Forest Bioenergy in Canada

Summary of Results from the 2023 Canadian Forest Bioenergy and Bioproducts Database (CFBBD)

TorchLight Bioresources

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Background

- In September 2017, the Canadian Council of Forest Ministers (CCFM) unanimously endorsed *A Forest Bioeconomy Framework for Canada* and in 2022, the *Renewed Forest Bioeconomy Framework*.

- The bioenergy and bioproducts represent an opportunity for Canada's forest sector to diversify and contribute to climate change mitigation.

- The *Forest Bioenergy and Bioeconomy Survey* was undertaken to better understand the Canadian bioeconomy and to inform the development of federal policies and programs through qualitative and quantitative data.

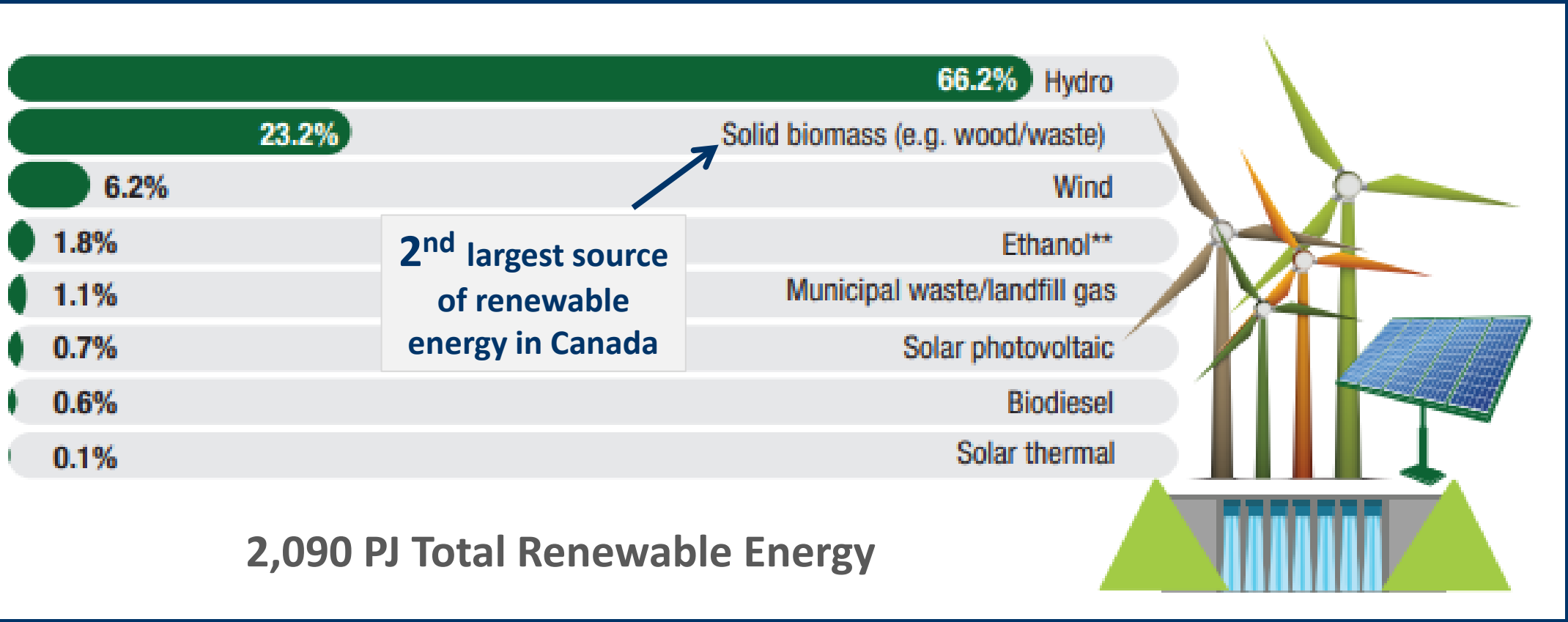
Survey Objectives and Scope

- Objective: To gather a detailed capacity, production, market and socioeconomic data of the bioeconomy in Canada, including on bioenergy, biofuels and other types of bioproducts.

- In 2023, the scope of previous surveys was expanded to including key aspects of the forest-based bioeconomy such as advanced solid, liquid and gaseous biofuels, biomaterials, biochemicals and advanced non-structural building materials.

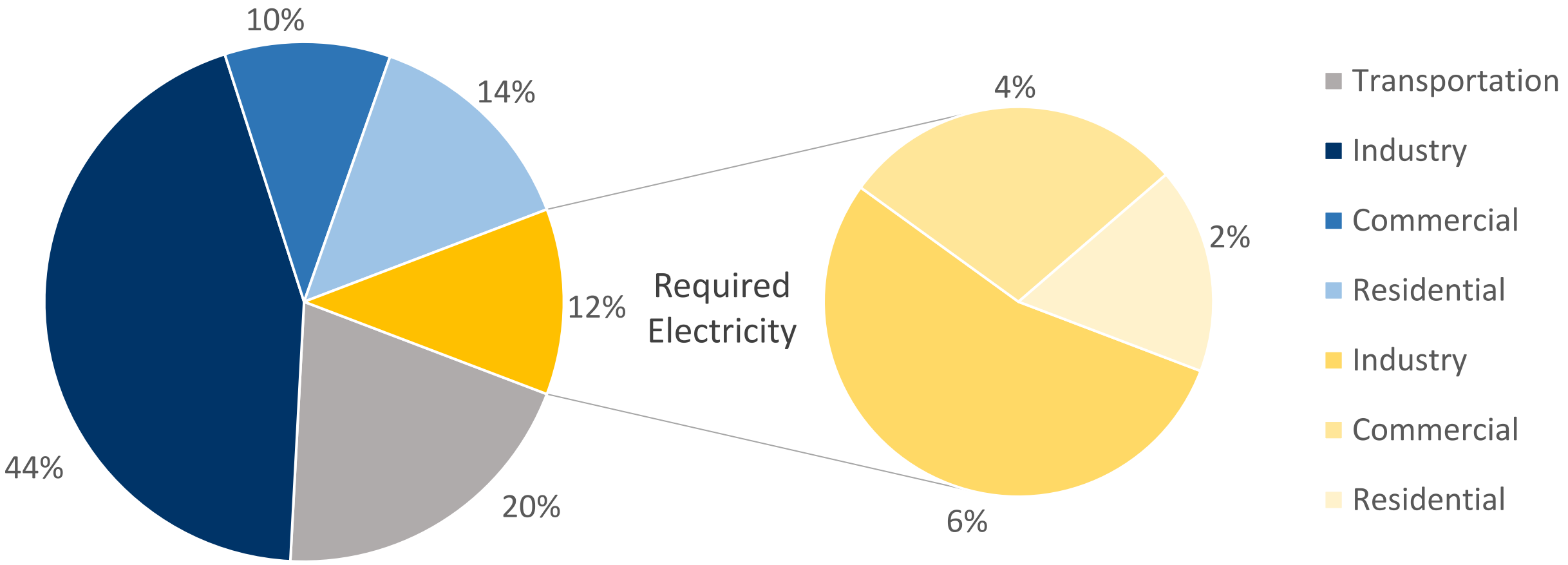
This presentation focuses on forest bioenergy generation and use in Canada, by industry, utilities, communities and buildings.

