



ENERGIZING OUR FUTURE

Biomass in Electrification

WPAC 2024 Annual Conference September 2024



Énergie NB Power

ENERGY TRANSITION

- **The electricity sector is experiencing disruptive change,** and the “Transition” pillar of NB Power’s strategic plan deals with **decarbonization goals** and moving to a clean and secure energy supply.
- In response to climate change, the Government of New Brunswick has set out its plan (via the Climate Change Action Plan) to **reach net-zero emissions province-wide by 2050.**



ENERGY TRANSITION

- **A decarbonized electricity system is required by 2035** as other industries move from higher-emitting processes to processes that demand more electricity to achieve net zero.
- In 2018, the federal government announced the **phase-out of coal-fired generation by 2030**. This is 13 years earlier than Belledune's planned retirement date.
- **The clean energy transition must be done WHILE ensuring energy security AND addressing debt.**



NEW BRUNSWICK'S ELECTRICAL SYSTEM

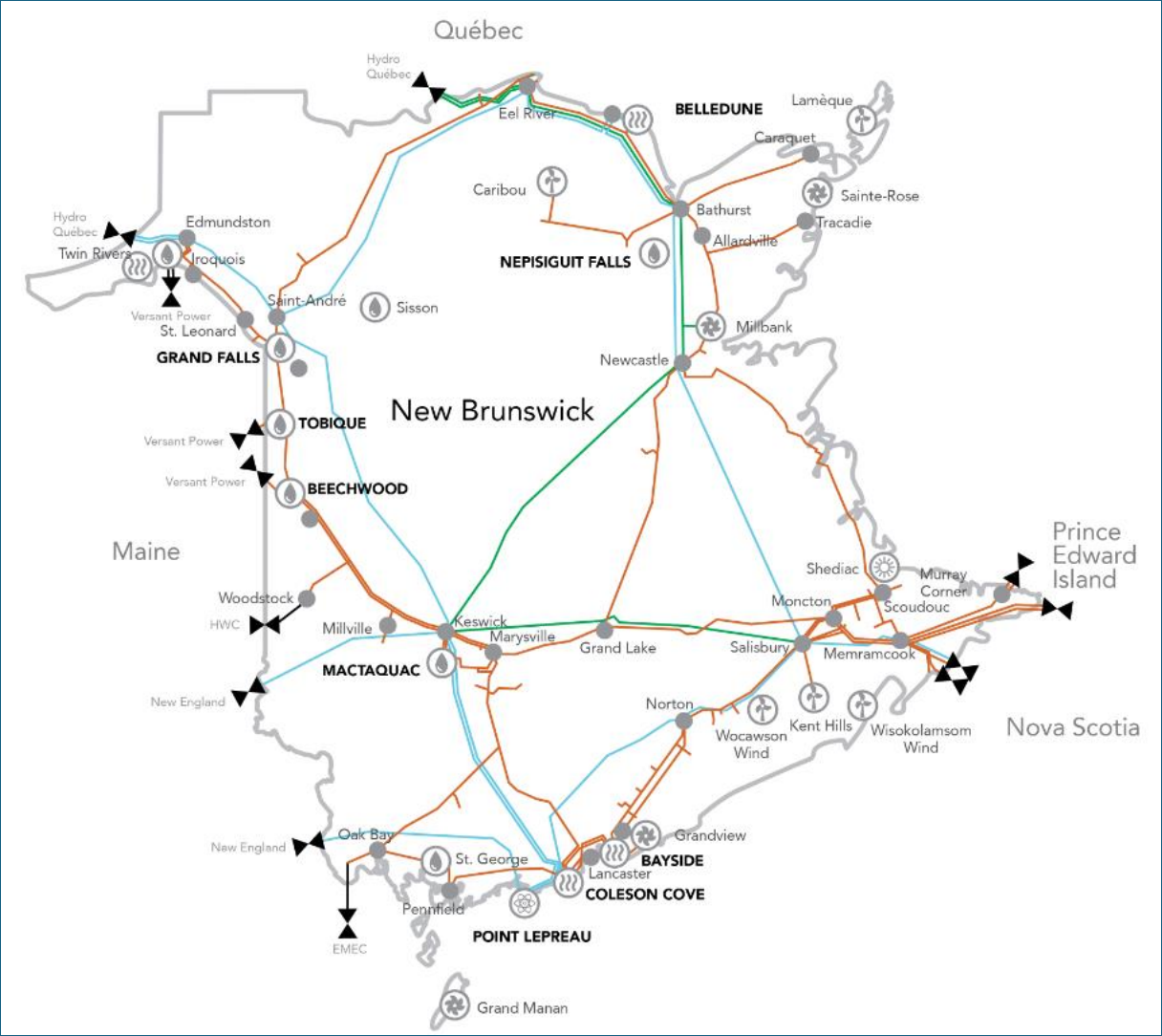


Table 8.1: Existing NB Power Generating Capacity and Other Statistics

Generating Capacity Thermal	
Coleson Cove	972 MW
Belledune	467 MW
Bayside	284 MW
Total Thermal	1,723 MW

Generating Capacity Hydro	
Mactaquac	668 MW
Beechwood	112 MW
Grand Falls	66 MW
Tobique	20 MW
Nepisquit Falls	11 MW
Sisson	9 MW
Milltown	3 MW
Total Hydro	889 MW

Generating Capacity Nuclear	
Point Lepreau	663 MW

Generating Capacity Combustion Turbines	
Millbank	397 MW
Ste. Rose	99 MW
Grand Manan	29 MW
Total Combustion Turbines	525 MW

Total Generating Capacity	
Thermal	1,723 MW
Hydro	889 MW
Nuclear	663 MW
Combustion Turbines	525 MW
Total Generating Capacity	3,800 MW

Power Purchase Agreements (PPAs)	
Kent Hills (Wind)	167 MW
Caribou Mountain (Wind)	99 MW
Lamèque (Wind)	45 MW
