

NORTHWEST TERRITORIES  
BIOMASS WEEK 2024

# THE SHIFT TO MAINSTREAM

Advancing Wood Pellet Heating Systems in Canada



**WOOD PELLET**  
ASSOCIATION OF CANADA

Gordon Murray, Executive Director  
January 29, 2024

Fueling a Greener Tomorrow!  
La solution de chauffage écologique!  
bsbheating.com

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# GROWING SUPPLY CHAIN



- 50+ members.
- Second largest producer of wood pellets globally.
- Employs more than 2,500 Canadians directly.

# WOOD PELLETS 101

- Renewable low-carbon fuel.
- Compressed wood fibre.
- Residues of primary forest sector.
- Sawdust and low-quality logs.
- Grinding, drying, pressing, cooling, sieving, packaging.
- No additives: wood lignin acts as a glue.
- Primary end uses are heat and electricity.



*New Brunswick's Grand Falls Hospital's biomass boiler uses 400 tonnes of wood pellets annually.*

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# RESPONSIBLE SOURCING



- Canadian wood pellet sector exists primarily to make better use of forests already being harvested.
- 100% residuals or fibre rejected by sawmills and pulp mills or left on the ground after harvesting.
- 100% committed to trees going to their highest and best use.
- Decline of pulp industry means more residuals need an outlet.
- 100% third party certified to global sustainability standards.

# WOOD HEATING SYSTEMS

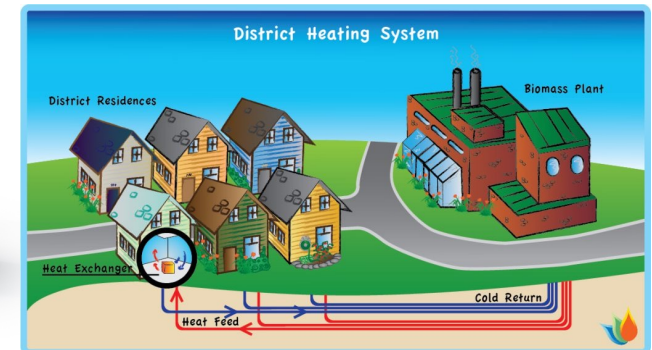
## Manually fed

- Stoves using cordwood or briquets
- Cordwood furnaces



## Automated

- Pellet stoves and furnaces
- Boilers using pellets or chips
- District heating





# WOOD PELLET STOVES AND FURNACES

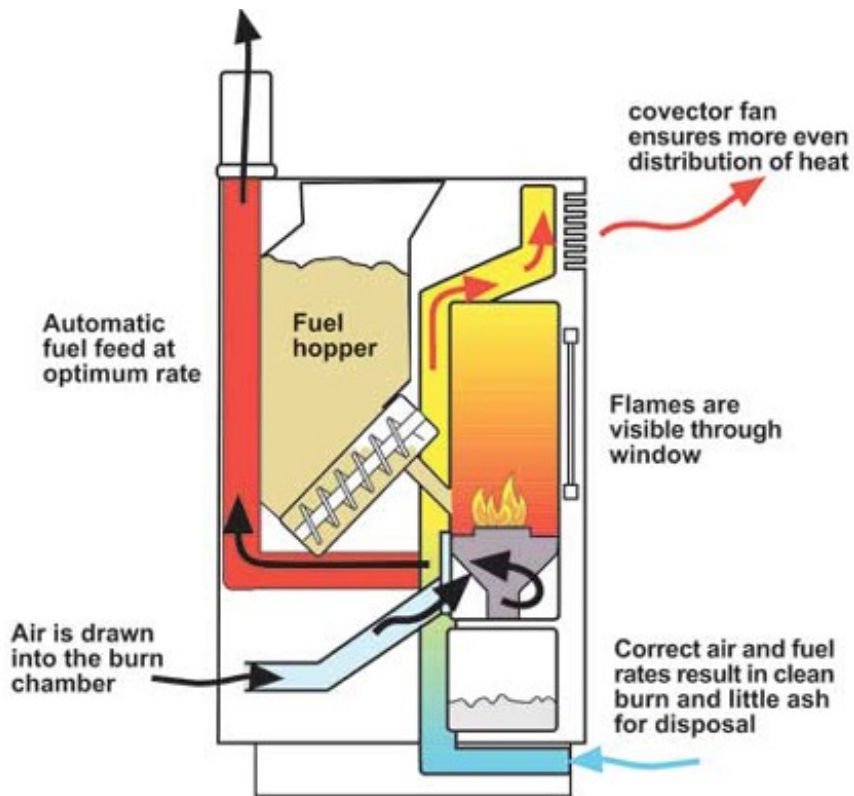
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# WOOD PELLET STOVES

- Primarily for single-room heating.
- Normally fed with bagged pellets.
- Typically, will run for 24 hours (with a full fuel hopper).
- Thermostatically controlled and automatic fuel feeding.



# WOOD PELLET STOVES OPERATION



- Turns on with flick of a switch.
- Electricity runs the feed auger and fan.
- Can adjust room temperature with thermostat.
- Requires daily glass cleaning, weekly ash removal and disposal.
- Installed cost: \$5,000-7,000.

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# WOOD PELLET FURNACES

- Alternative to oil and gas.
- Connects to duct system for warm air distribution through entire home.
- Electric backup available.
- Thermostatically controlled.
- Runs for up to 200 hours on a single hopper.
- ~ 85% fuel efficiency.



