



Bioenergy in Quebec

October 2022

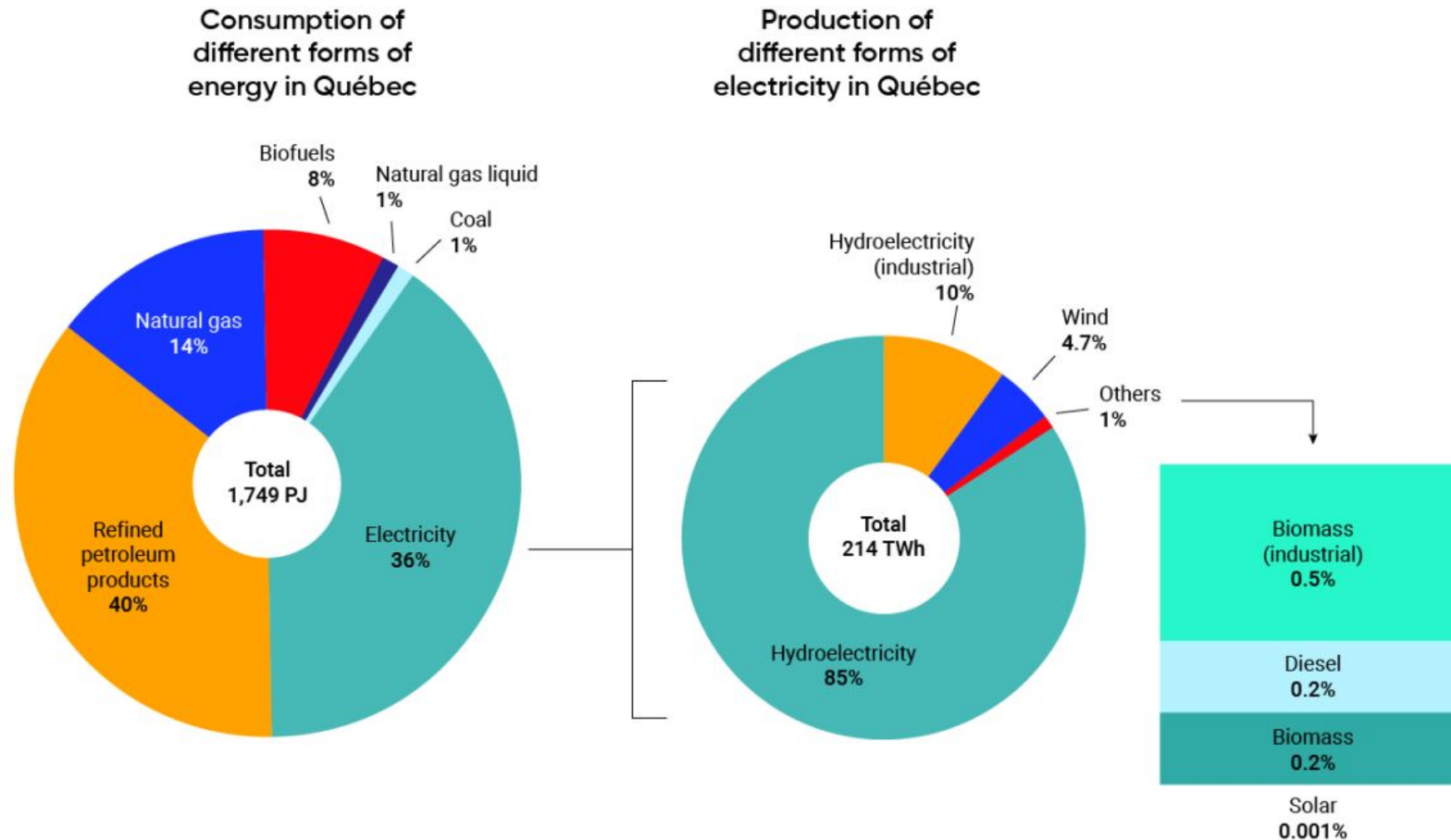
Content

1. Energy profile of Quebec province
2. The importance of hydroelectricity
3. Bioenergy
4. Biomass
5. Forest biomass
6. Wood pellets



1. Energy Profile of Quebec Province

In 2020, energy consumption in Quebec is dominated by oil which accounts for 40%, followed closely by electricity at 36%.



1. Energy Profile of Quebec Province

Crude Oil

- Quebec does not have any commercial crude oil production.

Natural Gas/ Natural Gas Liquids (NGLs)

- There is no natural gas production or field production of NGLs in Quebec.
- Small volumes of propane and butane are produced by refineries in Quebec.

Renewable Natural Gas (RNG)