Renewable Energy in Canada, 2020



From Natural Resources Canada (NRCan) Energy Fact Book 2022 – 2023.
Includes energy consumed for electricity, heat production and in the transportation sector.

Energy Demand in Canada, 2022



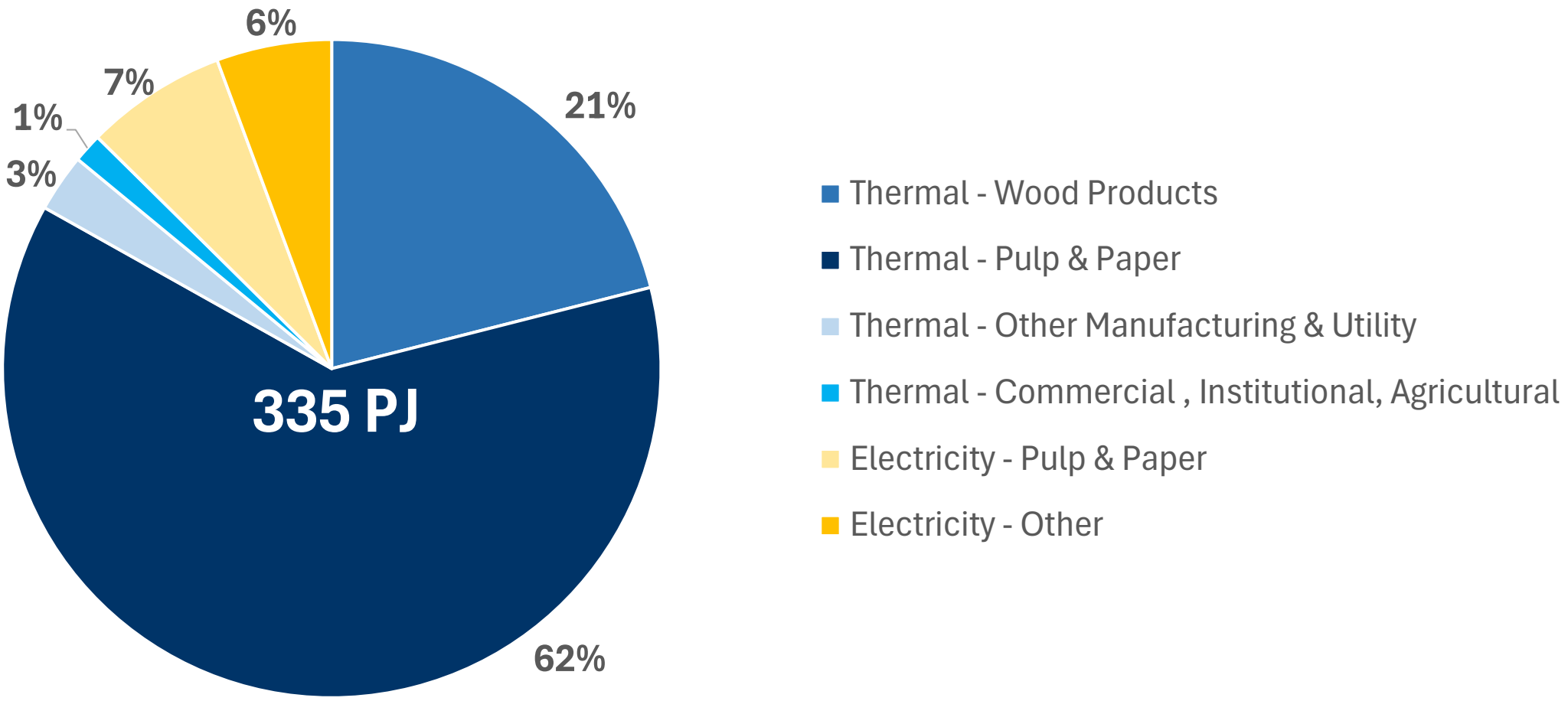
- **<u>Thermal energy (blue shades)</u>** is approximately 60-65% of Canada's energy demand
- Excluding existing electrical heating, electricity (yellow shades) is 12% of Canada's energy demand
- Industrial thermal energy demand is nearly 4x ALL of Canada's electricity demand

Canadian Forest Bioenergy and Bioproducts Database (CFBBD)

- Facility-level data captured for:
  1. **Wood Pellet Mills** – internal bioenergy + pellet production, feedstocks, exports, etc.
  2. **Pulp & Paper Mills** – internal bioenergy + bioproducts (coproducts)
  3. **Sawmills** – internal bioenergy, mostly heat
  4. **Panel Mills** – internal bioenergy, mostly heat
  5. **Utility and Other Industrial** – industrial bioenergy + utility bioenergy generation
  6. **Commercial & Institutional (C/I)** – bioheat (from Canadian Bioheat Database)
  7. **Agricultural** – bioheat (from Canadian Bioheat Database)
  8. **Advanced Bioproducts** – technology, product(s), internal bioenergy