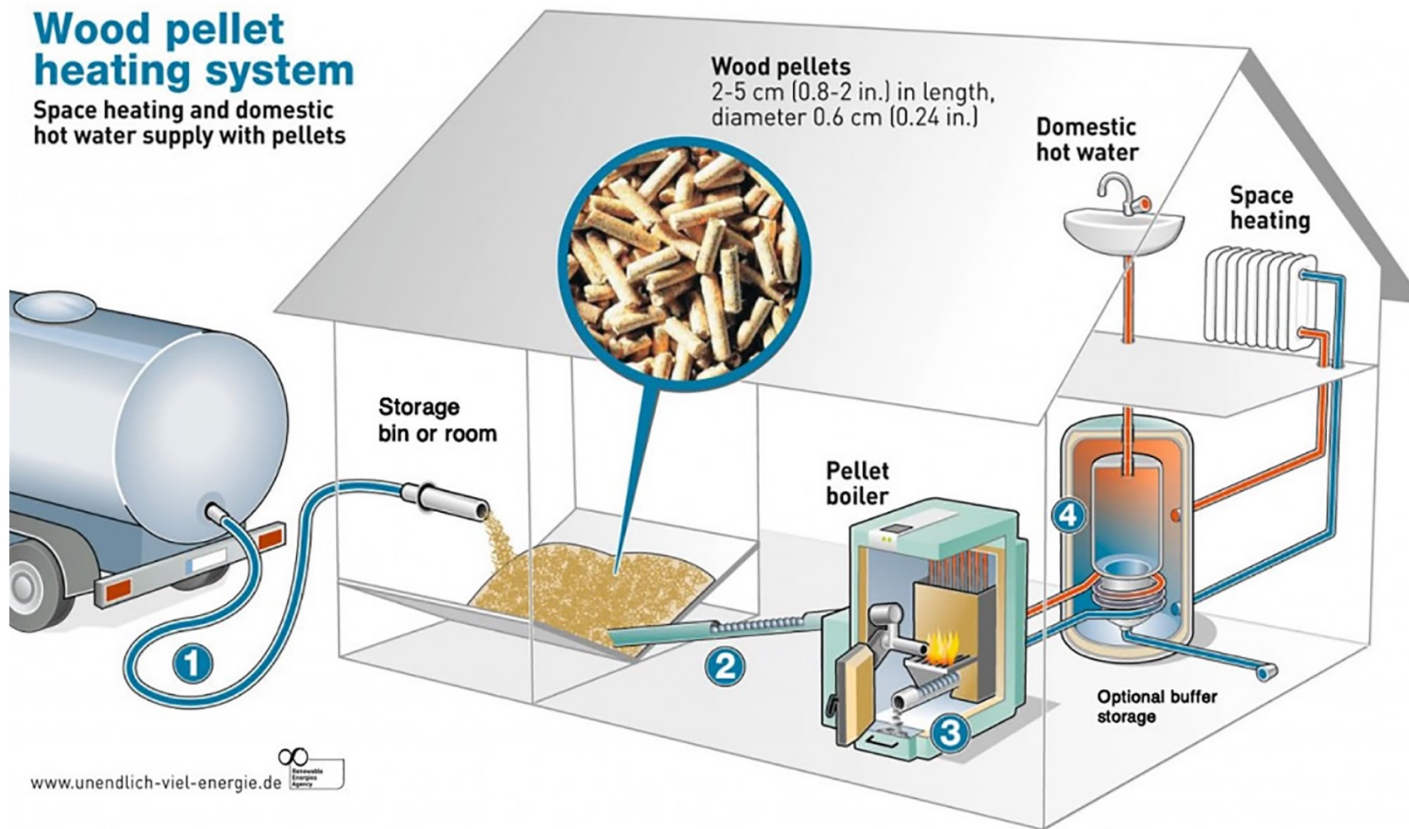
# WOOD PELLET BOILER SYSTEMS



# MODERN PELLELET CENTRAL HEATING

## Wood pellet heating system

Space heating and domestic hot water supply with pellets



www.unendlich-viel-energie.de



- 1 Once or twice a year the pellets are delivered by a silo tanker. A loaded storage room of 4.5 m<sup>2</sup> is enough to keep a single-family house warm for one year.
- 2 The pellets are carried from the storage room to the boiler by a fully automatic pellet feed.
- 3 After the burning process all that's left is ash – with a weight of only 0.5 per cent of the original pellet. The ash can be disposed of with the domestic waste.
- 4 If the pellet boiler is interconnected with a buffer storage, emissions can be reduced and efficiency increased.

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# PELLETS VS CHIPS

## Pellets

- Higher bulk density, lower moisture content.
- Easier to transport and store.
- More common and cost-effective in small boiler systems.



## Chips

- Less expensive if produced nearby.
- More common and cost-effective in systems >200 kw.
- Requires greater storage space.
- Needs more robust fuel handling system.