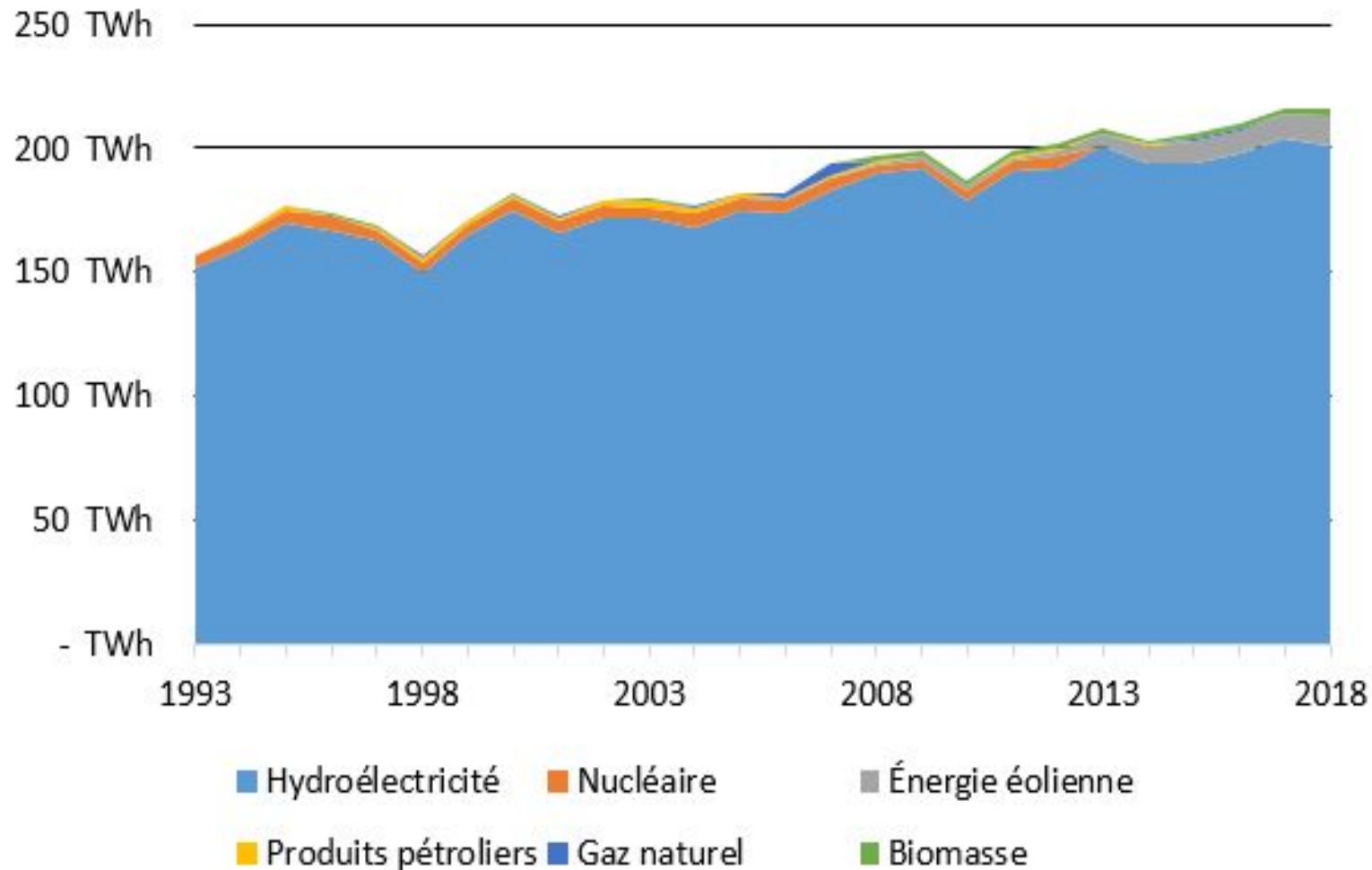
- There are 2 projects in Quebec that produce **15.3 million cubic meters of RNG per year**.
- 4 projects are under construction that will produce a combine total of 31 million cubic meters per year once they are completed.

Electricity

- In 2019, Quebec generated 212.9 TWh of electricity, which is about 1/3 of total Canadian generation. **Quebec is the largest producer of green electricity in Canada** and had an estimated generating capacity of 46 380 MW in 2019.
- With over 40 850 MW of installed hydroelectric capacity, **hydropower generates 94% of Quebec's electricity**. This includes Canada's largest hydro plant, the 5 616 MW Robert-Bourassa facility in northern Quebec.
- **Hydro-Quebec generates most of the electricity in the province**, including electricity from 62 hydroelectric plants. Independent power producers operate several smaller hydroelectricity plants, as well as all biomass and wind facilities.
- Quebec also trades with electricity markets in the US Northeast, primarily New England and New York. In 2019, Quebec was the largest exporter of electricity to the US of all Canadian provinces, with gross exports totalling 25.9 TWh.

1. Energy Profile of Quebec Province

In 2018, total electricity production in Quebec reached 215.6 TWh. More than 99% of this production is of renewable origin.