Wisokolamson Energy (Wind)	18 MW
Wocawson Energy (Wind)	20 MW
Grandview (Natural Gas)	95 MW
Twin Rivers (Biomass)	39 MW
Irving Pulp & Paper (Biomass)	33 MW
AV Nackawic (Biomass)	26 MW
AV Cell (Biomass)	21 MW
Edmundston Hydro	9 MW
Other Renewable	22 MW
Total Power Purchase Agreements	594 MW

Number of Lines	
Distribution Lines	21,717 km
Transmission Lines	6,868 km

Exporting and Importing Capacity	
Export Capacity	2,538 MW
Import Capacity	2,448 MW

Number of Customers	
Direct Customers	379,148
Indirect Customers	46,365
Total Customers	425,783



INTEGRATED RESOURCE PLAN – KEY ASSUMPTIONS

Appendix C - Project and Operating Cost Parameters

Technology	Installed Capacity (MW)	Capacity Factor (%)	In-Service Cost (\$/kW)	Expected Life (Years)	Heat Rate (MMBtu/MMWh)	CO2 Intensity (t/GWh)	LCOE - Capital (\$/MMWh)	LCOE - Fuel (\$/MMWh)
Solar - Utility Scale	50	19	1,969	30	0	0	65	0
Solar - Residential Rooftop	0.004	19	4,059	25	0	0	149	0
On-shore Wind	30	41	2,089	30	0	0	32	0
Off-shore Wind	400	45	5,399	30	0	0	75	0
Wave	1	26	18,599	30	0	0	450	0
Tidal	10	26	14,267	30	0	0	345	0
New Biomass Boiler	60	90	6,556	20	13,500	0	58	203
Geothermal	1	90	11,437	25	0	0	89	0
Gas - Combined Cycle Gas Turbine	500	75	2,101	25	6,410	340	20	51
Combustion Turbine - Dual Fuel	150	5	1,472	25	9,460	502	205	114
Combustion Turbine - Gas	150	5	1,267	25	9,460	502	176	114
Gas - Combined Cycle Gas Turbine with Carbon Capture Sequestration	500	75	4,366	25	7,124	19	41	57
Combustion turbine - Hydrogen	150	5	3,732	25	9,730	0	520	304
Lithium-ion Battery (1-hour)	1	4	646	20	1,000	0	123	96
Lithium-ion Battery (4-hour)	1	17	1,861	20	1,000	0	89	96
Lithium-ion Battery (12-hour)	1	43	5,100	20	1,000	0	96	96
Flow Battery	1	35	4,058	20	1,000	0	93	117
Belledune Biomass Conversion	375	33	67	11	10,000	0	3	151
Bayside Gas Turbine Extension	230	5	0	15	10,370	550	0	120

