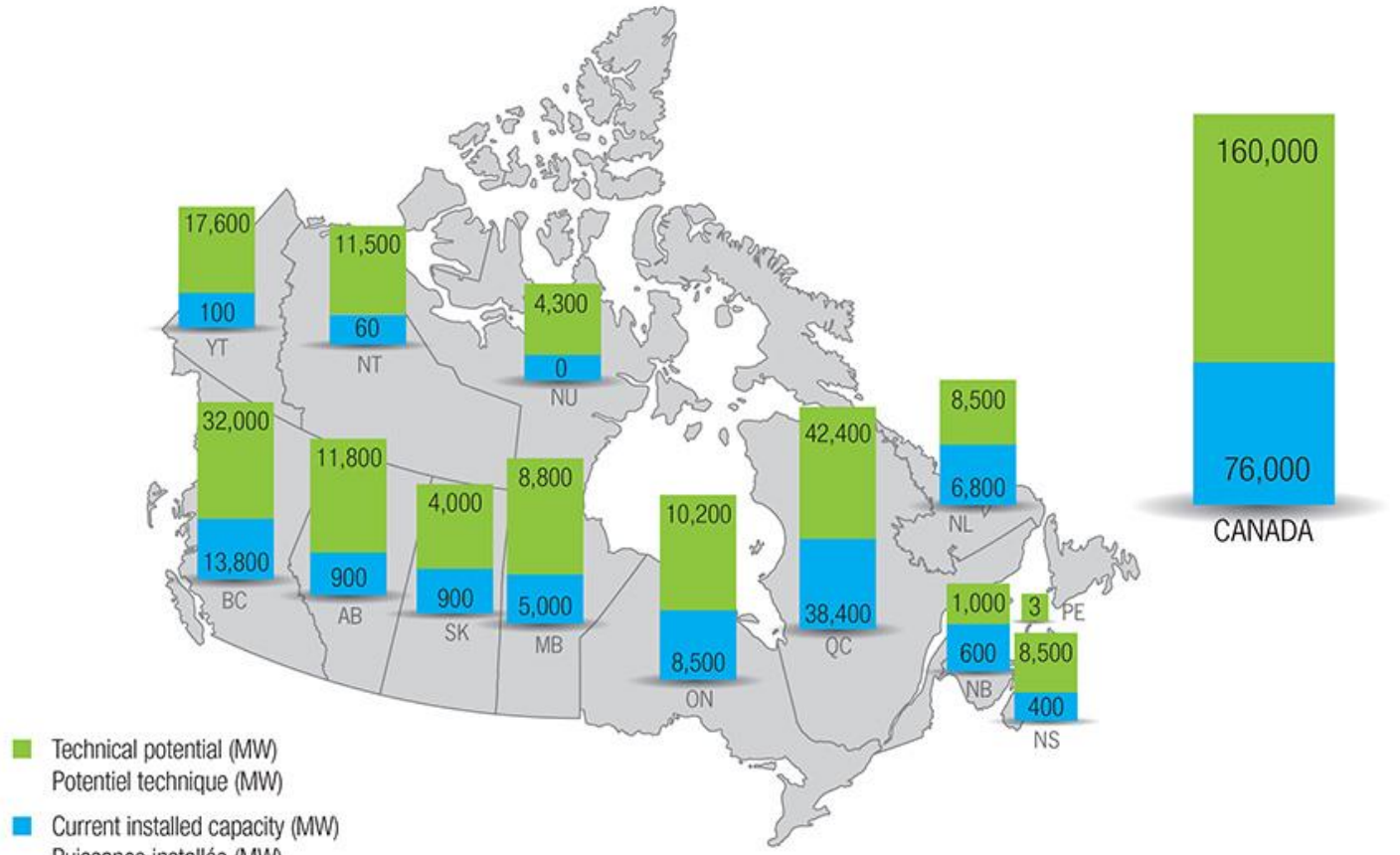
MAJOR HYDRO FACILITIES IN CANADA* (≥1,000 MW)



Hydroelectricity capacity in Canada was 79,245 MW in 2015.

*There are 492 hydro facilities in Canada with a capacity of at least 1 MW.