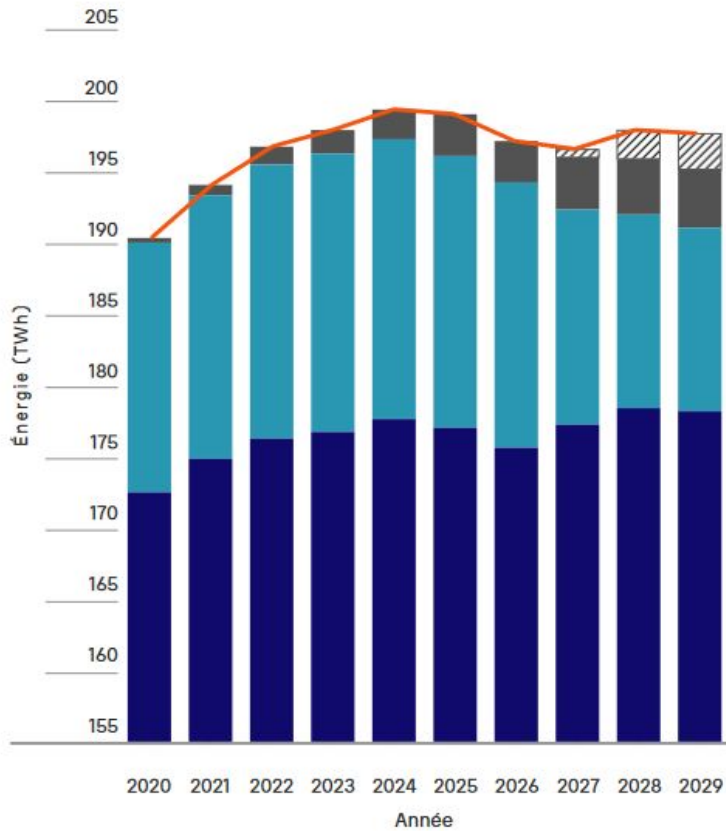
2. The importance of hydroelectricity

While bioenergy is the most consumed form of renewable energy in the world, in Quebec it's hydroelectricity.

Hydro-Québec's operations:

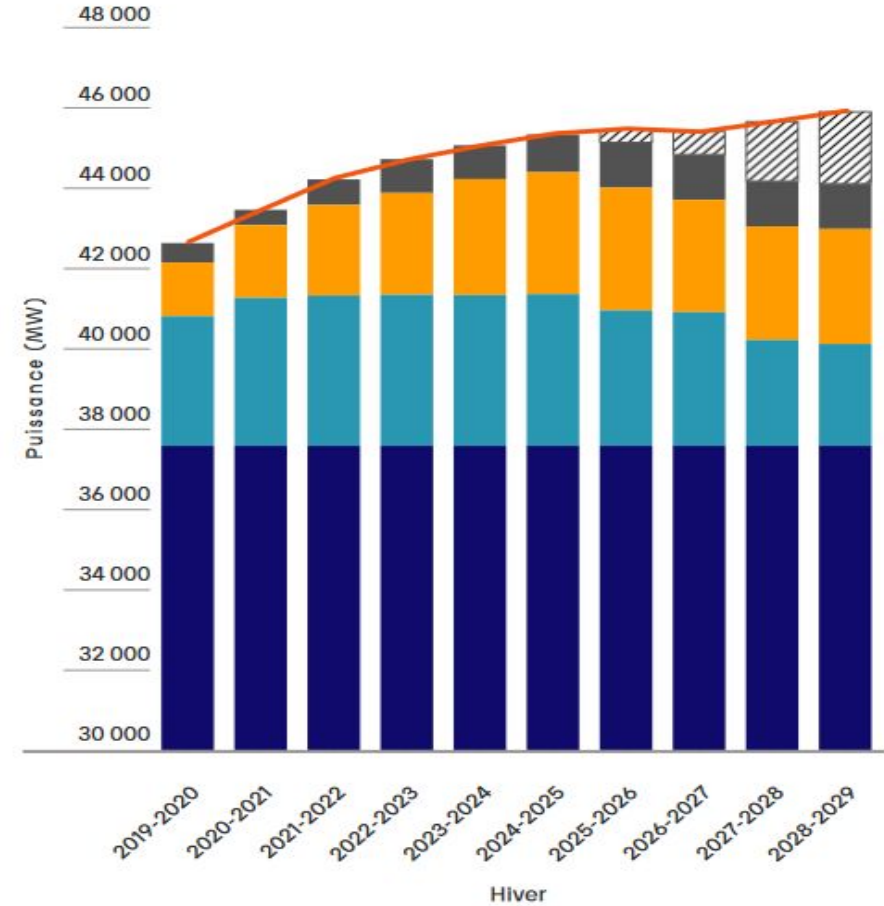
- ✓ Account for **4% of Quebec's total GDP**.
- ✓ Generates about **95% of Quebec's electricity**.
- ✓ Operates a generating fleet with an **installed capacity of 37,555 MW**, and has other sources of supply with a total capacity of 10,314 MW, under contracts entered into with other producers.
- ✓ **Surplus hydroelectric energy can be stored in 28 large reservoirs, up to 176 TWh** (almost one and a half times the annual consumption of the 6 New England states) or exported.

2. The importance of hydroelectricity



The energy balance is sufficient to meet the needs of Quebec customers until 2026.

The power balance indicates the state of supplies for the winter peak. The balance is assured until the winter of 2024-2025.



- Électricité patrimoniale*
- Contrats d'achat d'électricité et moyens de gestion
- Achats sur les marchés de court terme
- Besoins
- ▨ Approvisionnements additionnels requis

* Y compris les pertes de transport et de distribution.

- Électricité patrimoniale
- Contrats et moyens de gestion
- Gestion de la demande de puissance
- Achats sur les marchés de court terme
- Besoins
- ▨ Approvisionnements additionnels requis