# DELIVERY, STORAGE & HANDLING

## Transportation and delivery



## Storage

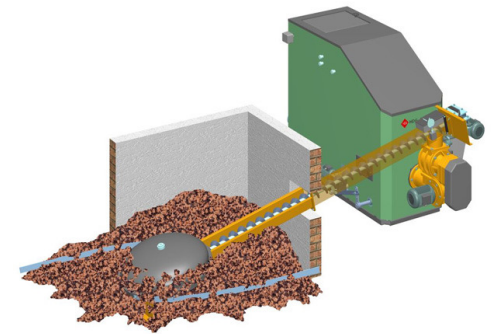


Silo



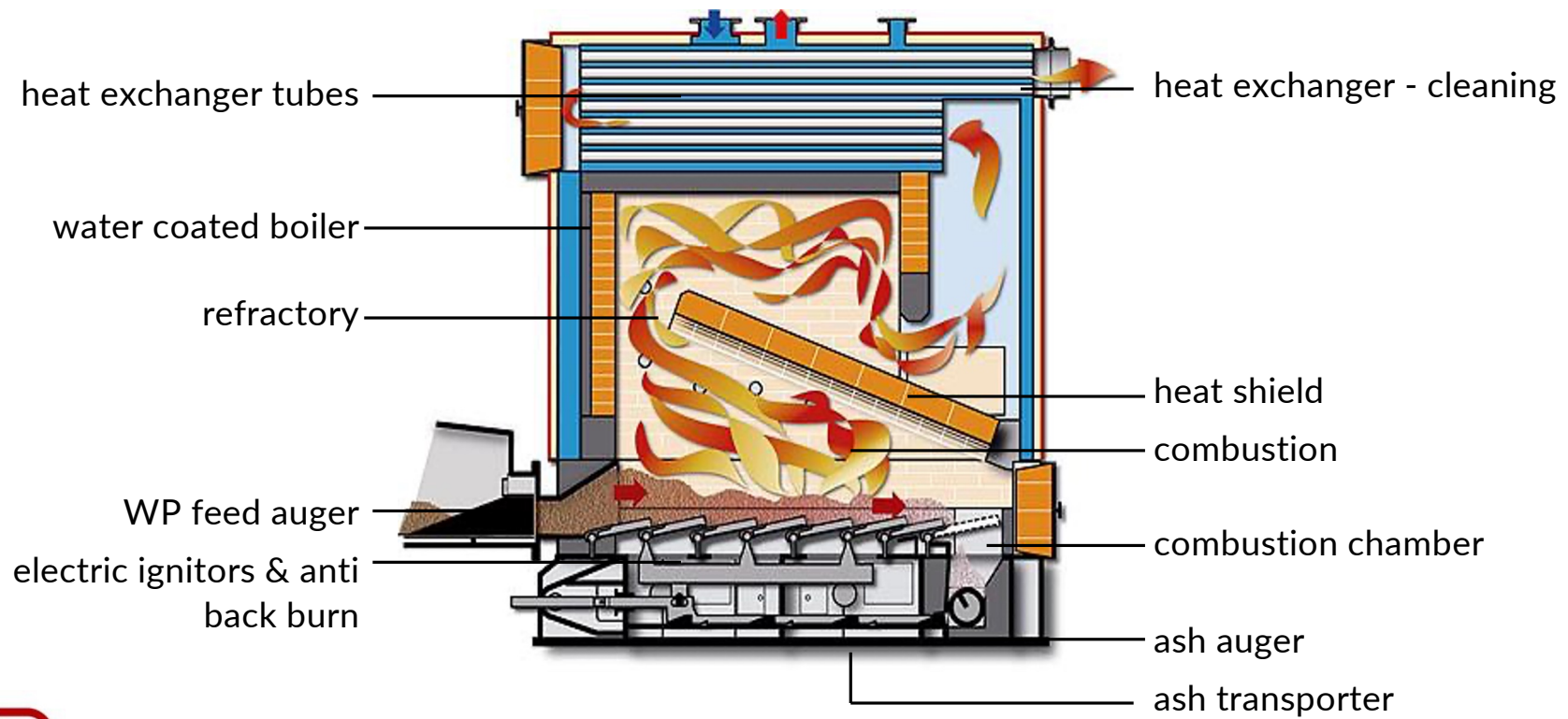
"Flexilo"

## Fuel handling



A boiler is typically fed by an automatically controlled screw auger.

# TYPICAL COMMERCIAL/INDUSTRIAL BIOMASS BOILER



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# BUFFER TANK

- Intended to:
  - Decrease frequency of boiler cycling;
  - Store heat; and
  - Reduce running costs.
- Water used for:
  - Domestic hot water; and
  - To run through the heating system.



# IN-BUILDING HEAT DISTRIBUTION



Radiator



In floor



Fan coil



Hydronic air handler & ducting (forced air)

