Biomass:

Better suited for heating – NOT electricity production at Belledune

Conservation Council *of* New Brunswick

Summary

New Brunswick, like all provinces burning coal and petroleum coke to generate electricity[1], must, under federal regulation, drastically cut greenhouse gas emissions (GHG) by 2030 or close plants. The Belledune Generating Station is a large greenhouse gas polluter, responsible for 1.6 million tonnes (Mt) of greenhouse gas emissions in 2020 (13 per cent of provincial GHGs), the second largest source after the Irving Oil Refinery. Overall, the electricity sector generates 22 per cent of the province's greenhouse gas emissions, the third largest emitting sector after industry (31 per cent) and transportation (29 per cent).

The federal government has committed to a net-zero grid by 2035 and to using a clean electricity standard as one mechanism to support the transition to a non-polluting electricity system. Federal regulations limiting greenhouse gas emissions from all thermal sources of electricity, combined with efforts to use electricity to power our lives (e.g., transportation, home heating and cooling, and industrial processes) requires an electrification strategy to plan for a smooth transition to a non-polluting electricity system that meets day-to-day needs affordably and reliably.

Without a strategy in place, New Brunswick is looking at singular solutions to the Belledune replacement—like small modular nuclear reactors that are unlikely to deliver power until the mid-2030s, if ever. Another solution the province and NB Power are considering is to burn biomass[2] as a replacement for coal at its 467 MW Belledune Generating Station.

The Conservation Council of New Brunswick (CCNB) favours an outcome for Belledune that positions the community and region for the transition to a non-polluting electricity system no later than 2035.

Converting the Belledune plant to burn biomass could lock in a significant portion of the province's energy mix for decades to come. Decisions about the future of the Belledune Generating Station should be within the context of a province-wide electrification strategy. That strategy should consider options that deliver strong environmental outcomes, including reducing greenhouse gases, but also sustainable practices, and solutions should be affordable and reliable.

Burning biomass for large-scale electricity generation is inefficient:

- Biomass has a lower energy density (the amount of energy that can be stored in a given substance) than coal;
- Electric power plant efficiencies are about 35 per cent (closer to 30 per cent if counting line losses); and,
- When used to heat buildings, for combined heat and power, or in district energy, efficiencies are as high as 85 to 90 per cent or more. New Brunswick's major energy demand is for heating. Small-scale wood pellet heating can take some burden off the electricity grid.

1 Nova Scotia, Saskatchewan, Alberta

2 Wood pellets, wood chips, other low-grade forestry or agriculture waste

Sustainable forestry practices:

- Wood pellets, from wood waste and low-grade wood fibre, are a sustainable option for bioenergy facilities for heating and combined heat and power generation in small-scale settings. Harnessing waste products from New Brunswick's abundant forestry industry can lower the demand for harvesting high-grade wood products;
- Sustainable forest management can **improve** the forest's ability to sequester carbon and can increase the size of the forest over time; and,
- Promoting biomass as a solution to large-scale electricity generation could increase demand and, in turn, increase unsustainable forestry practices.

Alternatives to burning biomass for electricity

- Renewable energy technologies such as wind, solar, and small hydro are readily available today and are the **least expensive** options.

Overview

The prevailing view is that burning biomass for power is carbon neutral because the carbon dioxide released from burning wood products is in balance with the carbon dioxide captured while trees are growing. Trees **sequester carbon dioxide** throughout their lifetime and release it when they die, decompose, or are burned. Burning biomass to provide heat or to generate electricity mimics this natural process and therefore is carbon neutral. It is important, however, to consider the health of the forest and ensure that more intact and diverse forests are thriving than harvested.

Greenhouse gas emissions from **forests and forestry practices** fluctuate annually based on natural disturbances and forestry activities. The Intergovernmental Panel on Climate Change (IPCC) has established rules for reporting greenhouse gases from managed lands, including for harvested wood products. Canada uses these rules to develop its greenhouse gas **inventory**.

The IPCC also **reports** that using biomass for fuel can reduce emissions 80 to 90 per cent below a baseline of fossil fuels if harvested from sustainable operations. The IPCC further cautions, however, that when considering land-use conversion, forest management, and potential loss of carbon stock can lessen and "in some cases more than neutralize, the net positive GHG mitigation impacts." A full life-cycle analysis is required to assess the total emissions impact of harvesting and burning biomass.