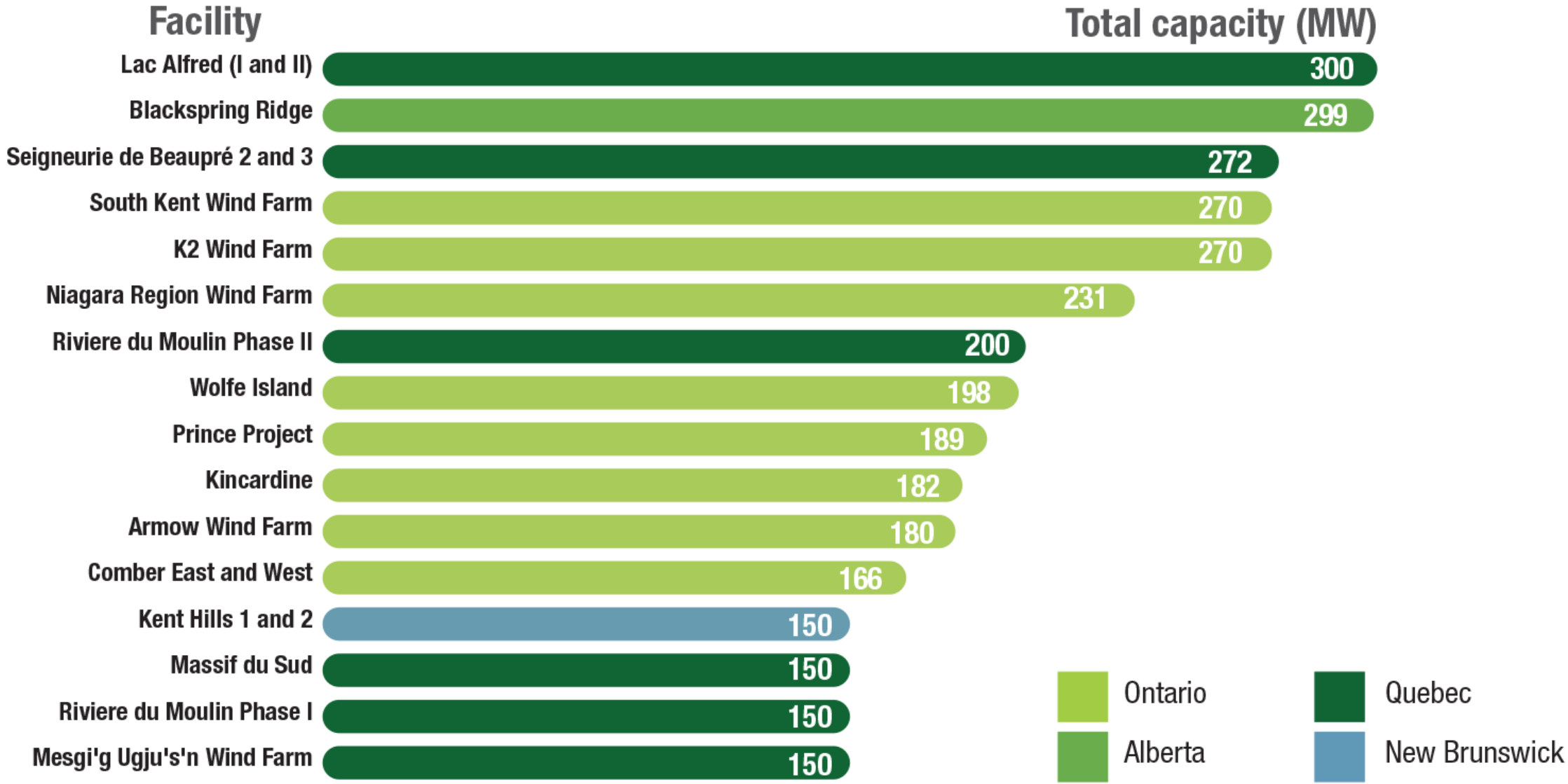
CANADIAN HYDRO CAPACITY & POTENTIAL (MW)
L'HYDROÉLECTRICITÉ AU CANADA: PUISSANCE INSTALLÉE ET POTENTIEL (MW)



Sources: 1) Potential: EEM study conducted for the CHA in 2007 : Executive Summary
2) Installed Capacity : Statistics Canada, CANSIM table 127-0009, values for 2006 and 2013 retrieved onFebruary 5, 2015
Note: The potential is defined as the techical potential determined by EEM for the CHA in 2006-2007 minus the capacity added since 2006 and therefore no more available for future development