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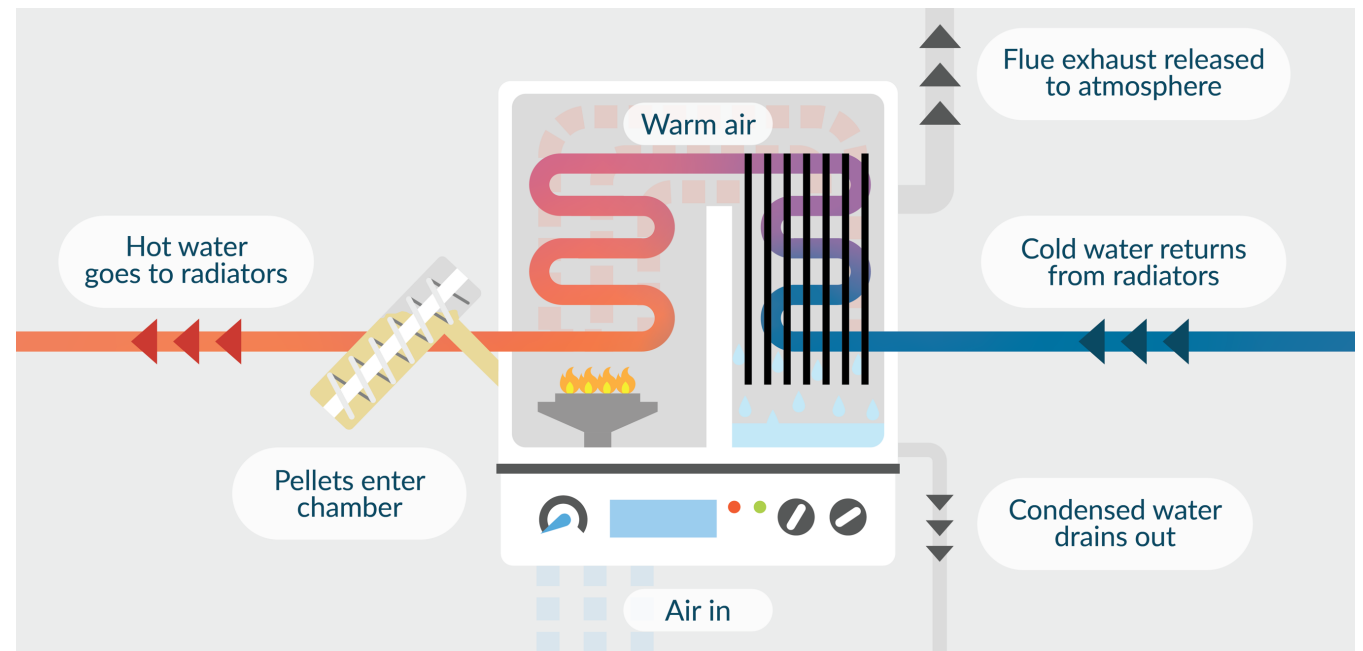
# ASH REMOVAL AND STORAGE

- Pellet combustion typically results in less than 1% of the burned volume in ash.
- Automatic system deposits ash in storage container easily removed from the boiler.
- Ash can be used as fertilizer.



# CONDENSING BOILER

- Condensing boilers operate at lower temperatures and use the heat from pellet combustion and the exhaust ( $\text{CO}_2$  &  $\text{H}_2\text{O}$ ).
- Exhaust water vapor is condensed on the outside of a second heat exchanger, and drips into a neutralizer to reduce acidity, then drained.



*Recovered heat reduces the heat wasted up the chimney, as well as reducing the fuel required to heat the water being drawn into the boiler.*



# WOOD PELLET QUALITY

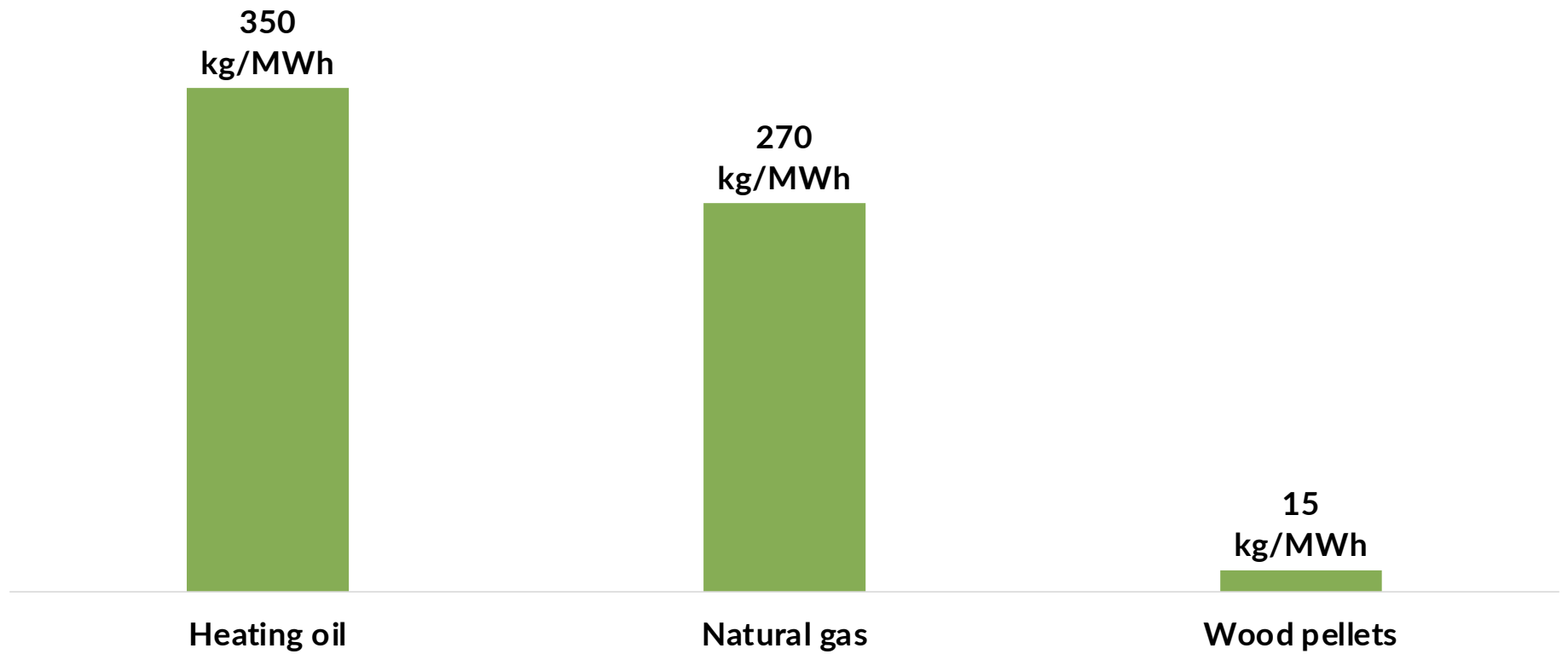
# QUALITY STANDARDS - CAN/CSA-ISO: 17225-2