Results: Forest Bioenergy Generation and Use in Canada

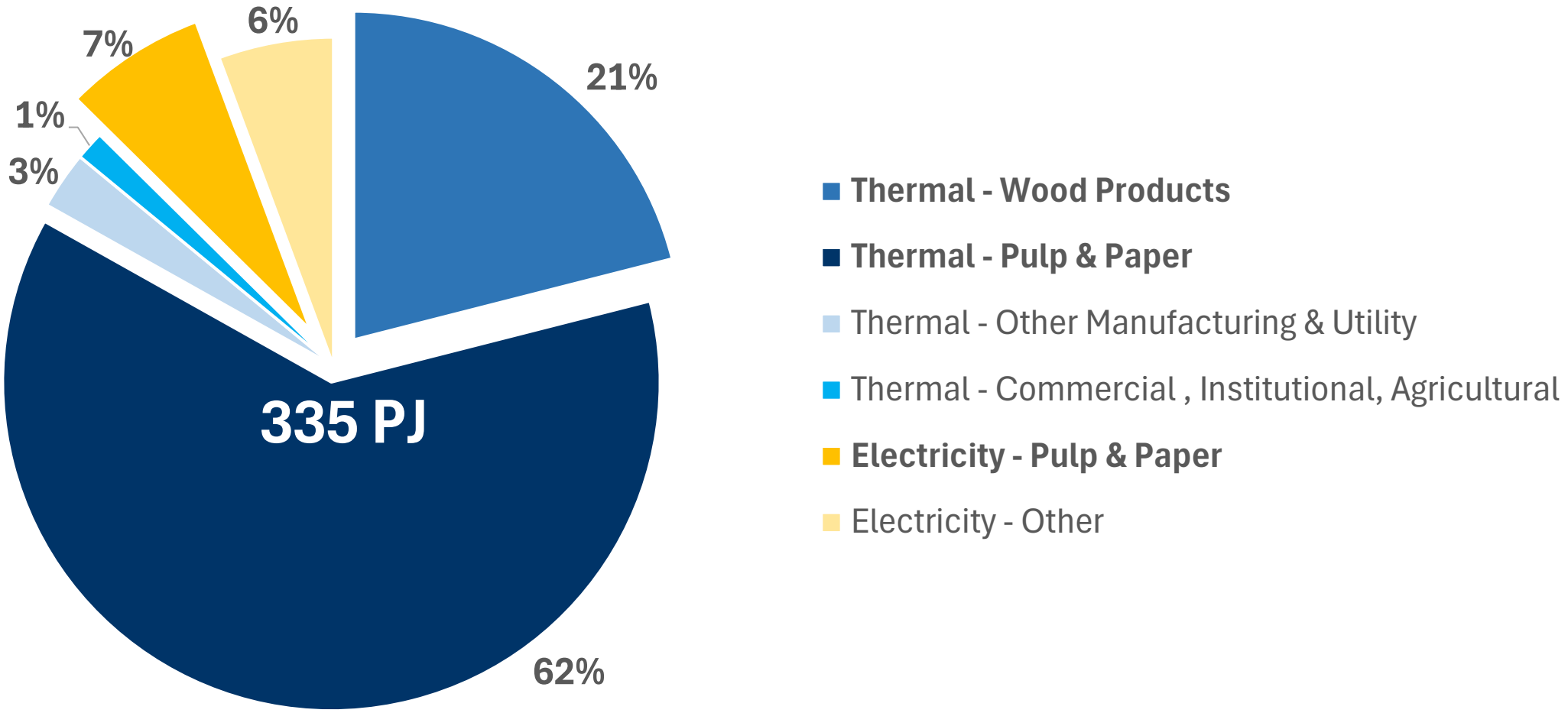
Forest Bioenergy End Use, CFBBD 2023



87% of bioenergy end use is for **Thermal Energy**

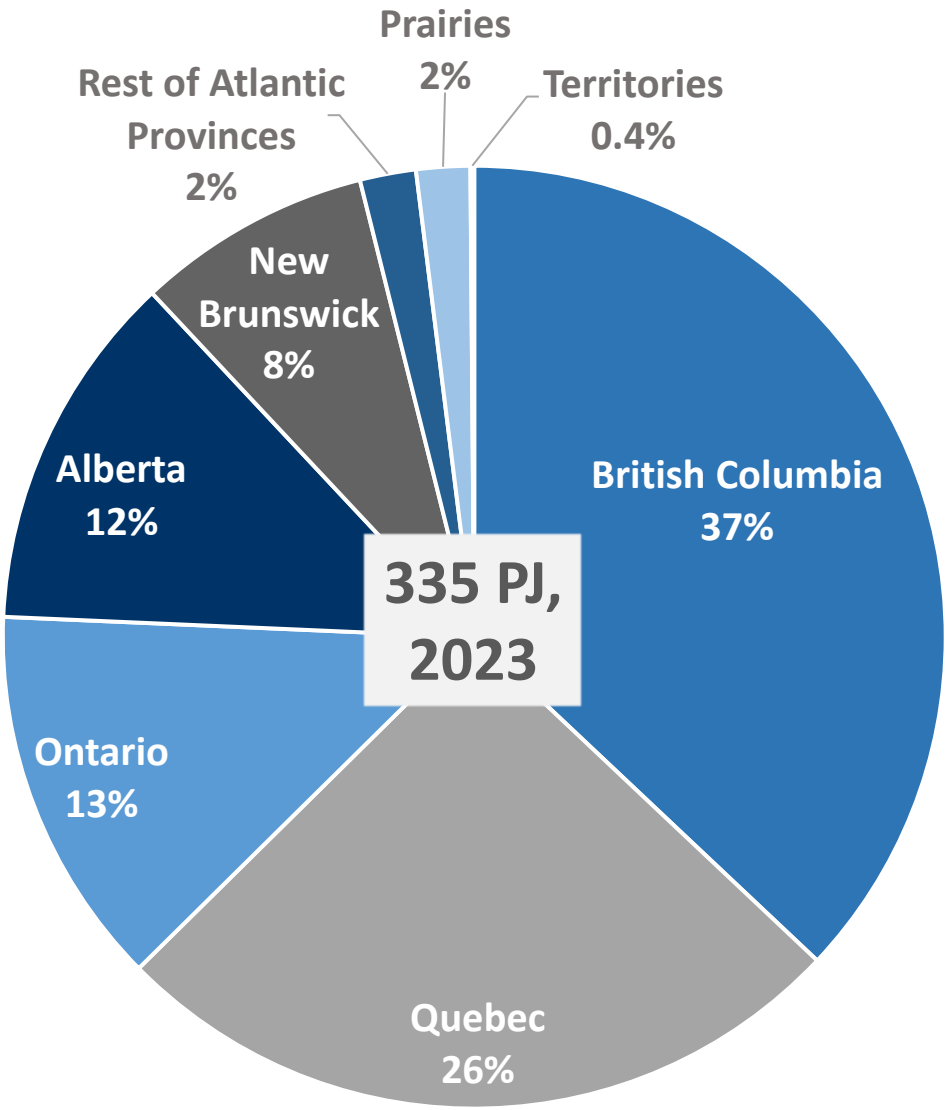
*Does not include residential wood burning

Forest Bioenergy End Use, CFBBD 2023



90% of (non-residential) forest bioenergy end use is in the **Forest Products Sector**

Bioenergy Generation by Province, 2023



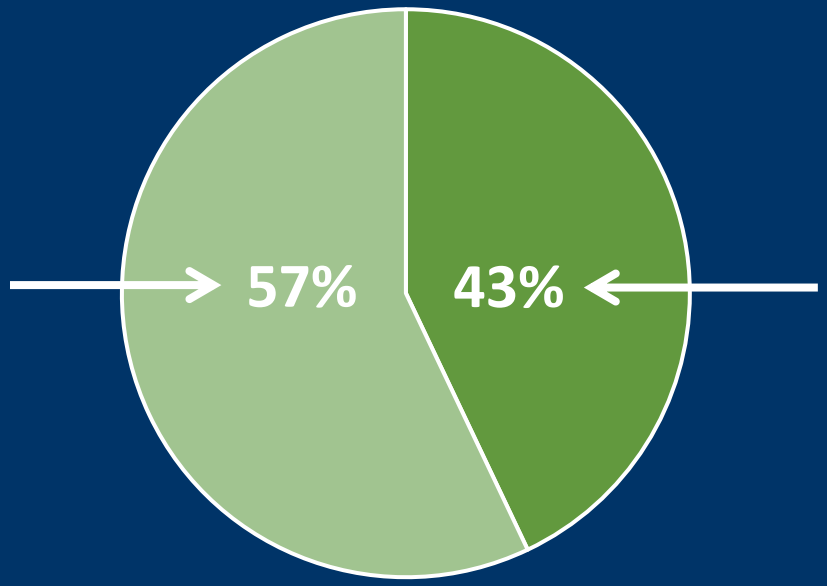
95% of forest bioenergy is produced in the five provinces that are responsible for 95% of Canada's forest sector GDP.

