A POSSIBLE GREEN SOLUTION FOR MANITOBA HYDRO'S THERMAL GENERATING STATION IN BRANDON

Draft as of June 7, 2025

SUMMARY

Manitoba Hydro has been mandated by the Government of Manitoba to find a way to replace its use of natural gas in its Brandon thermal generating station with a non-fossil-fuel alternative. So far, it would appear that no feasible solution has been found.

There may be a solution that, apparently, has not yet been thoroughly considered: *Biodiesel MAY be a viable replacement fuel for natural gas in the existing Brandon turbines.*

Manitoba Hydro's website indicates these turbines "use diesel fuel as a backup".[1] Adapting these turbines to use diesel as their primary fuel is feasible and may be fairly straightforward.

Some adaptation would also be needed to use biodiesel rather than fossil diesel. Because biodiesel gels at roughly 0°C, the biodiesel used in the Brandon plant would need to be warmed during winter. The on-site storage tanks can be insulated, and excess heat captured from the turbines could be used to keep the tanks at the desired temperature.

If this biodiesel was produced from off-grade Manitoba seed oils (such as canola and/or soybeans), this option would provide additional benefits beyond the environmental benefits of replacing a fossil fuel with a renewable fuel:

- Providing a new, reliable and local revenue stream for Manitoba farmers, who are searching for new markets.
- Further diversifying Manitoba's agribusiness sector, including the establishment of a biodiesel plant in Manitoba.

A thorough feasibility study is required to determine if this solution is viable. Questions to be answered include:

- What conversion would be needed for the existing turbines to use biodiesel instead of natural gas?
- What would the capital cost be for temperature-controlled storage tanks and supply piping?
- How much biodiesel would be needed per year?
- How would the estimated future cost of biodiesel compare to that of natural gas?
- What would be the costs and benefits of a Manitoba biodiesel plant?
- Could this option also be viable for Manitoba Hydro's proposed 500 MW thermal generating plant?

Given the broader economic and environmental implications of this possibility, this study should not be conducted by Manitoba Hydro alone, and its results should be made public. Ideally, this study should be commissioned by the Province of Manitoba.

[1] Manitoba Hydro. (n.d.). *Generation: Brandon.* https://www.hydro.mb.ca/corporate/operations/generation/#brandon

DETAILS

1 Electricity Produced from Natural Gas in Manitoba[2]

Beginning in 2001, Manitoba Hydro added natural gas[3] turbines to its facilities in both Brandon and Selkirk and began phasing out their coal-fired systems. The Selkirk facility was switched from coal to natural gas in 2002. The last of the coal-fired generators in Brandon was decommissioned in 2018. From 2018 to 2021, both facilities supplied electricity generated from natural gas.

In 2021, the Selkirk natural gas generation station was taken offline. Brandon is now the sole facility supplying electricity from natural gas onto Manitoba's electricity grid.

Currently, Manitoba Hydro operates two 140-MW combustion natural gas turbines (along with a synchronous condenser) at its Brandon plant, for a total capacity of 280 MW.

Figure 1: Manitoba Hydro's Brandon Facility, 2505 Victoria Ave East[4]

[2] Information from this section is derived from: Manitoba Hydro. (n.d.). *Generation*. https://www.hydro.mb.ca/corporate/operations/generation/

[3] The term "natural gas" is controversial because, while naturally occurring, it is a fossil fuel. Renewable energy advocates prefer the term "fossil gas". They prefer this term because they believe calling something "natural" implies that it is benign. While less harmful to the environment than coal, natural gas is still a major contributor to global warming. Worldwide, about 20% of CO_2 emissions currently come from burning natural gas. In this document, the more common of the two terms (natural gas) is used. See: Friedlingstein, P. (2023). Earth Systems Science Data. Volume 15, issue 12, 5301–5369, 2023. https://doi.org/10.5194/essd-15-5301-2023 (also found at: https://essd.copernicus.org/articles/15/5301/2023/)