Property	Unit	Grade A1	Grade A2	Grade B
Origin & source, CAN/CSA-ISO 17225-1	N/A	<ul style="list-style-type: none"> <li>Stemwood</li> <li>Chemically untreated wood residues from wood processing industry</li> </ul>	<ul style="list-style-type: none"> <li>Same as A1, plus</li> <li>Whole trees without roots</li> <li>Logging residues</li> </ul>	<ul style="list-style-type: none"> <li>Forest, plantation &amp; other virgin wood</li> <li>By-products &amp; residues from wood processing industry</li> <li>Chemically untreated used wood</li> </ul>
Diameter (D)	mm	$6 \pm 1$ or $8 \pm 1$	Same as A1	Same as A1
Length (L)	mm	$3.15 > L \leq 40$	Same as A1	Same as A1
Bulk density (BD)	kg/m <sup>3</sup> as received	$600 \geq BC \leq 750$	Same as A1	Same as A1
Mechanical Durability (DU)	w-%	$\geq 97.5$	Same as A1	$\geq 96.5$
Fines (F)	w-%	$< 1$	Same as A1	Same as A1
Moisture (M)	w-% as received	$\leq 10$	Same as A1	Same as A1
Ash (A)	w-% dry	$\leq 0.7$	$\leq 1.2$	$\leq 2.0$
Nitrogen (N)	w-% dry	$\leq 0.3$	$\leq 0.5$	$\leq 1.0$
Net calorific value (Q)	MJ/kg	$\geq 16.5$	Same as A1	Same as A1

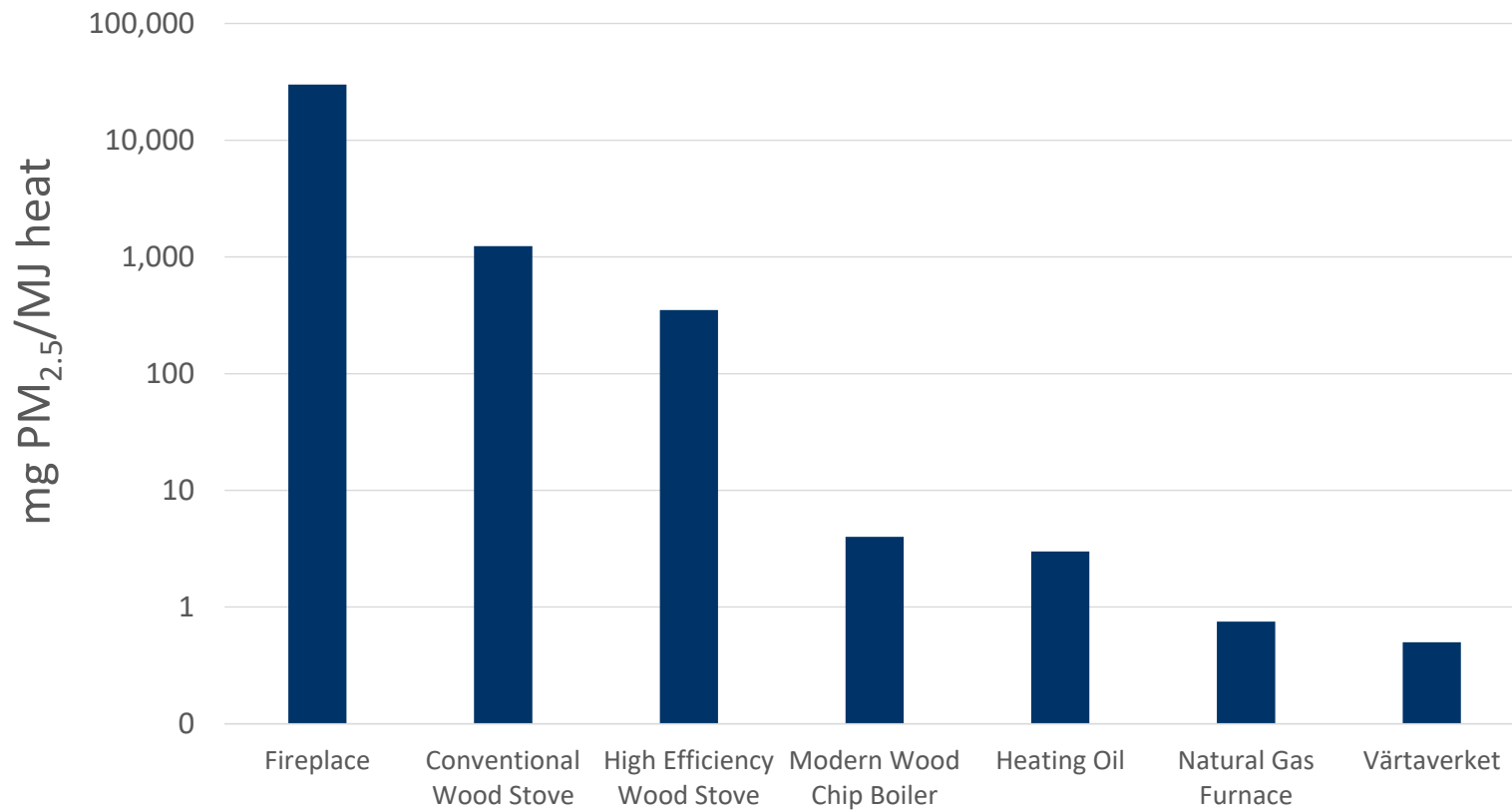
An aerial photograph of a residential neighborhood with single-story houses and green lawns. In the background, there are forested mountains under a cloudy sky. A solid green vertical bar is on the left side of the image.