2. The importance of hydroelectricity

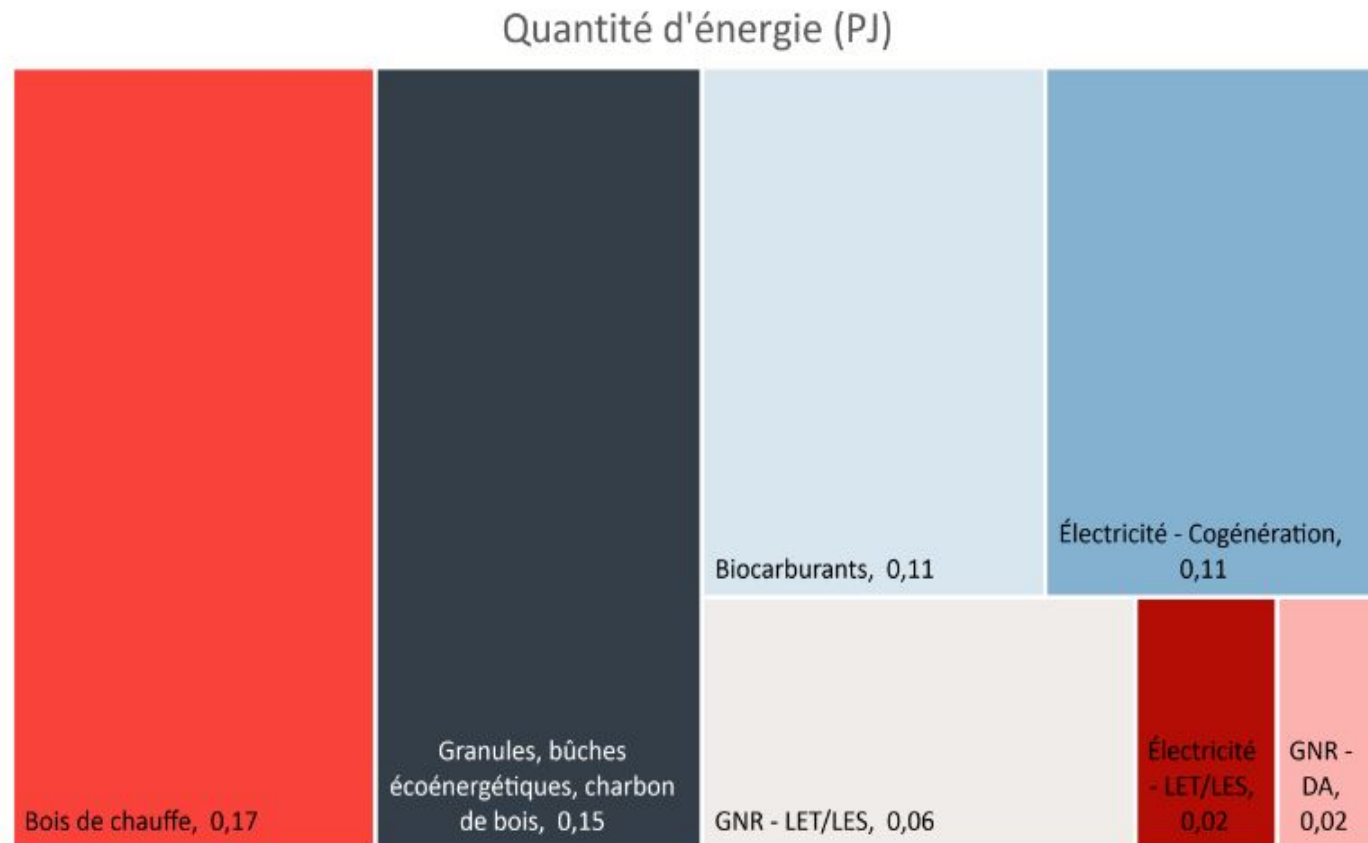


Hydro-Québec electricity transmission network is comprised of:

- 24 power stations
- 22 networks
- All network: 226 000km

3. Bioenergy

A total of 63.15 PJ of energy is estimated for all the producers who market their bioenergy of which firewood represents 27% and pellets, energy-efficient logs and charcoal, 24%.



Note : LET/LES correspond aux lieux d'enfouissement et DA correspond à la digestion anaérobie (biométhanisation)

3. Bioenergy

Quebec Government policy – Biofuel regulation

Currently: 3%

In 2023: 10%.

In 2030: 15%.

3. Bioenergy

Liquid biofuels

- Production capacity of 300 million liters.
- Energy capacity of 10.71 PJ/year.
- Most of it is ethanol (over 70%) and its importance is set to increase in the coming years.
- Biodiesel represents 20% of production and renewable fuel oil: 10%.

Electricity by cogeneration

- Installed capacity of 351 MWe, i.e. 9.89 PJ/year of energy.
- From residual forest biomass or wood residues, mainly from pulp and paper.

Pellets, energy-efficient logs and charcoal

- Production of 1.1 million tons of material annually or 15.02 PJ/year.
- Pellets represent nearly 95%, densified wood fiber logs: 5%, charcoal: 1%.