[4] Missinginsanity Ab. (July 2022). Manitoba Hydro Brandon Generating Station. https://www.google.ca/maps/place/Manitoba+Hydro/@49.8433035,-99.9026386

The Manitoba electrical grid currently has approximately 6,200 MW of installed generating capacity.[5] At 280 MW, the Brandon plant is only 4.5% of that capacity Although only a small percentage over overall capacity, this facility plays a crucial role in ensuring Manitoba has a stable supply of electricity. In times of drought, if there is an interruption on one of the lines coming down from northern dams, or if there is a surge in demand—or if all three happen at once—this station is brought online and fills the gaps.

Manitoba Hydro does not appear to report its annual natural gas consumption at its Brandon plant in its publicly available reports. However, it does appear that related data is reported by Canada's Energy Regulator.

Table 1: Manitoba electricity production from natural gas[6]

year	*Manitoba electricity production from natural gas (GWh)*
2012	61
2013	30
2014	32
2015	119
2016	69
2017	71
2018	51
2019	40
2020	21
2021	46
average:	*54*

Although this plant is not designed to run all the time, it does appear that it is run, at least intermittently, every year. When power from this plant is needed, that need is critical.

[5] Dunsky Energy + Climate. (July 27, 2023). *An Electricity Roadmap for Manitoba—Beyond Net Zero: A Pathway to Prosperity.* https://www.gov.mb.ca/jec/files/dunsky_report.pdf

[6] Canada Energy Regulator (March 31, 2023). *Electricity Generation.* https://apps.cer-rec.gc.ca/ftrppndc/dflt.aspx?GoCTemplateCulture=en-CA. (This analysis could be improved with up-to-date annual natural gas consumption data from the Brandon plant.)

2 Mandate to Phase out the Generation of Electricity from Natural Gas

In October 2023, in his Mandate Letter to Manitoba Hydro, the Hon. Adrien Sala, the Government of Manitoba's Minister Responsible for Manitoba Hydro, charged the Manitoba Hydro's board to:

> *Develop a plan to align Manitoba Hydro with our government's clean energy targets of a net-zero energy grid by 2035 and a roadmap to a carbon-neutral economy by 2050.*

This duty has been interpreted by many to mean that Manitoba Hydro:

- cannot continue to use natural gas in its Brandon generating station
- must either find and use a non-fossil fuel in the two natural gas turbine generators at the Brandon station, or shut those turbines down

It is not easy to both meet that mandate and have Brandon function as an "emergency" dispatchable, firm power source.

3 Options Discussed to Meet this Mandate

Numerous alternative renewable fuels that could be used in these turbines have been discussed in various forums.

3.1 "GREEN" HYDROGEN

One option that has come up multiple times is replacing the natural gas with "green" hydrogen as the fuel for the turbines currently operating in the Brandon plant.

To be considered green, the hydrogen would need to be produced by water electrolysis, which separates water into hydrogen and oxygen using electricity, and that electricity would, in turn, need to be produced from renewable sources.[7]

It has been suggested that this electricity could be produced by wind turbines. Although the hydrogen/wind option may seem simple, it is not:

- Gas-to-hydrogen conversions at the scale of the Brandon plant have not yet been done.
  - 50 MW systems are just now starting to come online.[8]
  - Conversions at the scale of the Brandon plant are still some years off. Probably the closest in time and scale to the Brandon plant is a conversion project in Los Angeles. Los Angeles Department of Water and Power (LADWP) has begun a competitive bidding process to convert a 346 MW natural gas plant to hydrogen by 2029. Costs are estimated at $800 million (US).[9]
- Water electrolysis requires a great deal of energy, and always requires more energy input than the hydrogen can produce when burned.
  - The closest in scale to what would be needed for Brandon is 150MW alkaline electrolyser, powered by a 200MW solar array, which recently came online in China. [10] A 200MW solar array needs between 300,000 and 500,000 solar panels, depending on how efficient the panels are.
- Hydrogen is difficult to transport and store. Among other challenges, hydrogen also has the drawback of making welds, steel pipes, and steel containment vessels brittle.