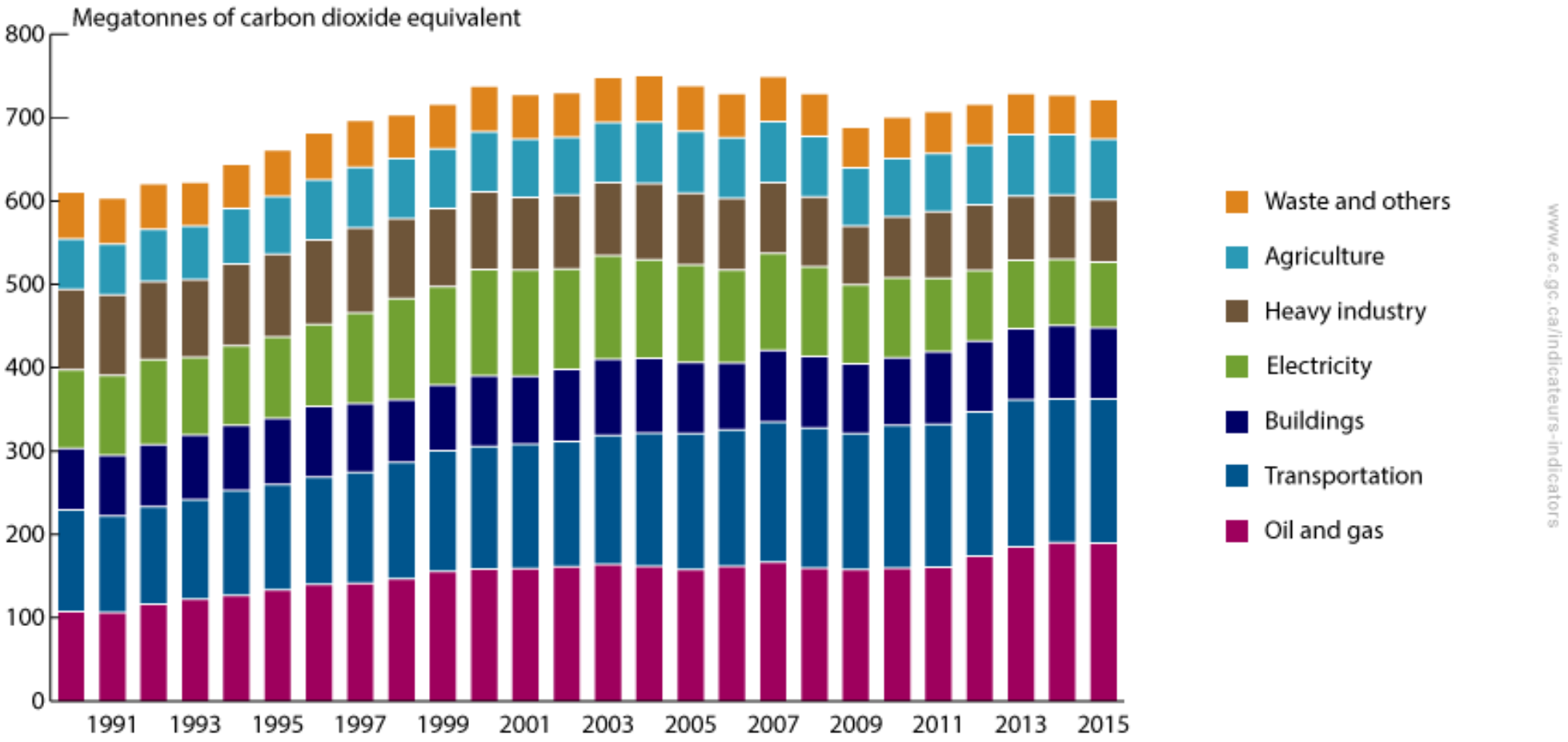
Canadian Hydropower Association
Association canadienne de l'hydroélectricité

LARGEST WIND FARMS IN CANADA* (≥150 MW)