Less efficient, higher emissions

The International Energy Agency (IEA) provides a **framework** for life-cycle analysis of a bioenergy or biomass system. It concluded that life-cycle analysis "is the tool of choice for quantifying the greenhouse gas (GHG) emissions from, and emissions saved by bioenergy systems." A **life-cycle analysis** integrates the environmental impact of resource extraction—including land use change, collection of extracted resources, processing and transport, and use and disposal. A life-cycle assessment of burning biomass for electricity sheds light on the efficacy of biomass as a sustainable replacement to coal at Belledune.

Emissions from biomass at a large generating plant, such as Belledune, can be higher than emissions from coal because biomass has a lower energy density than coal. To generate similar electricity levels as coal, the generating facility must burn more biomass, which can increase smokestack emissions. Power plants also operate at low efficiencies. To generate electricity, efficiency is roughly 35 per cent and closer to 30 per cent when counting transmission line losses. Heating buildings with boilers, combined heat and power, or in district energy, efficiencies are as high as 85 per cent to 90 per cent. The most efficient use of the province's biomass resources is for heating and combined heat and power generation.

The volumes of biomass required to run Belledune are potentially large. Converting the Belledune coal generating facility to biomass requires 660,000 tonnes/year of biomass if used only for winter peaking and 1.5 to 2.2 million tonnes/year to run the plant at full capacity, according to one industry expert. Current wood pellet production in the province's five plants produce 500,000 tonnes/year. There is debate about whether the increased supply necessary for electricity generation would require more forest resources than what is available from low-grade wood-fiber and industrial waste, such as sawdust and woodchips.

Land use and forest regeneration

Successful use of biomass products depends on a sustainably managed forestry industry. Well-managed forests can grow at a faster rate than unmanaged forests and increase the overall carbon sink, as data from Sweden shows from 1980 to 2019.

Unless the forest is growing faster than trees are cut, there is at least a short-term increase in carbon dioxide emissions as biomass for electricity generation produces similar levels of pollution to that of coal when burned. We need to protect the forest's ability to absorb carbon dioxide through photosynthesis because the world needs to drastically cut fossil fuel greenhouse gas emissions and protect and conserve nature to draw down greenhouse gases in the atmosphere. Together, these actions, if implemented urgently, can help the world avoid additional global warming. The risks of climate change are so severe that even biomass electricity generation will require carbon capture and storage technologies, adding to electricity costs, compared to using wind, solar and other storage technologies.

Feedstock type

In New Brunswick, the most likely candidate for power generation is biomass from industrial forest waste and forest residues, such as low-grade wood fiber.[3] A comparative life-cycle analysis of the emissions profile of different feedstock types found that forestry and industry contribute the least amount of greenhouse gases. A problem, however, that may arise from excessive harvesting of biomass off the forest floor is soil erosion and the forest's ability to replenish itself.[4] Biomass as a solution for large-scale electricity generation increases the risk of whole-tree harvesting. In areas where biomass production is growing in Canada, such as British Columbia and Nova Scotia, there have been reports of whole trees harvested for wood pellet manufacturing and biomass burning.

3 Jonathan Levesque and Jamie Stephen, "Wood Pellets and Bioheat," *Presentation to New Brunswick Standing Committee on Climate Change and Environmental Stewardship*, January 2022

4 Natural Resources Conservation Service, "Soil Sustainability of Forest Biomass Harvesting in Connecticut," *Connecticut Department of Energy and Environmental Protection*, April 2016, p. 8.

United Kingdom Drax Plant and New Brunswick

The Drax Generating Station in the United Kingdom (U.K.) is a case study of the potential problems with burning biomass for electricity. The Drax power station uses four of its six generators to burn wood pellets from the United States and Canada. In New Brunswick, the Port of Belledune ships most of the province's annual production of 500,000 tonnes of wood pellets to Drax. The Drax biomass facility was conceived as a viable carbon-neutral alternative for former coal-fired plants. The Drax station was recently dropped from an investment index of clean-energy companies over concerns about the emissions and sustainability of wood burning in this way.

It is unlikely that wood pellets that New Brunswick currently exports would be diverted to Belledune given companies have long-term contracts with customers such as Drax. Wood pellet production would most likely need to expand to power Belledune. How much depends on whether the plant operates all year or for winter peaking. In addition to questions about stable supply of fuel and the potential harm to New Brunswick forests, there is a significant opportunity cost to converting Belledune to a biomass generating facility. Converting the Atikokan plant in Ontario and the Port Hawkesbury plant in Nova Scotia cost approximately $200 million each. Any decision to convert a coal plant to biomass must also consider what other renewable solutions are available such as wind and solar.