[7] It is, of course, possible to produce hydrogen from non-renewable sources, but this would not meet the Government of Manitoba's mandate. (The most common method is steam-methane reforming, which extracts hydrogen from the methane found in fossil natural gas. The overwhelming majority of commercially available hydrogen is produced this way. For more information see:

- U.S. Department of Energy. (n.d.) Hydrogen Production: Natural Gas Reforming. https://www.energy.gov/eere/fuelcells/hydrogen-production-natural-gas-reforming
- IEA. (2024). *Global Hydrogen Review 2024* https://www.iea.org/reports/global-hydrogen-review-2024)

[8] Kawaski Heavy Industries. (December 9, 2021). *One of the World's First 100% Hydrogen-To-Power Demonstrations on Industrial Scale Launches in Lingen, Germany.* https://global.kawasaki.com/news_211209-2e.pdf

[9] Clark. K. (February 9, 2023). *L.A. authorizes conversion of largest gas plant to hydrogen.* Power Engineering. https://www.power-eng.com/gas/l-a-authorizes-conversion-of-largest-gas-plant-to-green-hydrogen/#gref

[10] Collins. L. (February 1, 2022). *Record breaker | World's largest green hydrogen project, with 150MW electrolyser, brought on line in China.* Recharge. https://www.rechargenews.com/energy-transition/record-breaker-world-s-largest-green-hydrogen-project-with-150mw-electrolyser-brought-on-line-in-china/2-1-1160799

- Using publicly available data, a wind farm at the scale of the St Joseph or St Leon wind farm would be needed to produce enough hydrogen to match the average electricity output of the Brandon plant.
    - This is only a rough estimate. In-house Manitoba Hydro data could provide a more accurate estimate.

(A more detailed—though still preliminary—analysis of the hydrogen/wind option is available on request from bruce.duggan@bokeconsulting.com.)

3.2 RENEWABLE NATURAL GAS (RNG)

Another option that has been proposed is Renewable Natural Gas (RNG)—also called "biomethane", or "green natural gas". RNG can be derived from a number of sources, including landfills, livestock operations, and wastewater treatment.[11]

Although not produced in Manitoba, RNG is commercially available; the main RNG production facilities in Canada are in Quebec. Additional facilities operate (or are coming into operation) in Ontario, BC, and Alberta.

RNG has a number of drawbacks which, while challenging, are not insurmountable:

- RNG costs roughly twice as much as "fossil" natural gas.
    - This cost is projected to come down in the future, if more commercial operations come online.
- RNG is not commercially produced in Manitoba.
    - To be used in the Brandon plant, RNG sourced from outside Manitoba would need to be either piped in or converted to Liquid Natural Gas (LNG) and shipped in. This would further add to the cost.

Currently, less than 0.5% of the natural gas consumed in Canada is renewable—the rest is fossil natural gas.[12]

If RNG production matures and consumption increases as a proportion of all natural gas consumed, RNG could become a more viable fuel for the Brandon generating station.

[11] Alternative Fuels Data Center. (n.d.). *Renewable Natural Gas Production.* U.S. Department of Energy. https://afdc.energy.gov/vehicles/natural-gas

[12] Canada Energy Regulator. (April 19, 2023). *Market Snapshot: Two Decades of Growth in Renewable Natural Gas in Canada.* https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/market-snapshots/2023/market-snapshot-two-decades-growth-renewable-natural-gas-canada.html#:~:text=Despite%20making%20up%20just%200.36,processing%2C%20and%20wood%20waste%20processing.

4 Biodiesel—An Unconsidered Option?

This document proposes an option that could meet the Government of Manitoba's mandate to end fossil fuel consumption at the Brandon station well before the Government of Manitoba's target date of 2035—biodiesel.

This option does not appear to have been publicly discussed yet.