Renewable natural gas by biomethanization

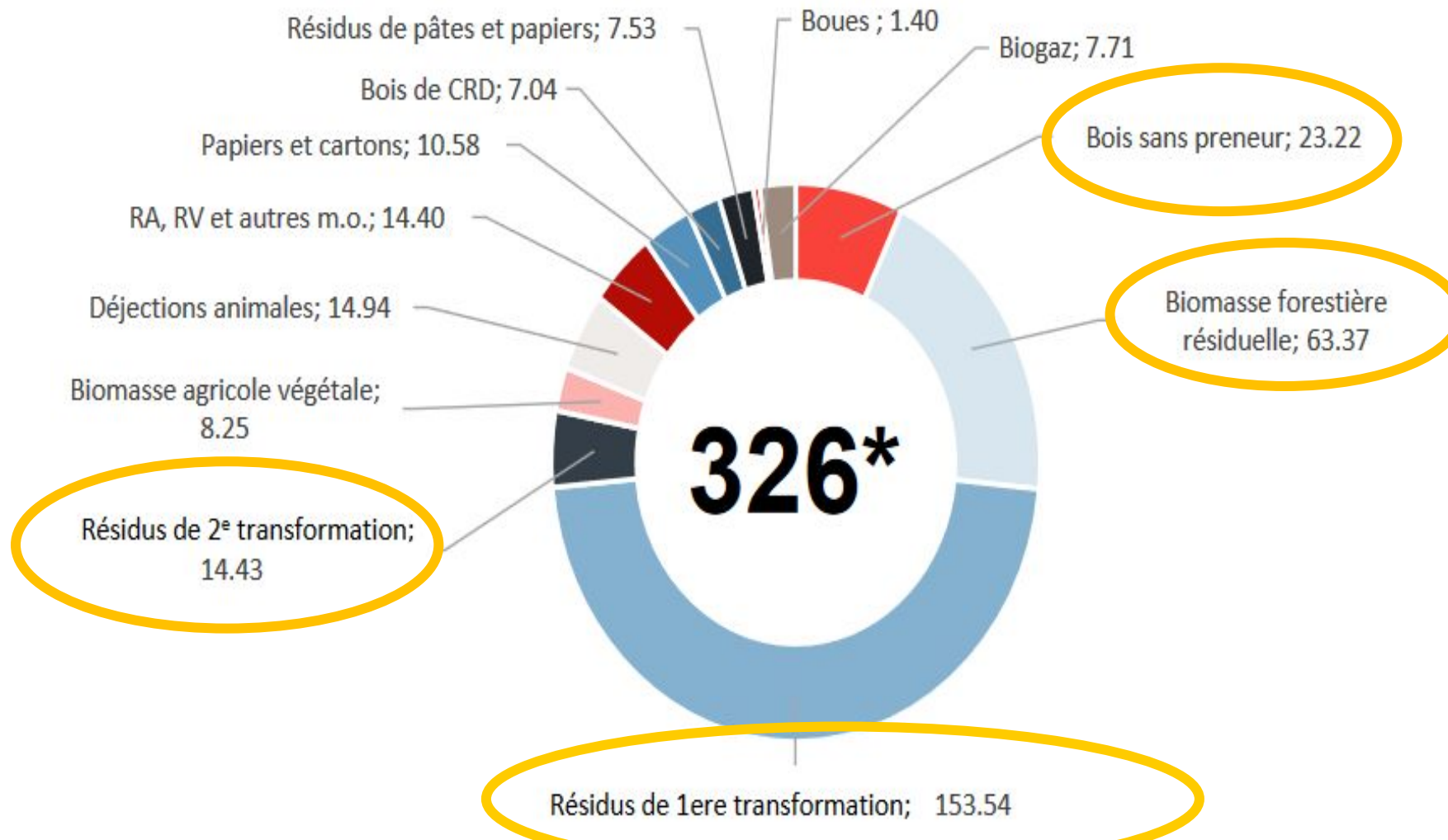
- Renewable natural gas (RNG) production capacity of 28 million Nm³ of methane (CH₄) per year or 1.07 PJ/year.
- Comes from residential organic materials and sludge from treatment plants or septic tanks.

Landfill

- Produce 169 M Nm³ CH₄ per year of renewable natural gas (RNG) or 6.44 PJ/year.
- Some produce electricity for a total of 36.65 MW of installed capacity or 2.10 PJ.

4. Biomass

2020 technical potential, all biomasses (PJ/year):



5. Forest biomass

Quebec's forest territory covers an area of 700,000 km², the equivalent of the area of Norway and Sweden.

13% of the planet's certified forests are in Quebec.

Private forest: around 18%
Public forest: around 82%



Legend

Arctic area

- Low Arctic tundra subzone
 - Low-lying shrub tundra
 - Tundra with upright shrubs
- Not mapped

0 100



Boreal zone

- Forest tundra subzone
 - Forest tundra
- Open boreal forest subzone
 - Spruce-lichen stand
 - Spruce moss
- Closed boreal forest subzone
 - Spruce moss
 - Paper birch fir stand

Northern temperate zone

- Mixed forest subzone
 - Fir tree with yellow birch
- Deciduous forest subzone
 - Basswood maple grove
 - Yellow birch sugarbush
 - Sugar maple-bitternut hickory

5. Forest biomass

The forest sector in Quebec

- Includes **25 pulp and paper mills** and **187 sawmills over 2,000m³**.
- Represents **60,000 jobs**.
- **Exports annually** outside Quebec \$CAD 10.47 billions (**€ 7.86 billions**).
- Represents \$CAD 6.45 billions (€ 4.84 billions), or 1.8% of Quebec's GDP.
- An accessible forest area estimated at **67,636 km² in private forest** and **377,734 km² in public forest**.

→ Our forest regime strongly favors the natural regeneration of the forest by limiting high-yielding plantations. Thus, **the productivity of the Quebec forest of approximately 1.27 m³/ha/year in public forests and 2.46 m³/ha/year in private forests** remains comparatively low compared to the United States, Scandinavian countries or in tropical countries. The increased productivity in private forests can be explained, among other things, by a more favorable climate in southern Quebec.