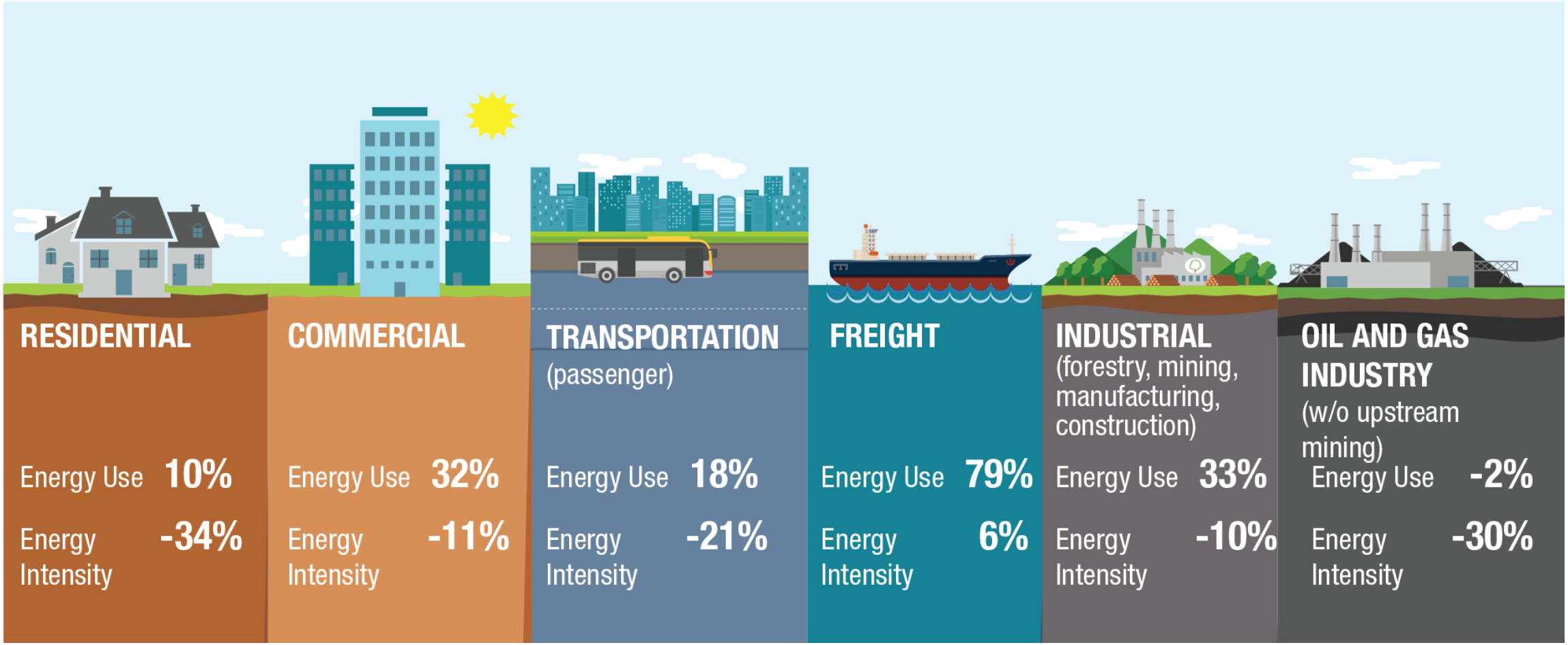


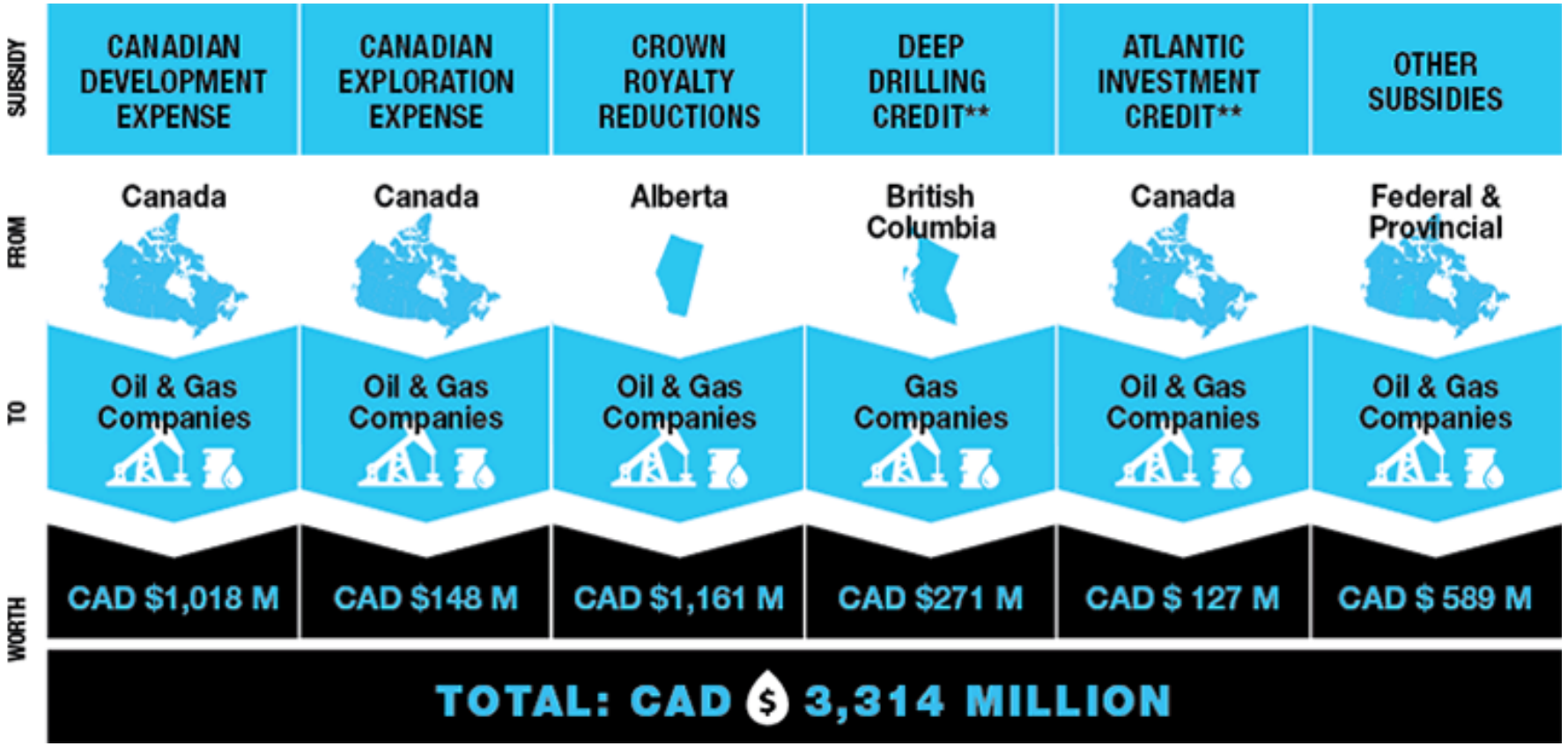
*There are 255 wind power facilities in Canada with a capacity of at least 1 MW.

Greenhouse gas emissions by sector



TRENDS IN ENERGY USE AND INTENSITY BY SUBSECTOR, 1990–2014





Source: IISD

Fossil Fuel Subsidies

CANADIAN ENERGY STRATEGY

Canada still the only G8 country without an official energy strategy
mandate letter from the Prime Minister that states a commitment to work with provinces and territories to advance a **Canadian Energy Strategy.**

In December 2016, Energy Ministers presented a Joint Action Plan with collective commitments in four priority areas:

- **Energy Efficiency:** aligning standards, updating building codes, and facilitating adoption of energy management systems for industry
- **Energy Infrastructure:** exploring new and enhanced electricity interconnections, smart electricity grids, natural gas infrastructure, and improved regulatory review processes
- **Energy Technology and Innovation:** expanding RD&D cooperation and investment and reducing reliance on diesel in remote communities
- **International Energy Collaboration:** deepening collaboration on international energy issues, including joint missions.

Some of the energy market challenges in Canada

- No coherent market approach to electricity generation, distribution and pricing
- Lack of electricity grid interconnections
- Powerful utilities that focus on large scale power generation in isolation
- No general vision or guidance on energy market reform and integration at the federal level
- Lack of infrastructure for electrification to take off
- GHG Emissions from oil and gas and transport sector
- Pipelines and Retaliation
- Clean rather than green energy

Our government firmly believes that Canadians don’t have to make the choice between building a stronger economy and protecting our environment. We can do both, we need to do both, and we are doing both. A strong economy where we invest in new technology, where we invest in **green infrastructure** allows us to not only make our communities green but also allows us to create jobs.”