4.1 BIODIESEL—NOT RENEWABLE DIESEL

There are two types of non-fossil-fuel diesel—biodiesel and renewable diesel[13].

What is being proposed as a potential fuel for the Brandon generating station is biodiesel (FAME). This is the fuel blended with fossil diesel during the summer in Manitoba, sold here commercially, and consumed here in trucks, heavy equipment, and heating systems.

Renewable diesel (HDRD) is not being proposed as a fuel for the Brandon generating station for at least two reasons:

- Renewable diesel is more expensive than biodiesel
    - Numerous sources report that renewable diesel is more expensive than biodiesel,[14] but more research is needed to determine the actual price differential in Manitoba.
- Renewable diesel plants are much more expensive to build than biodiesel plants.
    - The only HDRD production facility in Canada—Tidewater Renewable's plant in Prince George cost between $342 and $450 million to build.[15]
    - HDRD production facilities are expensive because use the same technologies as conventional fossil fuel refineries. Most HDRD production facilities appear to be conversions from fossil fuel refineries.

[13] Confusingly, biodiesel is also called FAME (Fatty Acid Methyl Esters) diesel, green diesel, 1st generation biodiesel, B100, and B100 biodiesel RME. To further add to the confusion, renewable diesel is also call HDRD (Hydrogenation-Derived Renewable Diesel), green diesel, 2nd generation biodiesel, and HVO100 renewable diesel.

[14] See, for example:

- Navius Research. (November 1, 2023). *Biofuels in Canada 2023.* Advanced Biofuels Canada. https://advancedbiofuels.ca/wp-content/uploads/Biofuels-in-Canada-2023-2023-11-01.pdf
- Deloitte. (June 20, 2013). Natural Resources Canada: Financial and Market Analysis Hydrogenation-Derived Renewable Diesel Canadian Business Case Analysis. Natural Resources Canada. https://natural-resources.canada.ca/sites/nrcan/files/energy/pdf/HDRD%20Business%20Case_English.pdf

[15] See:

- Tidewater Renewables. (March 27, 2025). Tidewater Renewables Ltd. Announces Fourth Quarter and Full Year 2024 Results, and Refinancing of Credit Facilities. https://www.tidewater-renewables.com/investors/news-events/tidewater-renewables-ltd-announces-fourth-quarter-and-full-year-2024-results-and-refinancing-of-credit-facilities/
- Slark. C. (December 12, 2024). *Renewable diesel refinery could close by March if foreign subsidy issues not resolved.* Prince George Citizen News. https://www.princegeorgecitizen.com/local-news/renewable-diesel-refinery-could-close-by-march-if-foreign-subsidy-issues-not-resolved-9948631

5 Conversion of Brandon's Natural Gas Turbines to Biodiesel

The gas turbines currently in operation at the Brandon plant are able to use diesel as a backup fuel.[16]

It is unclear from publicly available information what modifications (if any) would be needed for these turbines to use diesel as a primary fuel, rather than a backup fuel. It is also unclear what additional modifications would be needed (if any) would be needed to the turbines to use biodiesel rather than fossil diesel as the primary fuel.

5.1 CONVERSION OF TURBINES FROM NATURAL GAS TO DIESEL

Some natural gas turbines are designed to run only on natural gas, while others are designed to run on both natural gas and diesel.

If the turbines at the Brandon plant were designed to run only on natural gas, significant modifications are required for them to be able to use both natural gas and diesel. The technical requirements and costs of these modifications are well known and could be accurately estimated.[17]

However, based on the fact that Manitoba Hydro reports that these turbines can use diesel as a backup fuel, it appears likely that they are equipment with what is commonly called "bi-fuel" or "dual fuel" capacity. This may mean that little, if any, modification would be needed to make diesel the primary fuel in these turbines. A technical and engineering consultation with Manitoba Hydro and the manufacturer of these turbines (which, apparently, is Alstrom)[18].