Biomass Consumed for Energy

>27 Million Tonnes (Dry) of Forest Biomass were used for energy annually in 2022 and 2023

Solid Wood Biomass

- **Hogfuel (Bark)**
- **Other Mill Residues**
- Harvest Residues
- Management Residues
- Urban Wood Waste
- Wood Pellets



Spent Pulping Liquor, a waste stream from Kraft pulp production

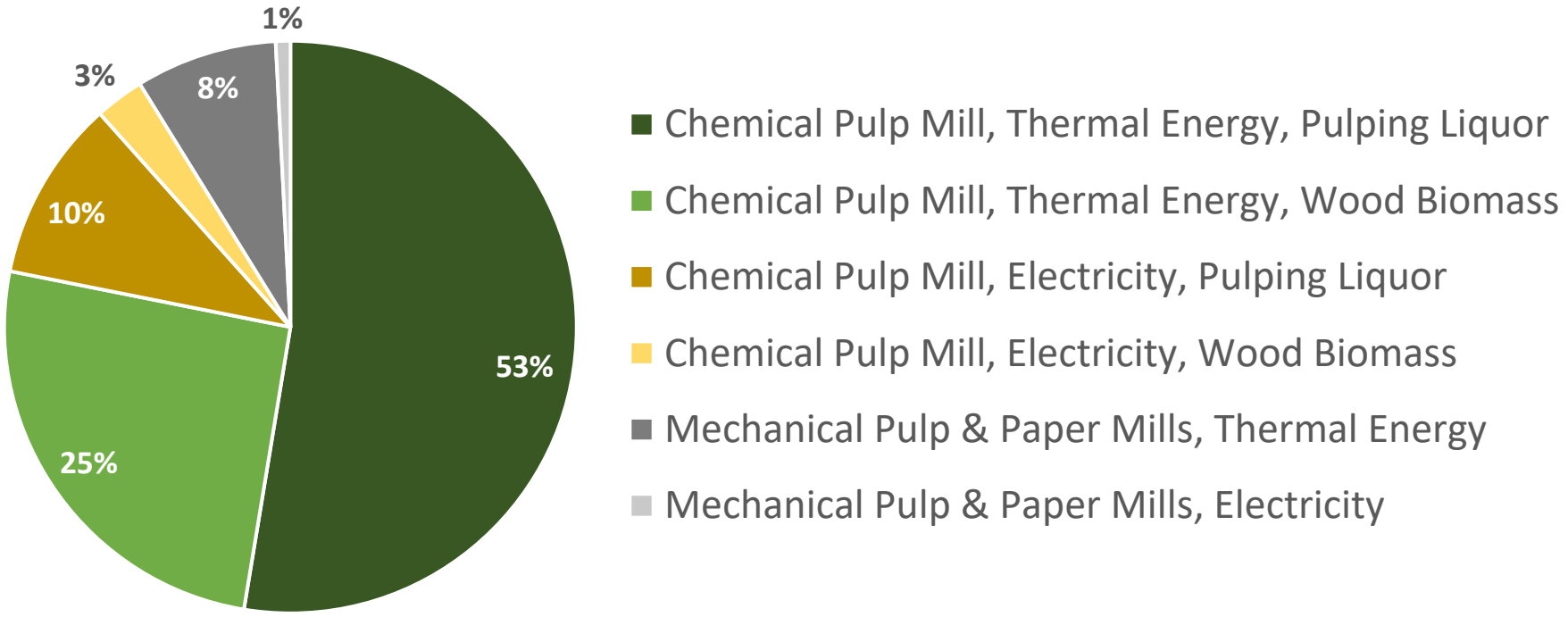
Proportions are average of 2022, 2023

Bioenergy in Pulp & Paper Mills, 2023

256 PJ, 2022

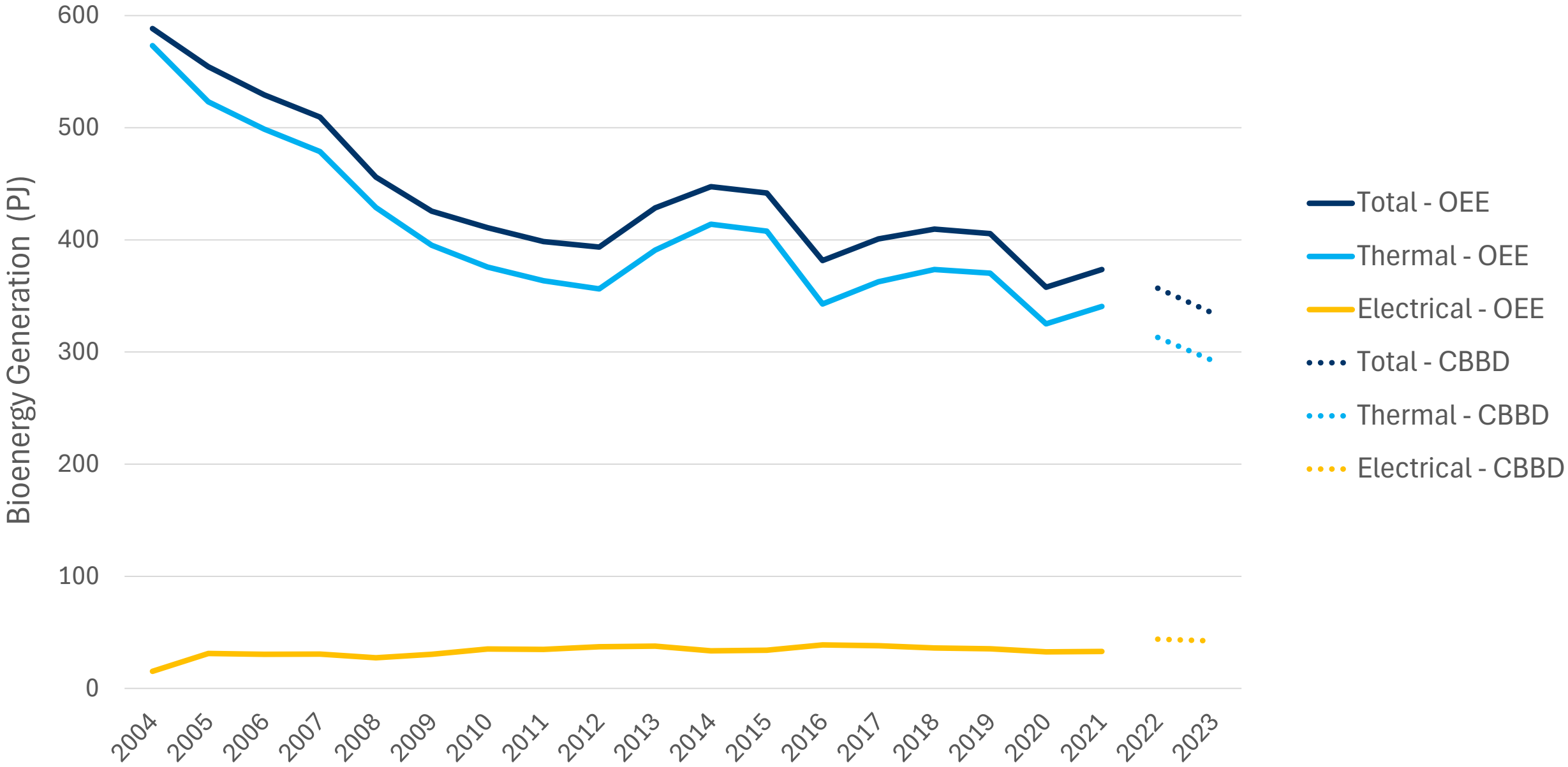
240 PJ, 2023

(Proportions from 2023, similar in 2022)