Appendix A - Key Assumptions

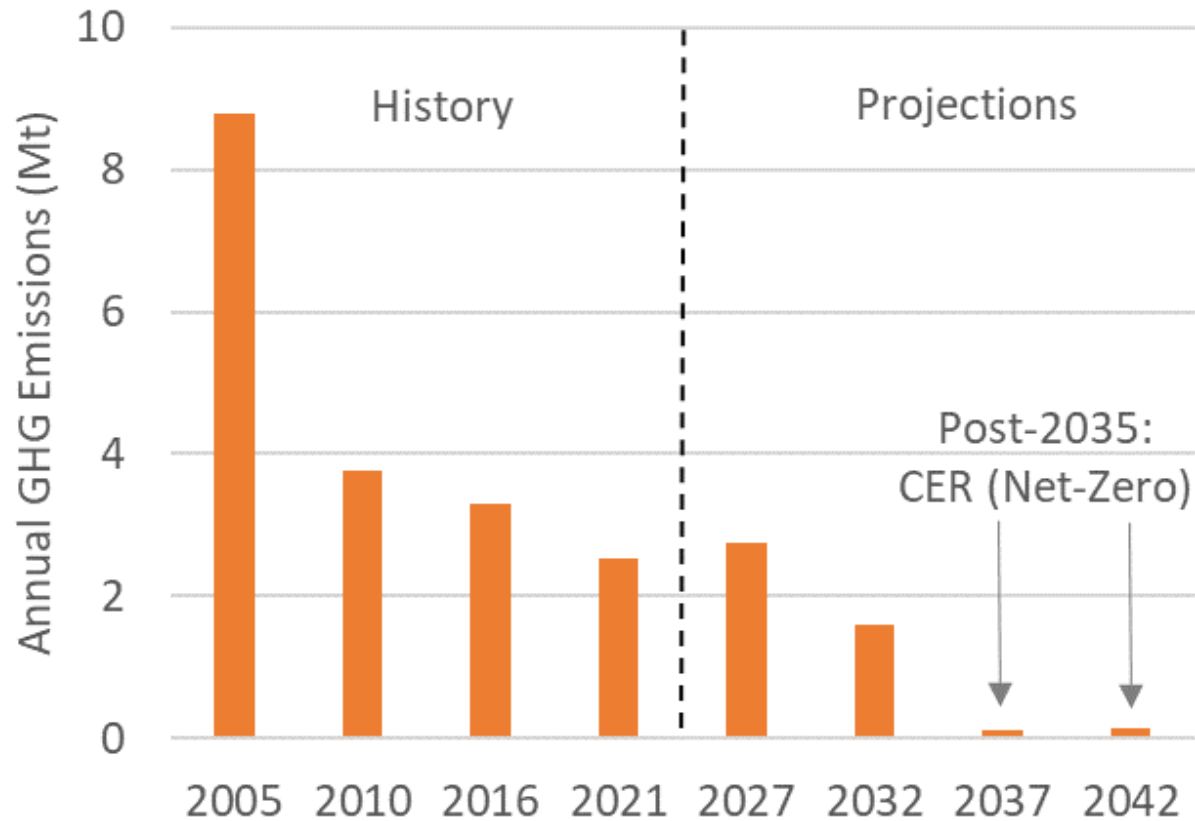
Category	2023 Integrated Resource Plan Assumption
Belledune	<ul style="list-style-type: none"> Coal as a fuel does not continue beyond December 31, 2029. Biomass fuel available in 2030, operation limited to November to March due to fuel volume limitations and fuel costs.
Mactaquac	<ul style="list-style-type: none"> Life Achievement project goes from 2027 - 2032. Capacity losses during MLAP are replaced through contract purchases from neighbouring utilities.
SMRs	<ul style="list-style-type: none"> Two first of kind SMRs added in all scenarios as part of NB Climate Change Action Plan. Roll out varied by timing and volume based on scenario <ul style="list-style-type: none"> High Electrification / Rapid Tech - 750 MW 2029/30-2034/35 High Electrification / Moderate Tech - 750 MW 2034/35-2040/41 Low Electrification / Rapid Tech - 450 MW 2029/30-2034/35 Low Electrification / Moderate Tech - 450 MW 2034/35-2040/41
Greenhouse Gas Regulations	<ul style="list-style-type: none"> Based on the New Brunswick Output-Based Pricing System for large emitters until 2035. <ul style="list-style-type: none"> Price ramping from \$65/tonne in 2024 to \$170/tonne in 2030 and beyond. Based on Clean Electricity Regulations discussion paper <ul style="list-style-type: none"> All emissions taxed beginning 2035. Fossil fuel generators allowed for renewable integration and reliability. Generation limited to 5 per cent capacity factor per year. Responsibly sourced Biomass considered non-emitting.