5. Forest biomass

Production per species (Total of 52,1 m³/year)

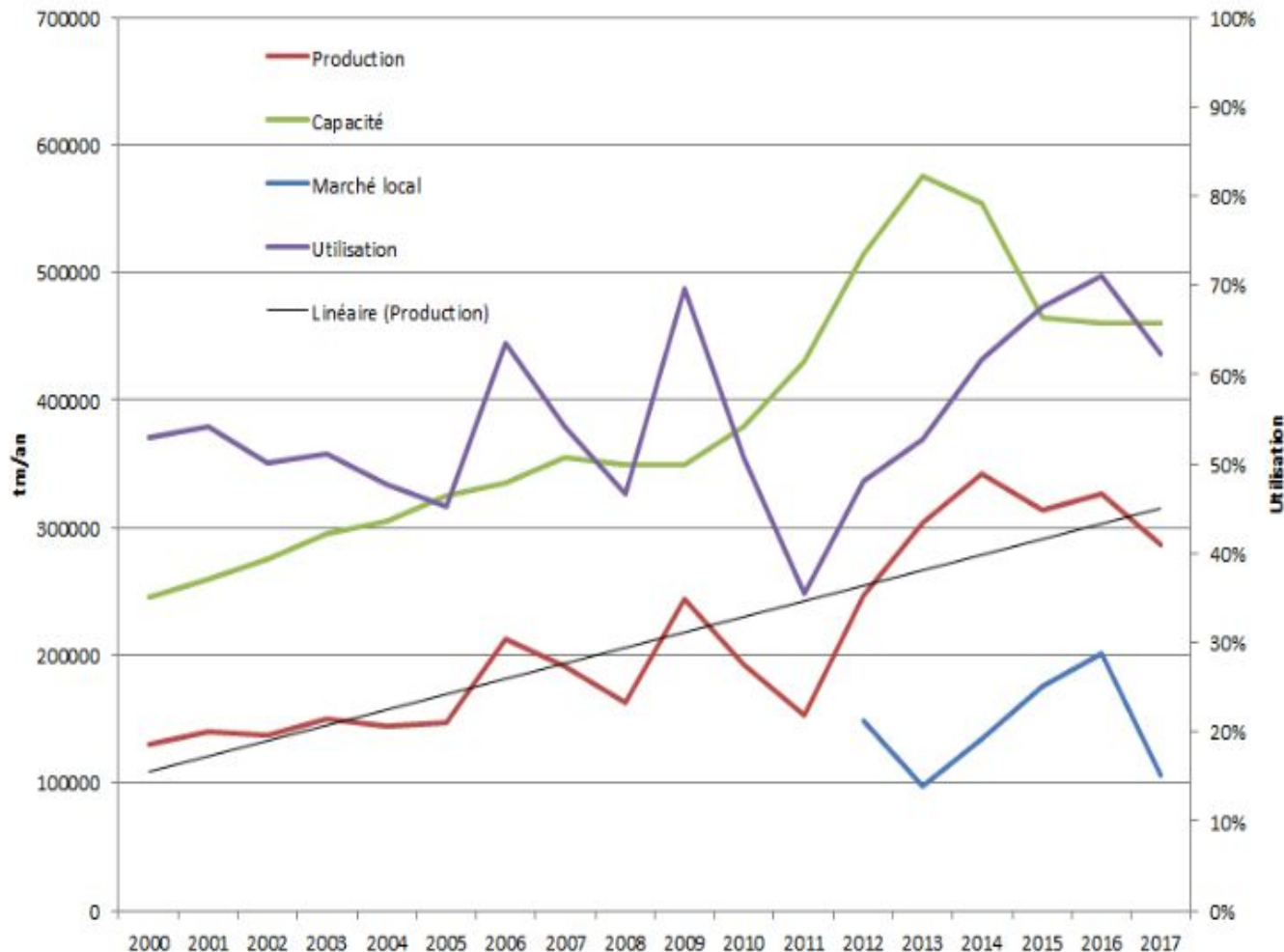
- FSPL (fir, spruce, jack pine, larch): 29,2M m³/year.
- Other softwoods : 3,2M m³/year.
- Poplar : 6,3M m³/year.
- Hardwood : 13,4M m³/year.

Plant production (Total of 415,000 tma & 7,500 GWh of electricity)

- 13 cogeneration plants
- 18 fuel plants :
 - ✓ 3 charcoal
 - ✓ 7 residential and industrial pellets
 - ✓ 1 liquid and gaseous biofuels
 - ✓ 7 energy-efficient logs

6. Wood pellets

Production/Use of pellets in Quebec



- Wood pellet production has tripled since 2000 to reach 300,000 metric tons.
- Production is massively exported, mainly to New England.
- Quebec has:
 - more than 12 forest biomass processing and packaging centers,
 - 14 pellet and log producers.
- 90% of the production is produced by 7 players.

6. Wood pellets

Exportations - Québec

		2019		2018		2017		2016	
Rang	Pays	Quantité : (KGM)	Valeur : (\$CAN)	Quantité : (KGM)	Valeur : (\$CAN)	Quantité : (KGM)	Valeur : (\$CAN)	Quantité : (KGM)	Valeur : (\$CAN)
Total	Le monde	196 144 430	50 988 190	227 313 288	50 909 627	213 246 345	52 927 758	241 056 044	54 926 547
1	États-Unis	151 184 245	42 645 197	157 757 371	39 590 240	155 150 769	38 823 547	112 110 924	30 250 004
2	Italie	34 051 954	6 515 553	41 399 121	6 665 104	25 528 070	4 167 274	13 105 787	2 097 445
3	Danemark	10 563 740	1 743 048	28 059 370	4 629 878	0	0	0	0
4	Panama	140 076	42 443	0	0	0	0	0	0
5	Royaume-Uni	203 400	41 639	0	0	32 545 736	9 926 449	115 834 333	22 577 598
6	Burkina Faso	1 015	310	1 015	310	0	0	0	0

6. Wood pellets

Port infrastructure

Port de Québec, Qc

- Project value : 30 M\$
- 2 concrete silos with an individual capacity of 37,500 metric tons.
- Wheel loading system allowing to load 1 600 metric tons per hour.
- Railcar system.
- Conveyors in tube system allowing to load 550 metric tons per hour.