–Amarjeet Sohi, Minister of Infrastructure, Renew Canada

“Green” Infrastructure Investments

Renew Canada, recently published its annual Top 100 Biggest Infrastructure Projects (see CEA website)
7 out of the top 10 projects are energy infrastructure projects, worth over $68 billion in total, with the energy sector representing nearly 70% of the biggest infrastructure investments in Canada

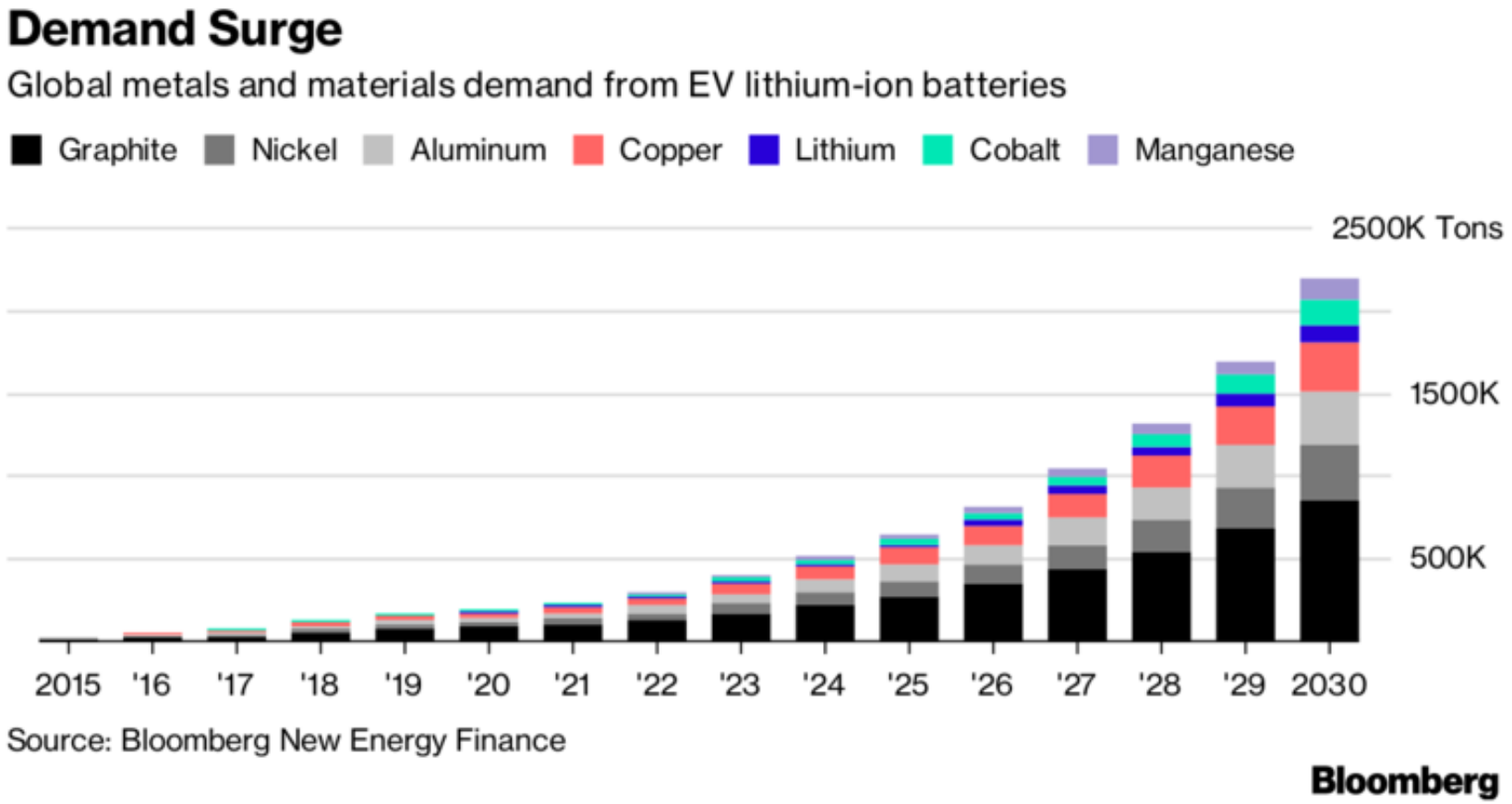
#1Bruce Power Nuclear Refurbishment(Nuclear – ON)
#2Darlington Nuclear Refurbishment(Nuclear – ON)
#3Muskrat Falls Project(Hydro – NL)
#5Site C Clean Energy Project(Hydro – BC)
#6Keeyask Hydroelectric Project(Hydro – MB)
#7Romaine Complex(Hydro – QC)
#9Bipole III Transmission Line(Transmission – AB)