Section 4.3 for more details on GHG regulations.

In 2018, the federal government announced the phase-out of coal-fired generation by 2030⁹. The regulation would see Belledune Generating Station cease to burn coal in 2030, 10 years earlier than its planned retirement date. NB Power continues to explore options to continue operation of Belledune Generating Station past 2030 using alternative fuels. Some of these fuel options include traditional biomass, torrefied biomass, liquified natural gas, renewable natural gas and conventional natural gas.



WHY TRANSITION TO AN ALTERNATIVE FUEL?

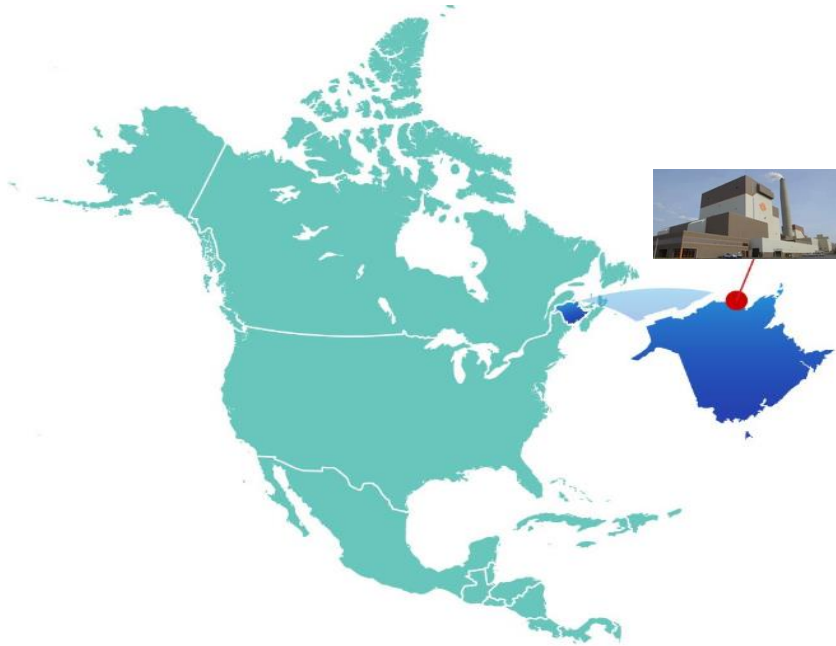


- Federal requirement that all coal-fired units be under 420 t/GWH of CO₂ by 2030.
- NB's Climate Change Action Plan calls for NB's electricity system to be net-zero by 2035.
- Allows for life achievement of Belledune plant.

**98% Reduction
from 2005
levels!**



BELLEDUNE GENERATING STATION



- 467 MW net baseload coal-fired plant located at the Port of Belledune. 12% of our capacity.
- Employs 130 people full time and ~ 40 to 60 contractors (not including outages).
- Current end of economical life (without major refurbishment) is 2043.
- Pursuing the option to convert from coal to biomass (wood pellets).





WHY BLACK RATHER THAN WHITE PELLETS?