- 29 Chemical pulp mills, 9 mechanical pulp mills and 4 paper mills use bioenergy
- Chemical pulp mills use bioenergy in **power** (hog) boiler & **recovery** (liquor) boiler, often both contribute to electricity
- **More wood fibre is converted to energy than pulp in chemical pulp mills**

Forest Bioenergy in Canada Since 2004



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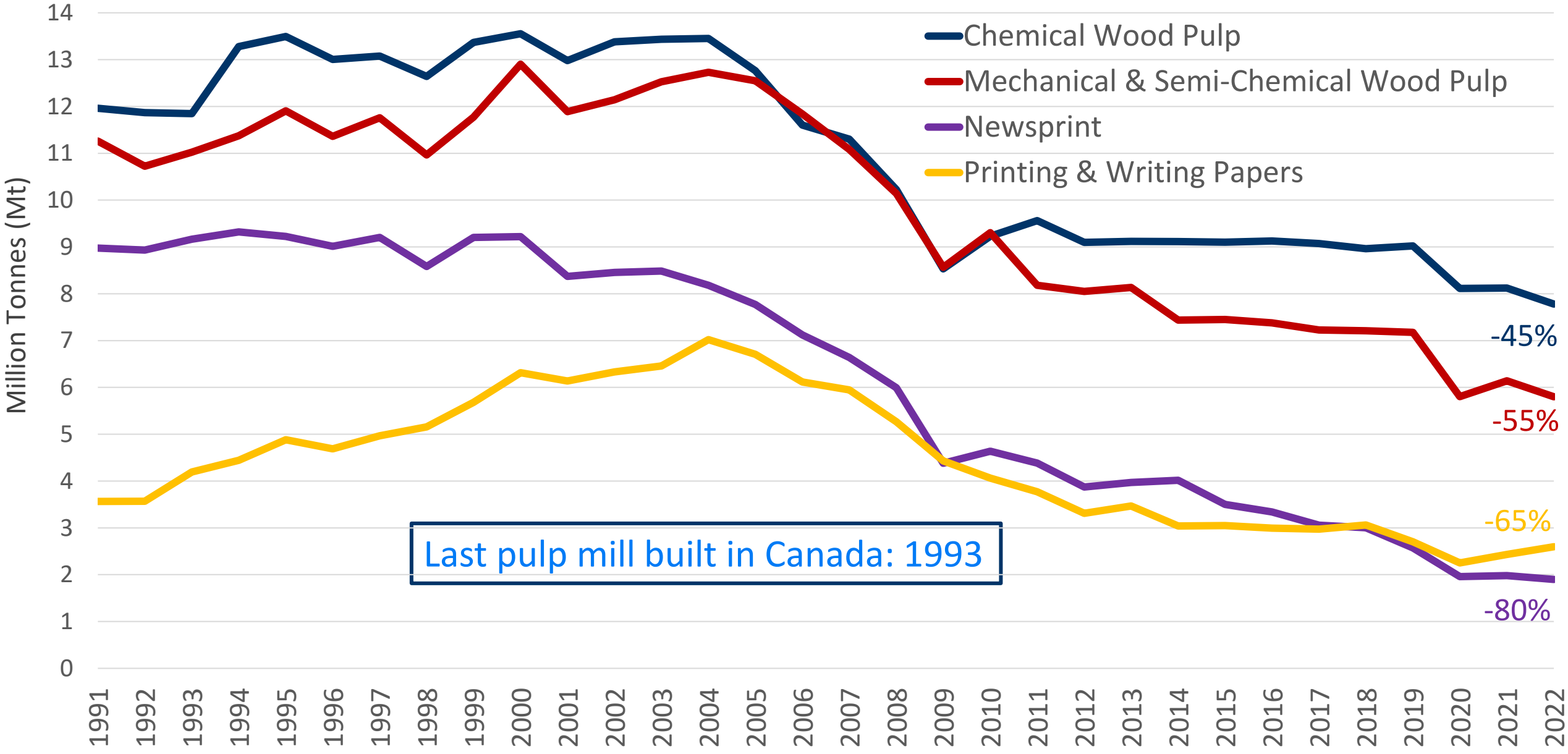
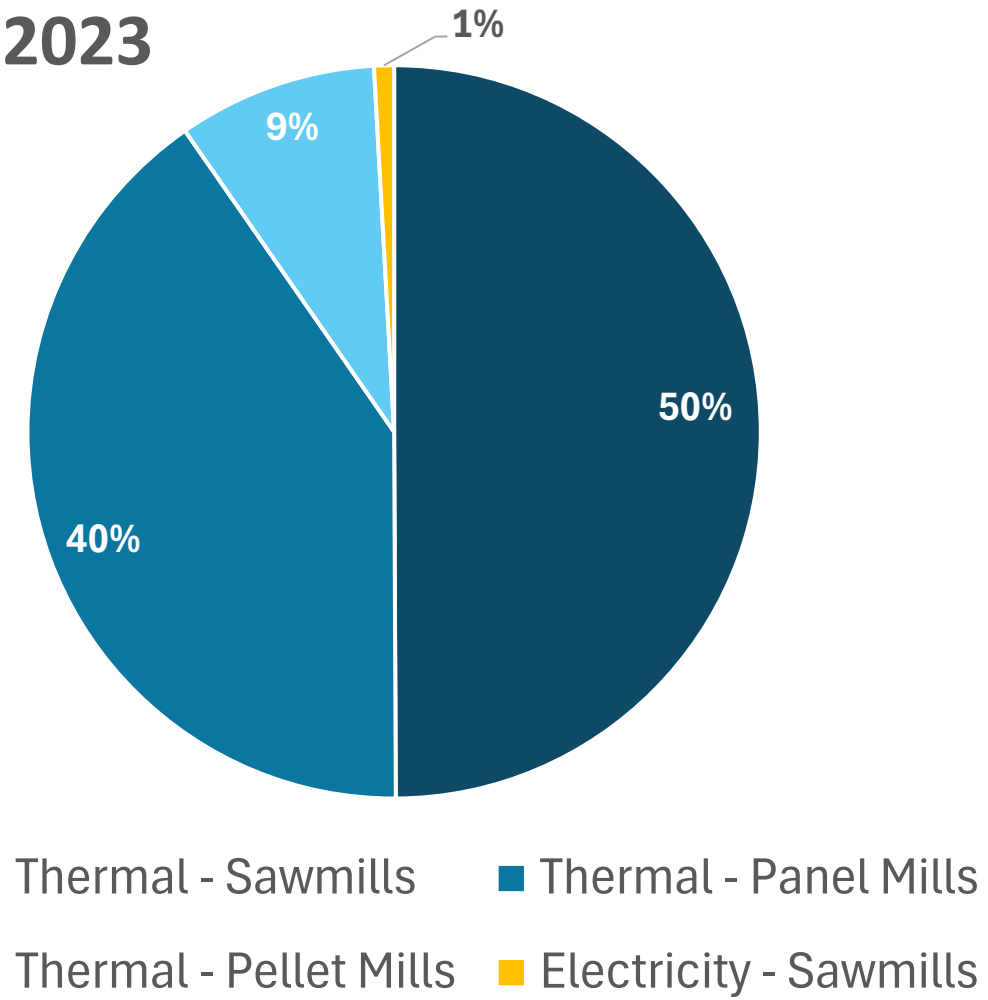
Canada's Pulp and Paper Production