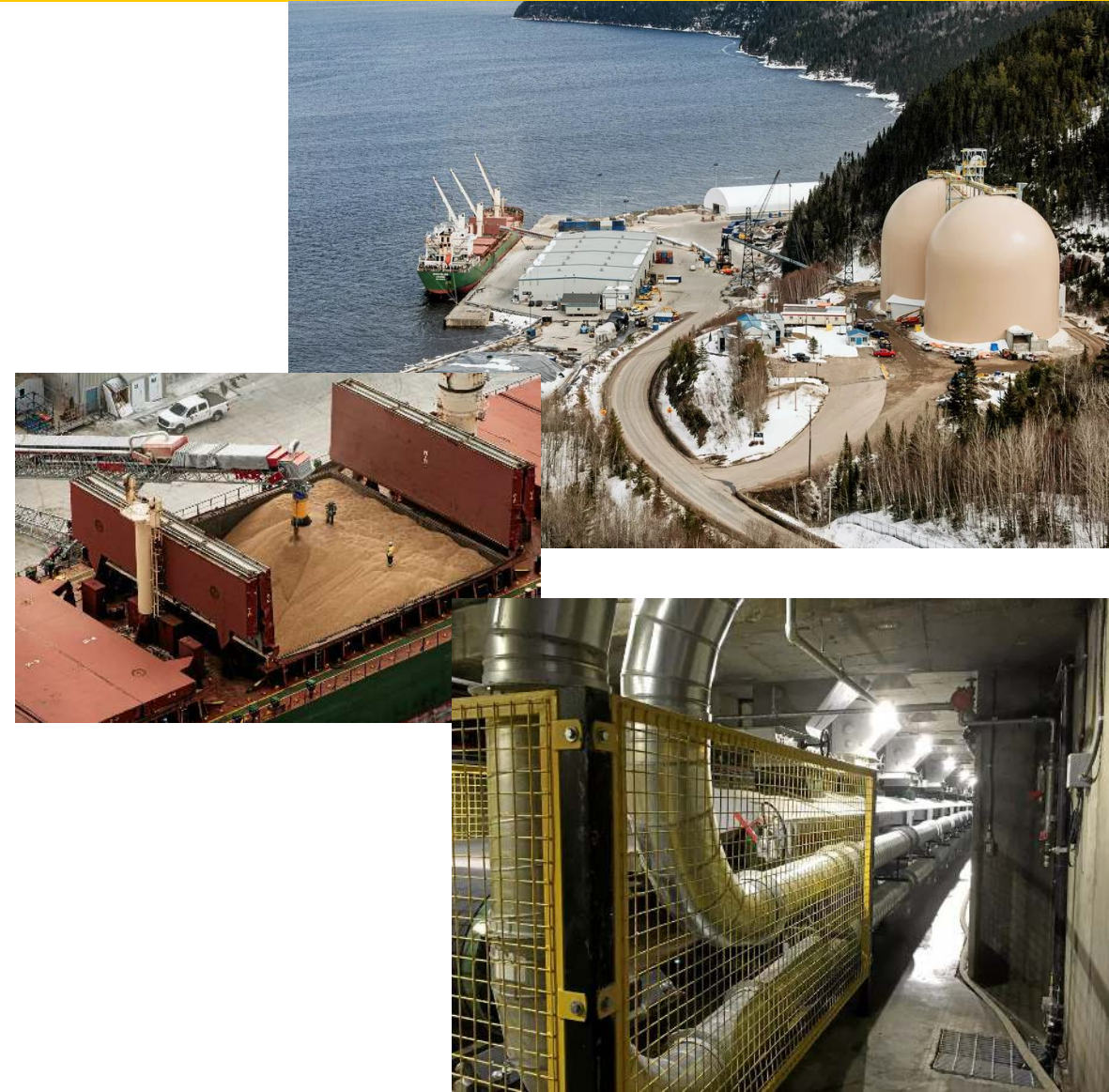


6. Wood pellets

Entreposage (suite)