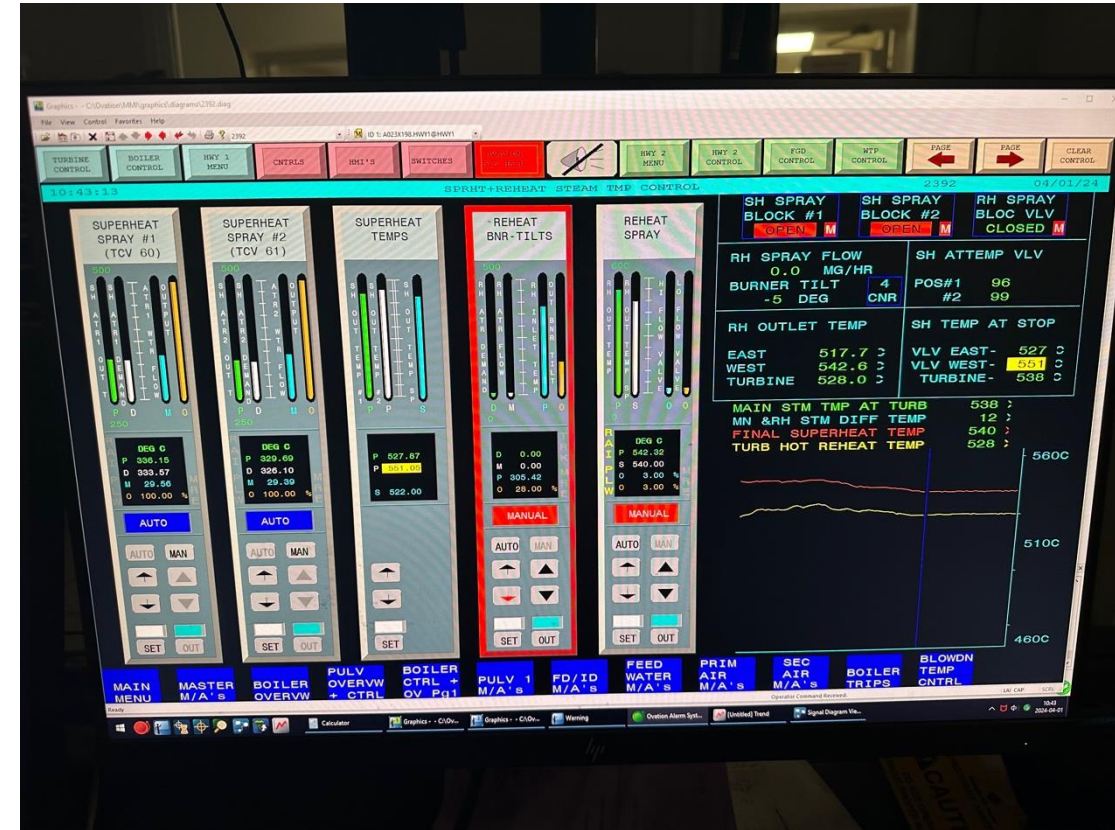
The expected operating profile of the station is less than 5 months per year.

- Any capital spent is spread over limited operating hours.
- Current debt on the station will not be completely paid until 2041.
- Black pellets results in lower CAPEX, higher OPEX compared to white pellets
- Higher output capacity than white 410 mw/h versus 360 mw/h at Belledune
- Grindability resulting in co-firing opportunities with coal.
- White pellets become viable when the operating profile allows for the increased capital to be spread over more megawatts.