Bioenergy in Wood Products Sector

73 PJ, 2022

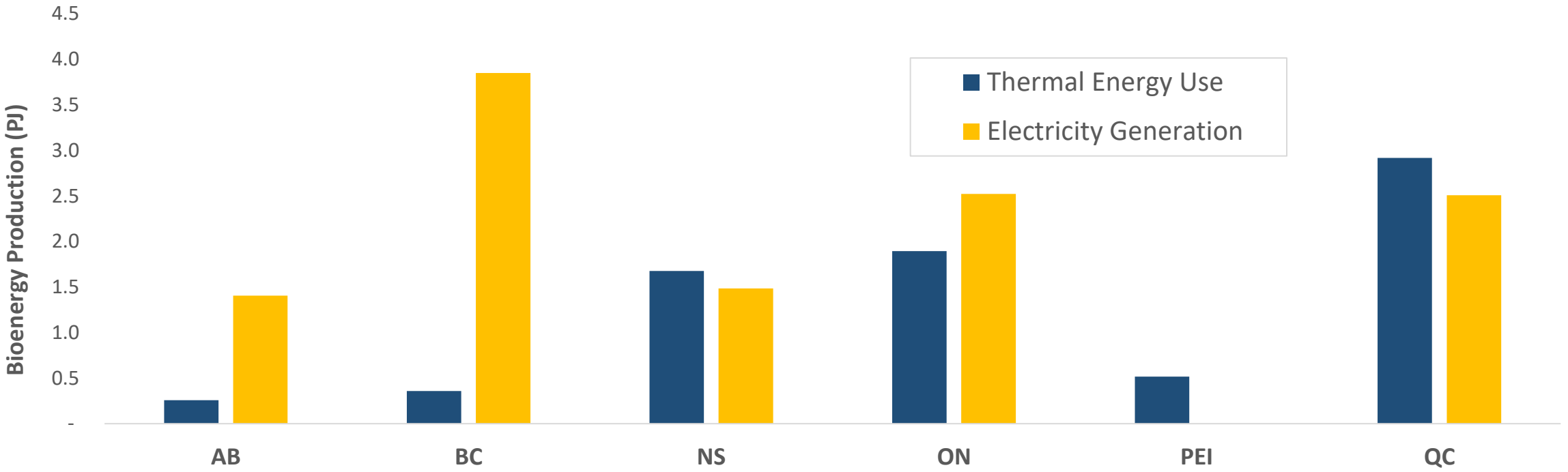
70 PJ, 2023



Proportions shown are 2023, similar in 2022

- 365 Sawmills, 56 Panel Mills, 45 Pellets Mills
- **99%** of Bioenergy generation in wood products sector is for **internal thermal energy**
- **>90%** of biomass fuels used are mill residues, smaller amount of harvest / management residues

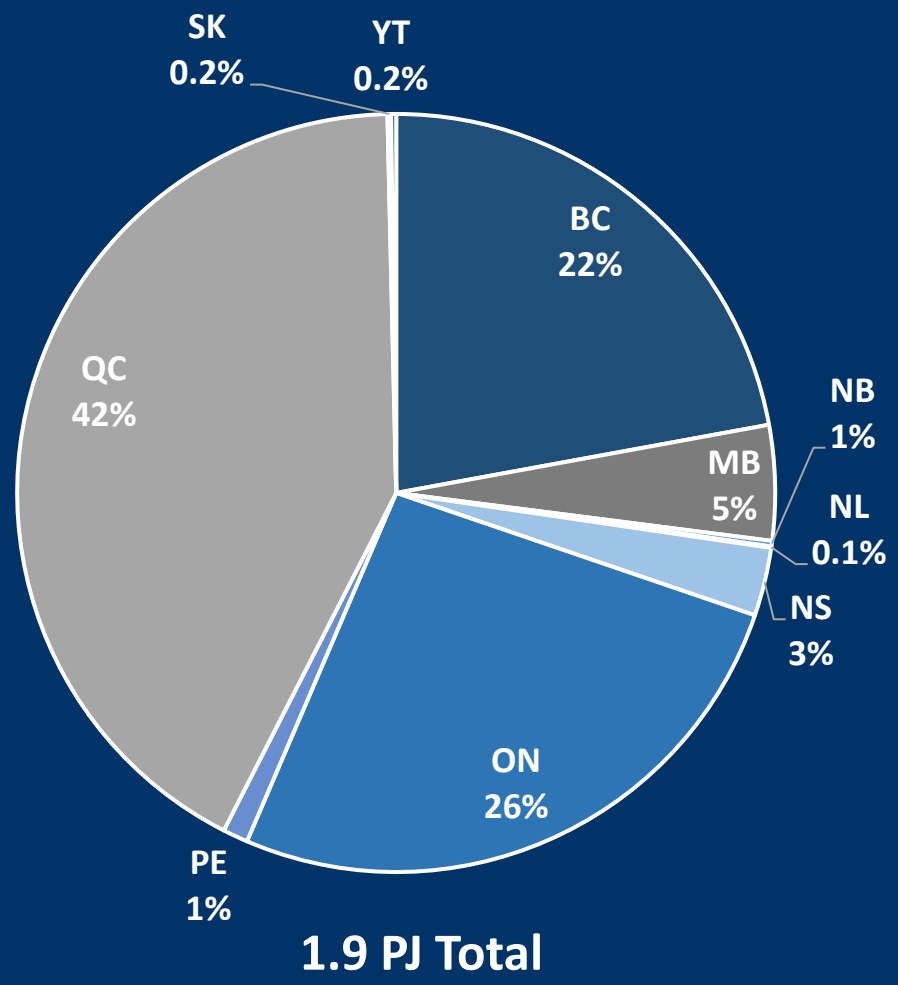
Utility Bioenergy by Province, 2023



- Includes 25 utility biopower producers and 4 utility scale district heat (e.g., Charlottetown, Ajax) and 7 industrial facilities (mostly cement plants)
- Total electrical bioenergy capacity of >800 MW
- Not as strongly tied to forest sector output; mill residues are still primary biomass fuel
- Several urban bioenergy plants use C & D waste, other urban biomass