**GOOD FOR OUR PLANET &  
FOR OUR COMMUNITIES**

# GHG EMISSIONS



# FINE PARTICULATE EMISSIONS



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# A CLIMATE SOLUTION (NEW BRUNSWICK)

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CURRENT  
PELLET  
PRODUCTION



SUSTAINABLY  
AVAILABLE  
UN-USED



REDUCE CO<sub>2</sub>  
EMISSIONS  
BY 3.1 MT/YR



2.5

MT CO<sub>2</sub>  
PER YEAR

by switching from coal-fired  
electric baseboard to wood  
pellet stoves/boilers in  
residential buildings



0.6

MT CO<sub>2</sub>  
PER YEAR

by switching from heating oil  
to wood pellet boilers in  
commercial, institutional, and  
residential buildings

\*25% reduction from 2019 inventory

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# GOOD FOR FORESTS

- Bioenergy provides a **market for sawmill residuals and low-grade material** that permits forests to be better managed for increased productivity, vigour, and health.
- The science shows that **when you increase the demand for bioheat, you also contribute to better-managed forests.**



# GOOD FOR FORESTS

## EXAMPLE: SWEDEN

- In Sweden, bioenergy, largely in the form of wood, provides 37% of the energy supply.
- Since 1990, **Sweden's bioenergy consumption has doubled and, at the same time, its standing timber volume has increased by 40%.**
- In fact, the net annual increase in standing timber in Sweden is so large it **reduces national GHG emissions by 70%.**
- This increase in standing timber volume is not in spite of bioenergy, it is because of bioenergy.



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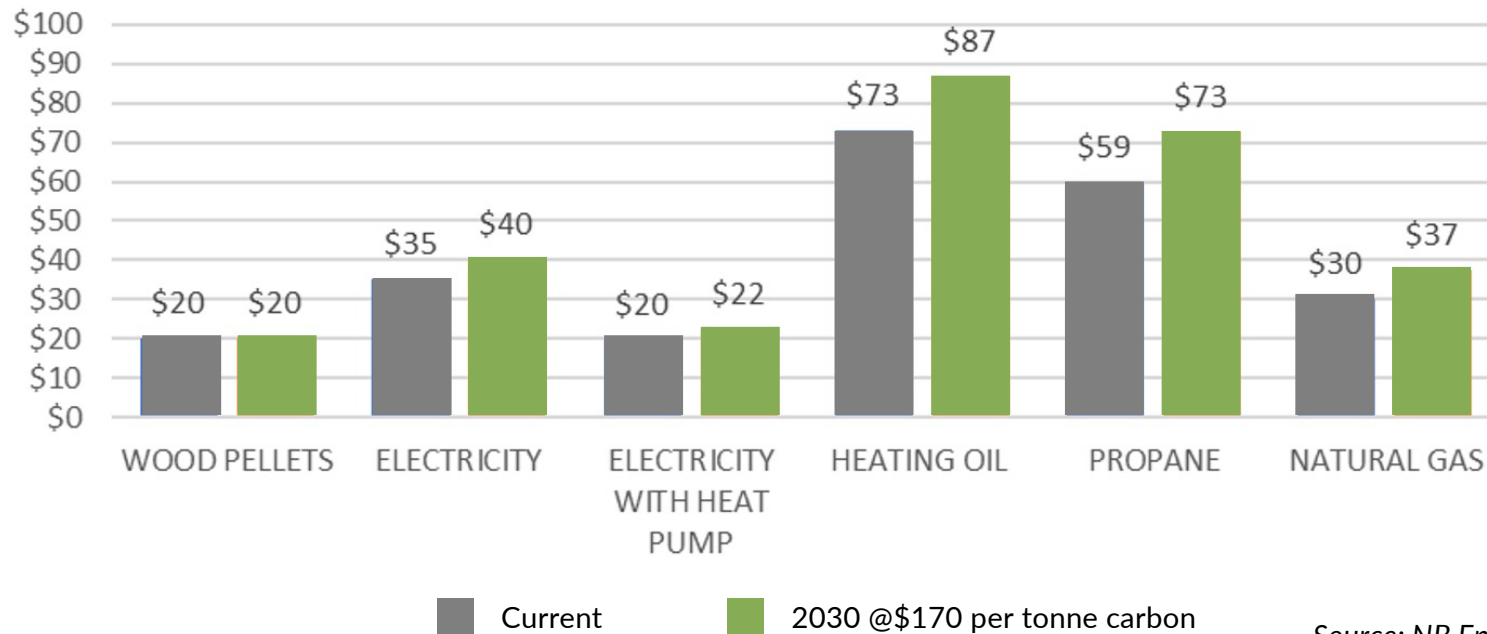
## AND GOOD FOR COMMUNITIES

- The five wood pellet plants in New Brunswick support more than **625 direct and indirect jobs**.
- The sector also procures more than **\$60 million** in local services and goods annually and has invested over **\$100 million** in capital expenditures.
- Wood pellets provide a critical outlet for bi-products from sawmills like sawdust and shavings—avoiding landfills.