5.2 ADAPTATION OF TURBINES TO BIODIESEL

It is important to note, however, that biodiesel and diesel are not the same fuel. Further research is needed—again in consultation with Manitoba Hydro and the turbines' manufacturer—on what modifications (if any) are needed to use biodiesel in these turbines instead of diesel.

5.3 OVERCOMING BIODIESEL'S COLD WEATHER GELLING

In addition to any modifications to the turbines that might be needed to use biodiesel as a fuel, some adaptation would also be needed to be made to the fuel storage system to use biodiesel rather than fossil diesel.

Biodiesel gels at roughly 0°C.[19] This is a well-known problem that makes the use of biodiesel (in either blended or pure form) in winter problematic for moving vehicles such trucks, heavy equipment, and farm vehicles.

---

[16] Manitoba Hydro. (n.d.). *Generation: Brandon.* https://www.hydro.mb.ca/corporate/operations/generation/#brandon

[17] EPRI (Electric Power Research Institute). (September 2001). *Conversion to Dual Fuel Capability in Combustion Turbine Plants Addition of Distillate Oil Firing for Combined Cycles.* https://restservice.epri.com/publicdownload/000000000001004599/0/Product

[18] Manitoba Hydro's website does not name the manufacturer of these turbines. However, Alstrom is listed as the manufacturer at: Wikipedia (last edited: 26 March 2024). *Brandon Generating Station.* https://en.wikipedia.org/wiki/Brandon_Generating_Station. This could need to be verified.

[19] See, among other sources: Farm Energy. (April 3, 2019). Biodiesel Cloud Point and Cold Weather Issues. https://farm-energy.extension.org/biodiesel-cloud-point-and-cold-weather-issues/

The problem of gelling is much easier to overcome for stationary uses. The biodiesel used in the Brandon plant would need to be warmed during winter. This can be accomplished fairly easily: the on-site storage tanks can be insulated, and excess heat captured from the turbines could be used to keep the tanks at the desired temperature.

6 Ancillary Benefits

The benefits of using biodiesel at the primary fuel at the Brandon plant could go beyond fulfilling the Government of Manitoba's mandate to eliminate fossil fuel for electricity generation.

6.1 BENEFITS TO MANITOBA FARMERS

Biodiesel can be produced from (among other inputs) off-grade canola and soybeans.

Canola is Manitoba biggest cash crop, with farm cash receipts of $2.28 billion in 2023.[20] Soybeans are also a significant cash crop in Manitoba, generating $835 million in receipts in 2023.[21]

More research is needed to determine how much of the canola and soybeans grown in Manitoba are off-grade—not suitable for human or animal consumption—and therefore could be available for processing into biodiesel.

This research should not be difficult to conduct and should be done in coordination with stakeholders including:

- Government of Manitoba's Department of Agriculture
- Keystone Agricultural Producers
- Manitoba Canola Growers Association
- Manitoba Pulse and Soybean Growers
- Pulse Canada
- Soy Canada
- Canadian Oilseed Processors Association

In addition to the usual challenges of market and price fluctuations, Manitoba's canola farmers are grappling with the 100% tariff recently imposed by China on canola oil and meal[22]. As well, both soybean and canola producers face uncertainty regarding exports to the United States.

Diversification of markets is essential for farm viability.

Using biodiesel as the primary fuel in the Brandon generating station could provide a crucial, local source of additional revenue and market stability for Manitoba canola and soy producers.