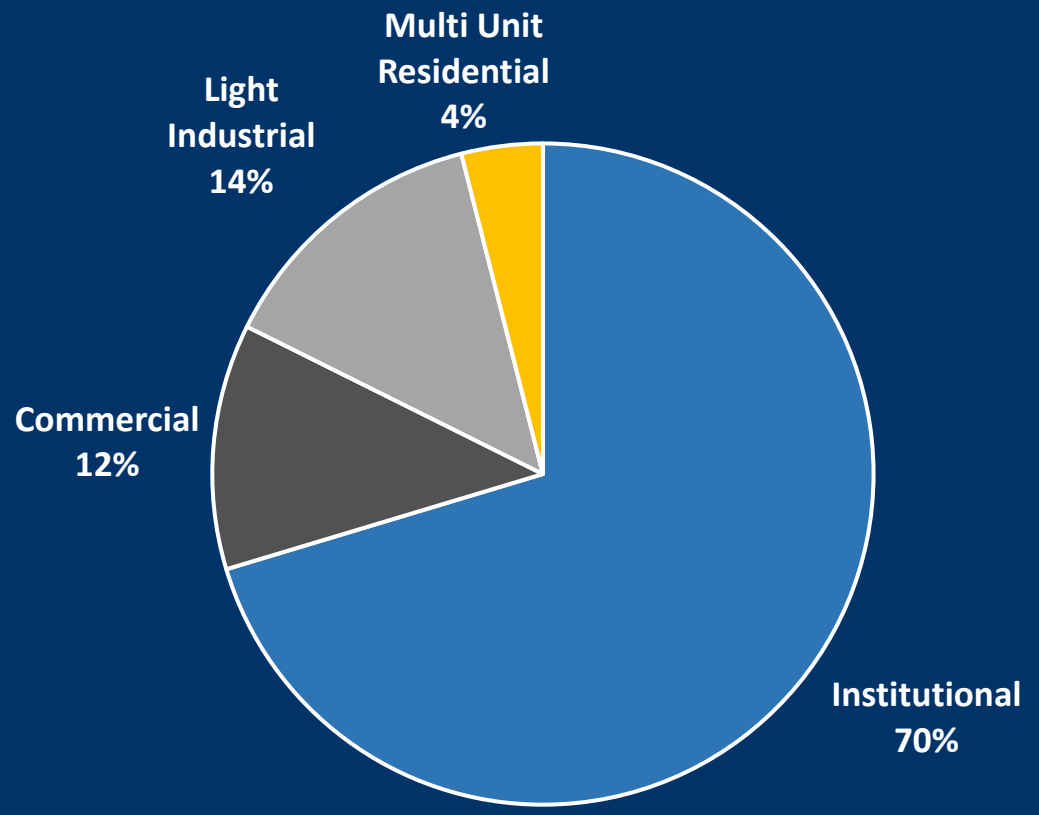
Agricultural Bioheat, 2023

- 147 bioheat systems in CFBBD, total capacity of 300 MW
- Range in scale from 100 kW to >25 MW, Average of 2 MW
- **44%** of bioheat systems in greenhouses, account for **83%** of bioenergy use
- **56%** in barns, other farm buildings, account for **17%** of bioenergy use



Commercial & Institutional Bioheat, 2023

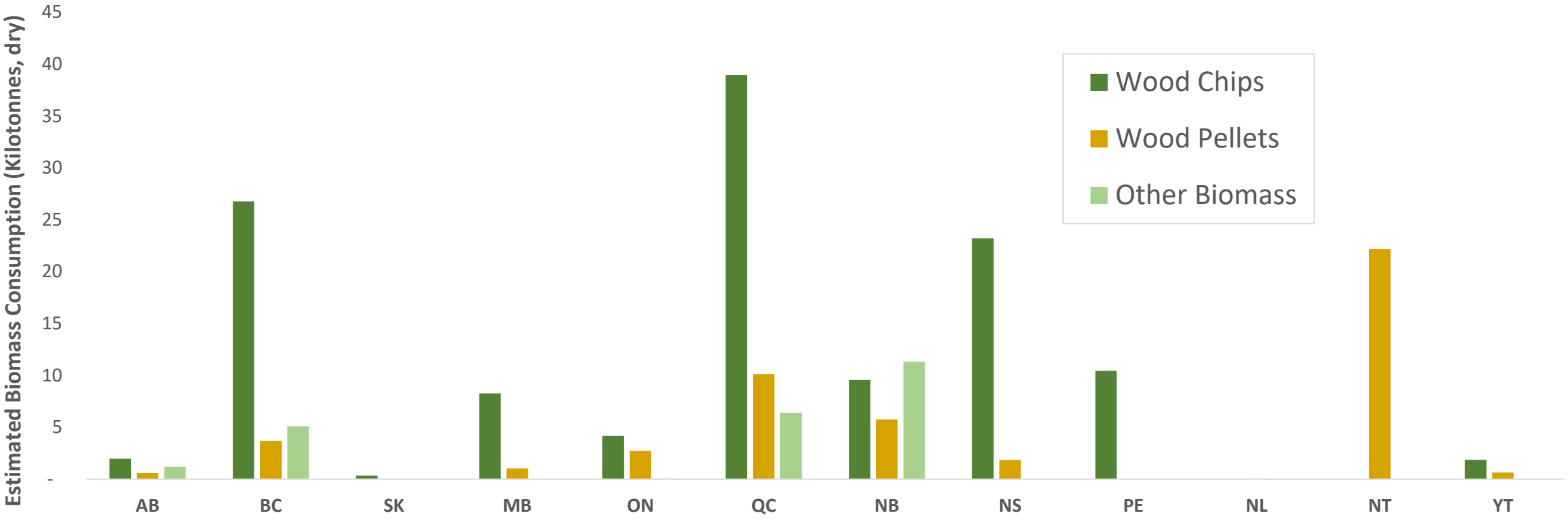
- 460 bioheat systems in CFBBD
  - Total capacity of 290 MW
- Range in scale from 50 kW to >20 MW
  - 89% are < 1 MW
- 68 connect to a district heating network
- 109 in remote communities



Heat output of 2.8 PJ, 2023

- Institutional buildings include schools, hospitals, universities and public buildings such as recreation centres, churches, municipal or band offices

C/I Bioheat by Province and Biomass Fuel Type



- Development tied to provincial, territorial forest biomass programs and procurement policies, heating fuel prices
- **>10% of domestic wood pellet consumption is for commercial & institutional bioheat in NWT**
- *Other Biomass* includes hogfuel other mill residues, briquettes, whole logs