# AFFORDABLE (NEW BRUNSWICK)

Heating cost including carbon price impact  
Cost per GJ



Source: NB Energy & Utilities Board

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# ALLEVIATING ENERGY POVERTY

New Brunswick has among the highest carbon emissions from heating in the world.

- More than 30% of electricity generated in New Brunswick comes from imported fossil fuels (coal, gas and heavy oil), most is burned in winter to meet electric heating needs.
- New Brunswickers are highly vulnerable to energy price increases because the province's households rely heavily on electric heating.
- The Province faces difficult choices. Coal generation must stop in 2030.
- At the same time, electricity demand will increase as transportation moves more to electric cars. New generation capacity will be very expensive.



# SUCCESS STORIES



# UNIVERSITÉ DE MONCTON SHIPPAGAN CAMPUS

# REPLACED 3 OIL STEAM BOILERS WITH PELLET BOILER SYSTEM (LOCAL WOOD)

- Heats 156,000 sq. ft. with **100% locally sourced** wood biomass.
- Combustion chamber heats up to 800 degrees C.
- On average uses 30 tonnes of pellets over 20 days or **548 tonnes/year**.
- Uses **20% less fuel** even though footprint grew 36,000 sq. ft.
- Payback on the project expected 6-7 years.
- **Emissions reduced by 85%** (to 108 from 752 tonnes of CO<sub>2</sub>).



# REDUCED COSTS OVER THE LONG TERM

	2017-18	2018-19	2019-20
Building footprint	120,000 sq. ft.	156,000 sq. ft. (+36,000 sq. ft)	156,000 sq. ft.
Oil heating cost	\$158,000	\$97,000	\$21,000
Pellet cost	n/a	\$95,000	\$109,000
Total costs	\$158,000	\$194,000	\$130,000

*Note: carbon tax rate in 2023 is \$65/tonne*





# GRAND FALLS GENERAL HOSPITAL

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Replaced oil heat boiler system with 850kW biomass boiler system.

	Winter 2014-15	Winter 2015-16
Oil savings	168,000	246,500 (adding the domestic water).
Pellet Consumption	425 TON	480 TON
Avoided emissions	512 TON CO <sub>2</sub>	784 TON CO <sub>2</sub>
Savings with carbon tax (\$20/TON*)	\$10,240	\$15,680

*\*Note: carbon tax rate in 2023 is \$65/tonne*





# KING STREET ELEMENTARY SCHOOL, MIRAMICHI

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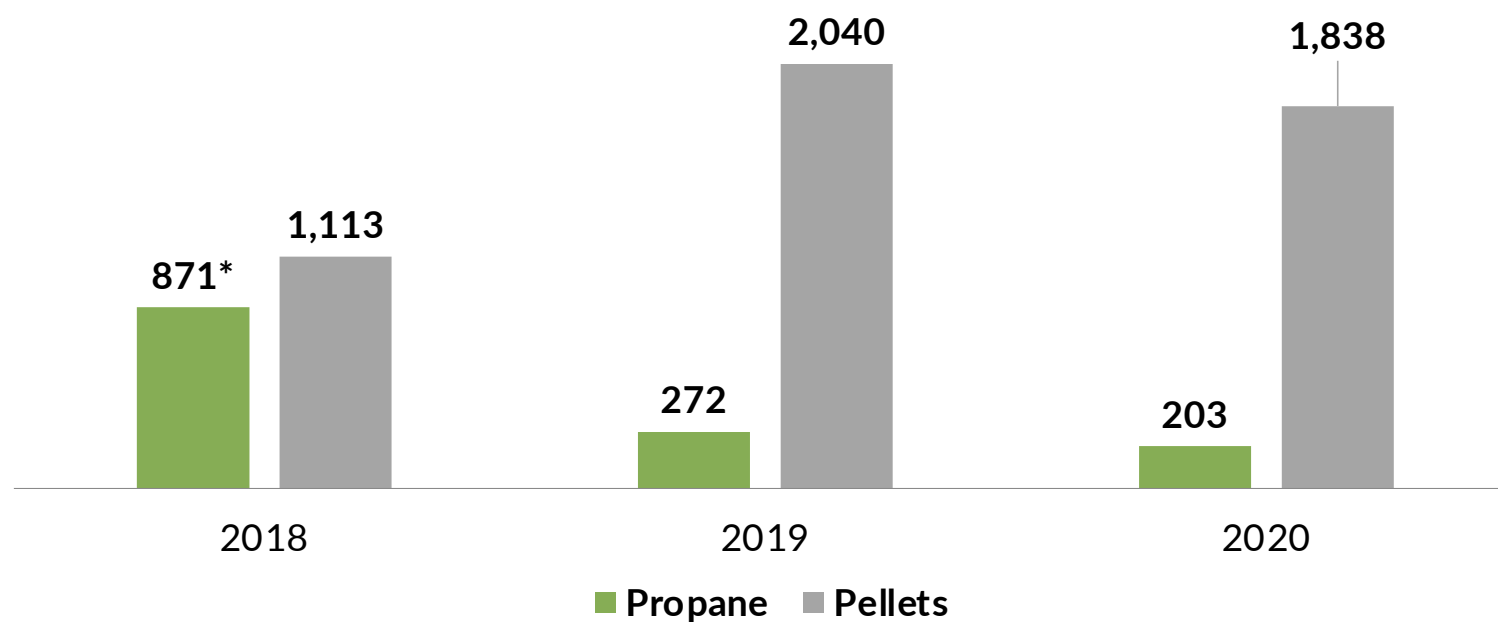


- 300 kW biomass boiler with 2 propane backup boilers for 66,000 sq. ft school.
- Pellets purchased 250 km away and delivered directly to school.
- In 2021-22 school year:
  - 67.33 MT of pellets purchased.
  - 74 MT CO<sub>2</sub> avoided, equal to planting 2,060 trees.