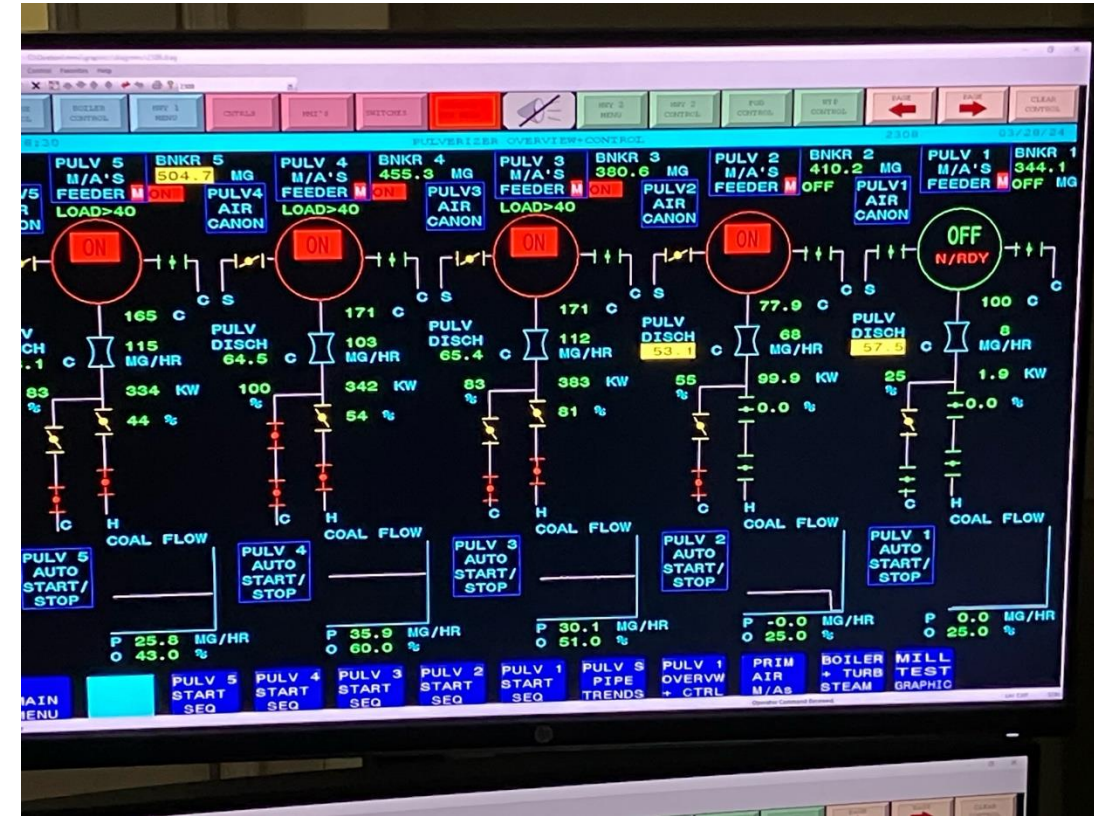
BLACK PELLET TESTING

- The goal of the test was to operate on 100% pellets without support energy. This was achieved:
 - March 28: 100% Arbaflame (steam-treated) energy production for 5 hours, with an average gross production of 174 MW.
 - April 1: 100% Airex (torrefied) energy production for 8 hours, with an average gross production of 168 MW.
- The team at Belledune worked diligently and supported all aspects of the testing. This test could not have been completed without their dedication and support.
- No safety issues during the testing. Planning for the test took place over 10 months.



BLACK PELLET TESTING

- A combined total of 5,800 tonnes of Airex (torrefied) and Arbaflame (steam-treated) black pellets were consumed.
- The amount of electrical power generated by these pellets was approximately 10,500 MWH.
- The 5,800 tonnes of black pellets substituted the burning of approximately 3,900 tonnes of coal.
- This equates to roughly 8,700 tonnes of coal-generated CO2 being offset by the pellets.





WEATHERABILITY TESTING

- All the steam treated pellets and most of the torrefied pellets were stored outside from December to the end of March.
- The fuel in the yard appeared wet after significant precipitation the week prior (2 feet of snow and 50 mm of rain), however it was dry just below the surface.
- Based on performance in the boiler and moisture content values collected during the test, it appears this fuel can be stored similar to coal (i.e., outdoors).



CLEAN FUEL REQUEST FOR EXPRESSION OF INTEREST

- A Request for Expression of Interest (REOI) was posted on NBON from November 2023 to February 2024, for black pellets.
- Intent of the REOI was to gauge interest but also signal to the market the potential for a long-term contract.
- NB Power received 25 proposals from 19 different proponents.
- This represents more than 1.9 million tonnes of pellets from Eastern Canada, the USA and Europe.
- NB Power is currently developing MOUs with a select number of proponents in Eastern Canada while additional station modeling is completed.
- The list of proponents include First Nations involvement.



REQUEST FOR EXPRESSION OF INTEREST Document # 0740-23-128

Clean Fuel (Torrefied Biomass) supply for
Belledune Generating Station

Deadline for submissions:
February 16, 2024



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Thank you



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