There are also health concerns to consider. Emissions from biomass with inadequate emissions control technology in both small residential settings and large-scale energy production plants contribute to the total concentration of particulate matter ($PM_{2.5}$) in the local environment. A large-scale biomass generating plant at Belledune could pose a similar public health risk to that of coal. In addition to smokestack emissions, a biomass power plant at Belledune would increase tractor-trailer traffic to transport the fuels to the plant whereas coal is arriving through the Port of Belledune.

In New Brunswick, wood pellets are used primarily to heat buildings and in district energy systems (boilers in schools, hospitals, homes). Emissions from biomass boilers with emissions controls are a good alternative solution to site-specific space heating. Testing of ACFOR biomass boilers in two locations in Prince Edward Island (PEI) showed they release fewer pollutants (such as particulate matter, nitrogen dioxides, and carbon monoxide) and were below the limits the provincial government provided as guidance for biomass boilers.[5]

Legislative and forestry context in New Brunswick

The New Brunswick Department of Energy and Resource Development (NBDERD) has a policy for biomass harvesting on Crown land. The policy, known as the Crown Land Forest Biomass Policy, restricts biomass harvesting to the above-ground portion of trees and shrubs. Biomass is residual treetops, branches, foliage, non-merchantable woody stems of trees and shrubs, pre-existing dead woody material and flail chipping residue. Pulpwood fiber generated from full-tree chipping is not biomass. The biomass policy restricts biomass removal to protect the forest's ability to regenerate and to minimize nutrient loss. Unlike on Crown land, there is no similar policy or legislation applicable to private holdings that account for 50 per cent of New Brunswick's forests.

5 Stantec Consulting Ltd. Prepared for PEI Department of Transportation and Renewal, "Appendix A: Biomass Source Emissions Testing 2015" in *Prince Edward Island Biomass Heat: A Local Renewable Resource*, (2015), p. 13.

Conclusion: The Renewables Solution

The decision on the future of the Belledune generating station will affect the province's electricity mix for decades to come. There are more effective solutions for New Brunswick's energy system. Renewable energy technologies such as wind, solar, and small-scale hydro are affordable, reliable, and sustainable. There are opportunities to lower energy demand through energy efficiency investments and to shift demand to off-peak hours. Biomass is a valuable resource for small-scale space heating and furnaces, as well as the co-generation of electricity, when sourced from waste products.

Problems arise when biomass use is scaled up for large-scale electricity generation as would be the case in Belledune. The resource input and the energy loss when converted to electricity rather than producing heat is too significant to be a viable alternative to fossil fuels. Wood pellet manufacturers in New Brunswick argue that the use of wood pellets for building heating is preferable to electricity generation.[6] Wood pellet production has a future in New Brunswick's energy mix as a response to site heating which will lighten the electric heating demand on the energy grid.

To ensure the most sustainable outcome, the Conservation Council recommends an efficiency standard be applied to the use of biomass. A 2015 report by East Coast Environmental Law (ECEL) recommended that Maritime provinces implement minimum efficiency standards for biomass burning to at least 60 per cent conversion. This is in line with what Massachusetts is considering. Efficiency of at least 60 per cent effectively rules out biomass burning for electricity as the primary outcome. ECEL further recommended that Maritime provinces introduce biomass-harvesting regulations to ensure that "biomass harvesting maintains sufficient standing and fallen deadwood, forest structure, and soil quality so as not to cause significant negative impacts on biodiversity."

6 Jonathan Levesque and Jamie Stephen, "Wood Pellets and Bioheat," *Presentation to New Brunswick Standing Committee on Climate Change and Environmental Stewardship*, January 2022

Recommendations:

- Develop a **province-wide electrification strategy**. The discussion of converting to biomass for large-scale electricity generation is shortsighted. We need a strategic response to decarbonization, not a one-off response to the federal coal phase-out regulation. Other options are available, such as additional wind power in the region, energy efficiency and demand response. The province should compare costs across all options;
- Undertake a **life-cycle assessment** of all electricity options;
- Set a minimum standard for efficient use of biomass of at least **60 per cent**, favouring heating and combined heat and power over electricity generation at Belledune;
- Manage winter peak electricity use for heat with **efficient localized biomass boilers** with strong feedstock procurement policies which incentivize restorative forest management practices; and,
- Use biomass available only from **sustainable forestry practices** that are in line with climate change resiliency, restoration of the Acadian Forest and promotion of biodiversity.

The Conservation Council wants a positive outcome at Belledune and in New Brunswick that creates jobs, provides job security, and creates economic development in line with ecological protection.

Conservation Council *of* New Brunswick
180 St. John Street
Fredericton New Brunswick
Canada E3B 4A9
T. (506) 458-8747
E. info@conservationcouncil.ca
www.conservationcouncil.ca
/conservationcouncil /cc_nb