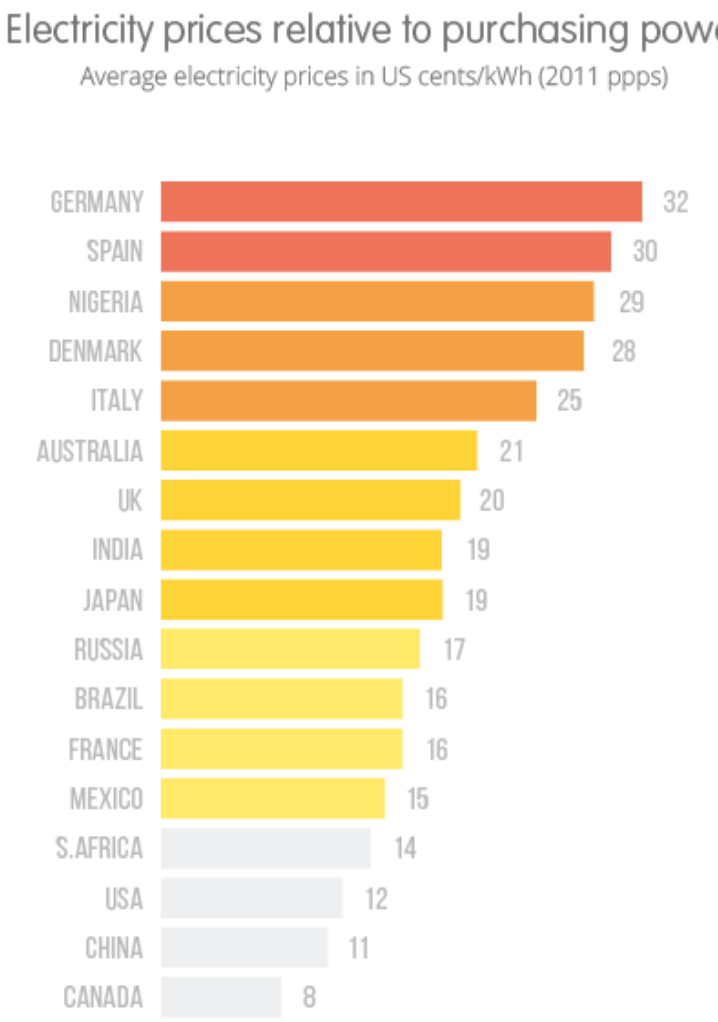
The Truth about “Green Infrastructure”

What will a Green Transition require?