*"I would highly recommend others consider installing a biomass system."*

*~ Ronald Lavigne,  
Facilities Manager,  
King Street Elementary School*

# HEATING FUEL CONSUMPTION (G/J)



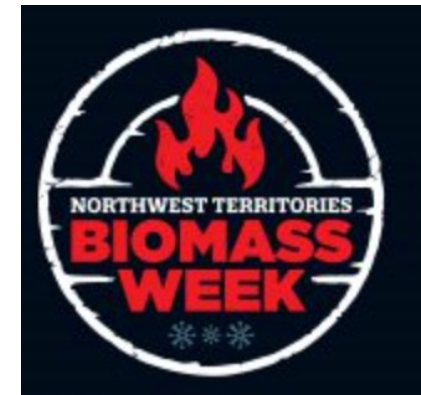
*\*Propane was used from September 2018 to the end of February 2019 until the pellet boiler was in operation.*



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# SOLUTIONS IN CANADA'S NORTH

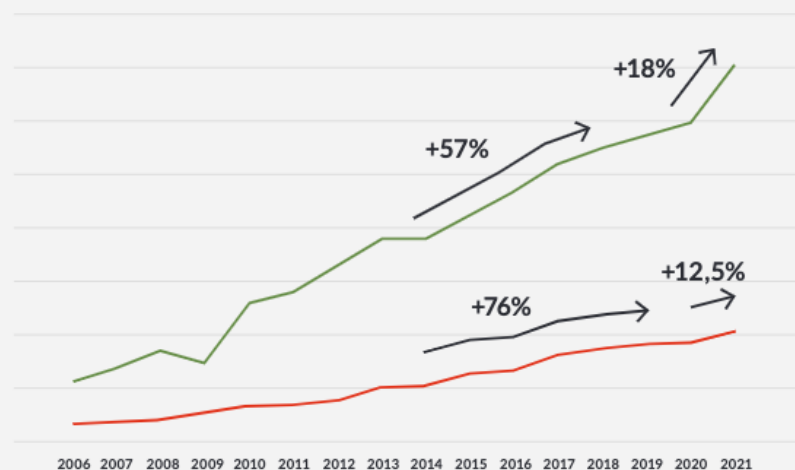
- NWT 2030 Energy Strategy targets include:
  - 25% reduction in GHG emissions from electricity generation in diesel-powered communities by 25%.
  - 40% share increase of space heating using renewable energy.
- 33% of territorial government buildings in Yellowknife are heated with wood pellets.



# BIOMASS IS MAINSTREAM IN EUROPE RECORD DEMAND

- 48% of global wood pellet consumption is from residential & commercial buildings.

EVOLUTION OF EUROPEAN PELLET CONSUMPTION FOR RESIDENTIAL (<50kW) AND COMMERCIAL (>50kW) HEAT EXCLUDING CHP (TONNES)



## RESIDENTIAL

From 2014 to 2020:

- +57% consumption over 6 years  
→ +9,5 pp increase/year

From 2020 to 2021:

- +18% consumption

## COMMERCIAL

From 2014 to 2020:

- +76% consumption over 6 years  
→ +12,6 pp increase/year

From 2020 to 2021:

- +12,5% consumption

Source: Bioenergy Europe

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# UPPER AUSTRIA: POLICY PACKAGE

- Comprehensive biomass policy package provided stable support to market for the past 30 years, including:
  - “Carrots”: Financial incentives.
  - “Sticks”: Regulatory requirements.
  - “Tambourines”: Information activities.



“AdieuÖl”, a large-scale information and public awareness campaign by the region’s energy agency OÖ Energiesparverband supported by the Regional Minister of Energy.

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## UPPER AUSTRIA: RESULTS

- **15% of the region's total primary energy** comes from sustainable biomass.
- **35% of all dwellings** are heated with modern, clean biomass.
- **More than 25% of all modern small-scale biomass boilers** installed in the EU are manufactured by Upper Austrian companies.
- **One of the highest densities** of small-scale automatic heating systems in the world.
- **Over 1 billion Euro per year** are invested in biomass fuels and equipment.
- **350 biomass district heating networks** are in operation.



*Austria has succeeded in making biomass a mainstream fuel and taken 30,000 homes off fossil fuels.*



# GOOD POLICIES & INCENTIVES

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# LEARNINGS FOR CANADA

1. Develop a thermal energy (heat) strategy that includes wood pellets.
2. Provide consumer capital financial support/incentives to address costs associated with installing boilers or wood pellet stoves.
3. Accelerate bioheat public procurement.
4. Introduce renewable heat incentives.



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## LEARNINGS FOR CANADA

5. Fund fuel switching feasibility studies for industry for switching from fossil fuels to electricity.
6. Fund district energy feasibility studies for municipalities.
7. Revise standards that restrict the required technology and equipment from entering Canada.



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# SUMMARY

- Canada is the world's second-largest producer of wood pellets: 90% is exported.
- Inroads to biomass have been made in Canadian areas where energy poverty is a reality.
- Markets like Upper Austria have demonstrated how to make biomass mainstream.
- Good public policy, fair incentives and removing trade barriers restricting importation of boilers are needed for biomass to reach its full potential as a local bioheat solution.





**WOOD PELLET**

ASSOCIATION OF CANADA