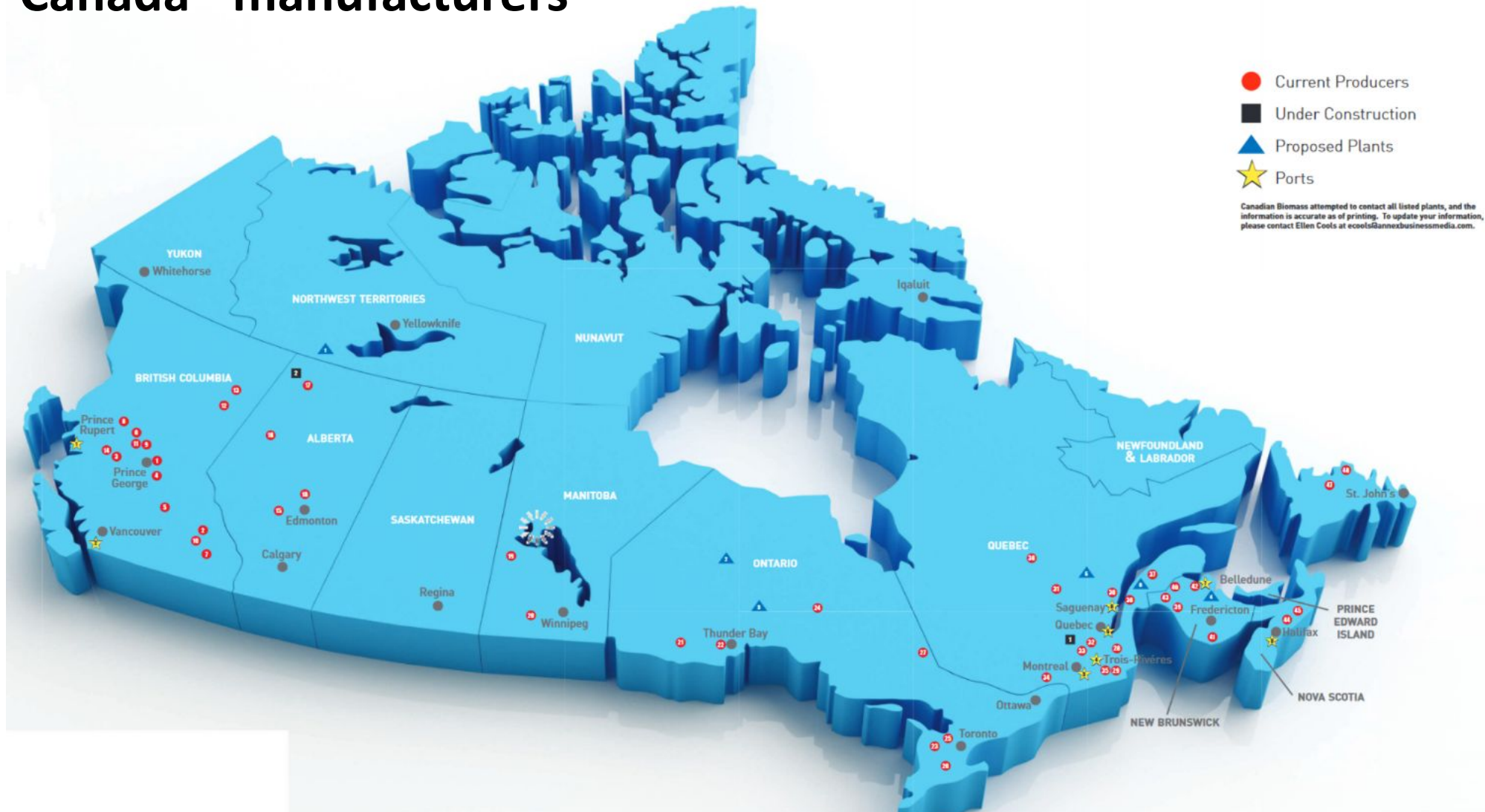
Port de Grande-Anse, Qc

- Project value : 17 M\$
- 2 concrete domes with an individual capacity of 22,000 metric tons.
- Built by Granule 777, a company founded by Barrette-Chapais Sawmill to meet a \$75M project to replace some of the coal used by Drax, the most powerful power plant in the UK.
- Loading a ship in 72 hours.



6. Wood pellets

Canada - manufacturers



Wood pellets

Wood pellets manufacturers in Québec:

<https://quebecwoodexport.com/produits/granules-de-bois/manufacturiers/>

https://www.canadianbiomassmagazine.ca/wp-content/uploads/2020/04/CBM_PELLET_MAP_APR20-LR.pdf

Business model: Essentially two types of manufacturers

- Companies that are already working in the field of wood processing (**sawmills: using sawdust, planing, chips**), cabinets, flooring, etc.) and have dry or green dry or green by-products to valorize (integrated plant) – Majority
- Entrepreneurs who decide to create a new company to valorize the residues or by-products of other companies – Minority

Next step: use the forest cutting residues (currently not valued)

Heating network

Still not very developed, heating networks serve 1.3% of the country's built-up areas, mainly in large cities, and are fuelled by gas and fuel oil.

In Quebec, energy recovery and reuse are motivated less by a concern for economy than by the search for energy efficiency. The province is lagging behind in the development of heat networks due to the very low price of electricity.

Strengths & Weaknesses

STRENGTHS	WEAKNESS
Increasing of wood pellet production in Canada (8% annually) – production capacity	Very competitive cost of hydroelectricity - hinders the development of other renewable energies
High resource availability in Quebec / Canada (forest/biomass)	Long distance between resources, transformation & markets, high transport costs
Strong forest industry	Public forest supply: complex system, lack of efficiency and predictability
Existing port infrastructures in Quebec for the export of pellets/chips	Need improvement in the logistics between harvesting and processing
Government program: subsidiaries	

Opportunities & Threats

OPPORTUNITIES	THREATS
Increasing of wood pellet consumption in the world (Europe is the bigger consumer)	Challenges with pellets inventory management
Need to develop other energy options in the short term in Quebec (other than Hydro-electric)	Social acceptability issues regarding forest harvesting
World energetic crisis	Soaring prices linked to the geopolitical context
Climate changes / carbon market	buyer for electricity - state monopoly limited access to domestic market
Government's desire to diversify green energy production	



Thank you!

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