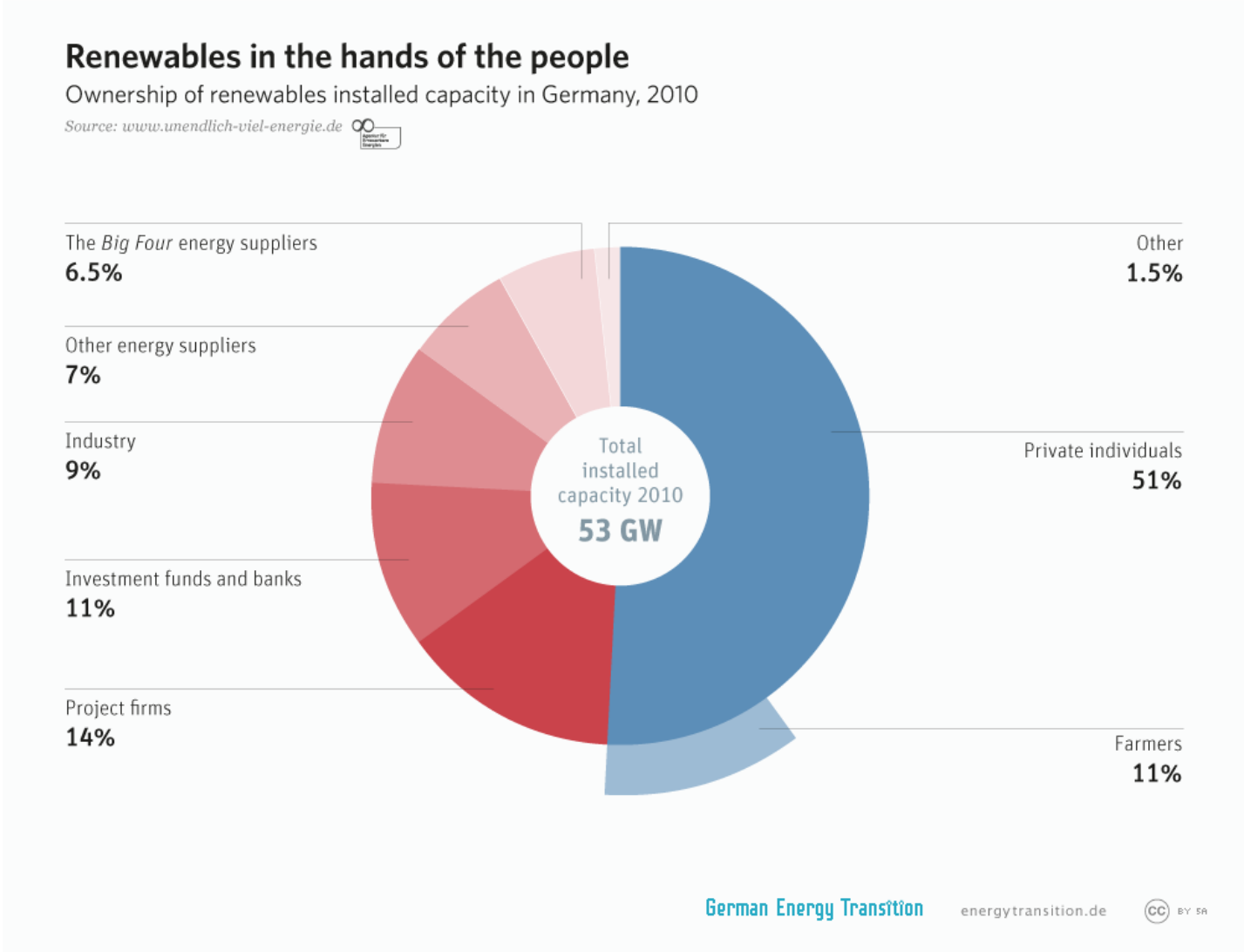
- Including all environmental, economic and social impacts of the energy supply chain
- New economic directions: knowledge based economy, smart grids, EVs and green technologies
- Increased electrification of all sectors
- New employment, skills creation, research clusters and capacity building
- Smart systems and prosumers: local and better balancing of demand and supply
- A transition from large scale isolated provincial power generation to integrated, more distributed, less intrusive technologies

The Green Transition in Canada




Electricity prices relative to purchasing power
Average electricity prices in US cents/kWh (2011 ppps)
GERMANY 32
SPAIN 30
NIGERIA 29
DENMARK 28
ITALY 25
AUSTRALIA 21
UK 20
INDIA 19
JAPAN 19
RUSSIA 17
BRAZIL 16
FRANCE 16
MEXICO 15
S.AFRICA 14
USA 12
CHINA 11
CANADA 8

Energy Democracy



Ontario Long Term Energy Plan (October 2017)

- Moving away from long term energy contracts
- Competitive mechanisms to procure new supply sources such as **incremental capacity auction**
  - Generators
  - Demand response providers
  - Importers
  - Emerging new technologies
- More interties to other provinces
- More innovative pricing: by season, peak and off-peak differentials, more use of smart technologies and apps
- Net metering to create incentives to invest in storage

Ontario Long Term Energy Plan

Modernizing the utility business: new business models and partnerships

Conservation programming should better meet community needs

Desire for First Nation and Métis ownership of and partnerships on projects: access to financing

Integrate electricity planning with municipal and regional planning

Consider impacts on economic development

Reform suggestions for a Green Transition

- Energy strategy that accompanies the Pan Canadian Framework on climate change to guide energy market integration and grid interconnections, as well as the future of oil and gas
- Storage markets: capacity, wholesale, balancing and auxiliary services (as in UK)
- Contestability of vertically integrated markets: minimum connectedness between provinces, better access to grids and transmission charges by use, free entry of IPPs
- Incremental capacity auctions (see Ontario Long Term Energy Plan)
- Green technology innovation and trade development: from Clean to Green

Reform suggestions for a Green Transition

- More distributed consumption and production: net metering and ownership of energy systems by private owners, cooperatives, farmers, etc.
- Empowerment of remote communities and indigenous people as active markets participants and regulatory decision-makers
- Active balancing of demand and supply through demand response, wide involvement of consumers as energy brokers (prosumers) and not just as consumers
- Shifting subsidies from fossil fuel industry to renewables, electrification and a mining sector that could enable a green transition in Canada