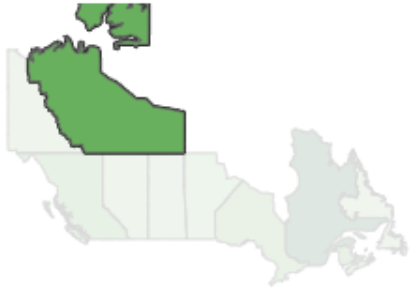
Canadian Bioheat Dashboard

Canadian Bioheat Database Overview

96	37	20,269	28,728
Systems	Installed Capacity (MWth)	Estimated Biomass Demand (bdt/y)	Estimated Avoided CO2 Emissions (t/y)

Bioheat Systems by Province and Territory

Click a Province or Territory to filter dashboard



Fuel Type

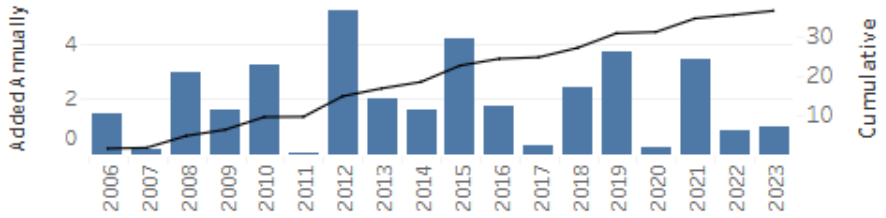
Click a slice to filter dashboard

- Wood Chips
- Wood Pellets

Go to Fuel Dashboard

Bioheat System Capacity (MWth)

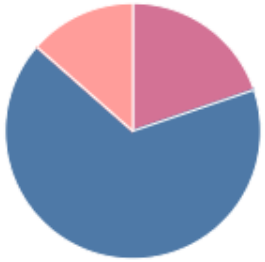
Click a year to filter dashboard



Go to Growth Dashboard

Sector Type

Click a slice to filter dashboard

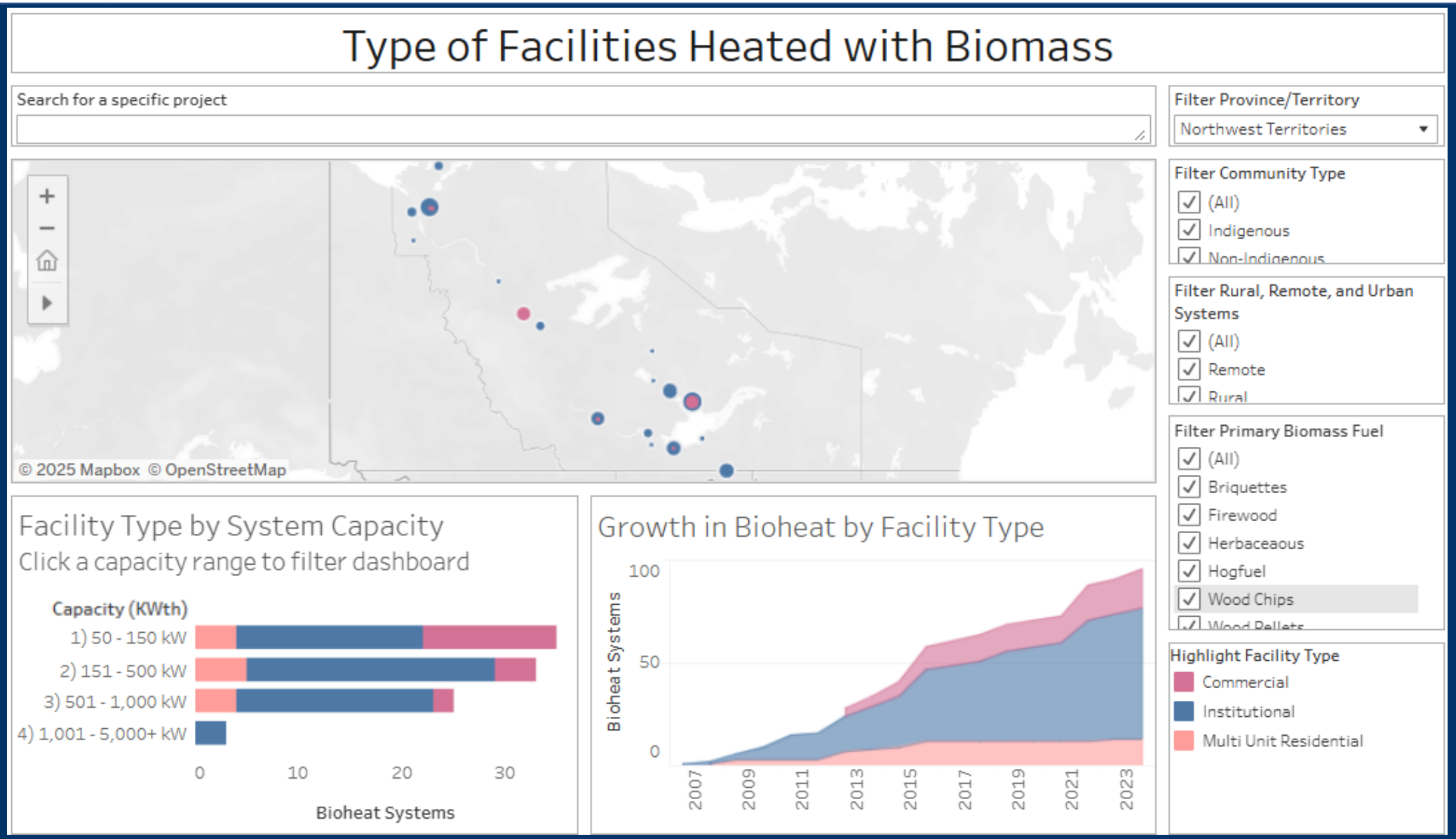


- Commercial
- Institutional
- Multi Unit Residential

Go to Sector Dashboard

Find the Bioheat Dashboard at: https://torchlightbioresources.com/canadian-bioheat-database

Canadian Bioheat Dashboard



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Opportunities for Bioenergy Growth in NWT

- Expansion and development of community-wide district heating
- Biomass combined heat and power (CHP)
- Decline of pulp sector means biomass available for energy & pellets
- Total forest harvest has declined 40% in 20 years, lots of wood in Norther Alberta, for example
- Increasing need for active forest management to reduce forest fire risk in the north could generate biomass locally
  - New jobs and economic development from network construction CHP operation and biomass supply
  - Local ownership and control of energy systems and fuel supply

Challenges for Bioenergy Growth in NWT

- Supplying biomass to larger scale bioenergy facilities
  - How to bring in more biomass affordably?
  - Or how to establish local supply chains for biomass (without significant lumber production)?
- Human resources for biomass supply, CHP operation and district heat network construction
- Added complexity (regulatory, technical) of electricity production
- Emerging bioproducts such as Bio-oil, Bio-diesel, Bio-char seem appealing but very high cost, uncertain supply

Concluding Remarks

- Thermal energy is largest market for biomass – NWT needs heat
- Most efficient use of biomass is production of both heat and power, reliable, affordable electricity also increasingly needed
- New markets for biomass are needed across the country; bioenergy is the only thing proven to replace pulp
- Lots of opportunity, challenges exist but not show-stoppers
- Coordinated effort required

Thank You!

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