[20] Department of Agriculture. (July 2024). *Sector Profile at a Glance: Canola.* Government of Manitoba. https://www.manitoba.ca/agriculture/markets-and-statistics/crop-statistics/pubs/canola-sector-profile.pdf

[21] Department of Agriculture. (July 2024). *Sector Profile at a Glance: Soybeans.* Government of Manitoba. https://www.gov.mb.ca/agriculture/markets-and-statistics/crop-statistics/pubs/soybean-sector-profile.pdf

[22] Canola Council of Canada. (March 8, 2025). *Trade with China. https://www.canolacouncil.org/china-update/*

6.2 AGRIBUSINESS DIVERSIFICATION BENEFITS OF A MANITOBA BIODIESEL PLANT

There is no production of biodiesel in Manitoba, even though approximately 25 million litres of biodiesel are consumed in the province every year.[23] The biodiesel consumed in Manitoba is currently produced elsewhere. As of 2023, there were 11 biodiesel plants in operation in Canada,[24] the closest being in Alberta.[25] There are also many biodiesel plants in the United States, with the closest being in North Dakota.[26]

The Government of Manitoba could play a crucial role in establishing a biodiesel plant in Manitoba. As part of its Biofuels Act, the province created a Biodiesel Fund Grant Regulation in 2010, offering a subsidy of $0.14 per litre to Manitoba biodiesel producers. This program lasted until 2015, when it lapsed without any Manitoba firm producing biodiesel at a commercial scale. It may be that no potential biodiesel producers took advantage of this subsidy, in part, due to uncertainty over market demand.

There are multiple options for ownership of this plant. It could be owned by an established oil company with experience in biofuels,[27] or producer's cooperative owned by soy and canola farmers—or a partnership with multiple shareholders.

Reviving this grant, in coordination with a commitment to purchase biodiesel for Manitoba Hydro's Brandon plant would significantly reduce the risk of establishing a biodiesel plant in Manitoba. A multi-year contract to purchase this biodiesel would also be to Manitoba Hydro's advantage, as it could reduce or eliminate its fuel supply and price risks.

[23] Government of Manitoba. *Biofuels*. Environment and Climate Change. https://www.gov.mb.ca/sd/environment_and_biodiversity/energy/biofuels/index.html#:~:text=As%20of%20January%201%2C%202022,fuel%20in%20non%2Dexempted%20areas.

[24] Voegele, E. (August 23, 2023). *Report: Canadian Consumption Of Biobased Diesel To Grow In 2023.* https://biodieselmagazine.com/articles/report-canadian-consumption-of-biobased-diesel-to-grow-in-2023-2518864

[25] Advanced Biofuels Canada. *Members Map.* https://advancedbiofuels.ca/resources/members-map/

[26] EIA (U.S. Energy Information Administration.). (January 1, 2024). *U.S. Energy Atlas: Biodiesel Plants.* https://atlas.eia.gov/datasets/eia::biodiesel-plants-1/explore

[27] Cenovus Energy, for example, operates an ethanol plant in Minnedosa. This plant was initially Husky Energy; Cenovus acquired Husky in 2021. See: Cenovus Energy. (June 2, 2025). *Minnedosa Ethanol Plant.* https://www.cenovus.com/Our-operations/Products-and-services/Ethanol/Minnedosa-Ethanol-Plant

7 Implications for Manitoba Hydro's Proposal for Additional Thermal Power Generation

Manitoba Hydro has projected that it will need to add an additional 500 MWs of thermal generating capacity by 2031. This would roughly triple its thermal generating capacity.

Manitoba Hydro has identified natural gas as the lowest-cost fuel option for this additional thermal generating capacity. It has also indicated that it would like to consider hydrogen and renewable natural gas, as potential fuels, but does not seem to be considering biodiesel.[28,29,30]

Considering biodiesel at this stage could have significant implications on planning for this facility, including what turbines are chosen and the plants configuration.

It may be that the most suitable turbines for this facility would turn out to be bi-fuel or dual fuel, ready for the inclusion of renewable natural gas (RNG) once that market matures.

[28] See: Kives, B. (February 27, 2025). *Manitoba Hydro proposes $1.4B fuel-burning generating station to stave off winter power shortages.* CBC News. https://www.cbc.ca/news/canada/manitoba/manitoba-hydro-fuel-combustion-plants-1.7469200

[29] Public Utilities Board. (March 28, 2025). *Comments and Recommendations on Manitoba Hydro's Preliminary Estimate for a 500 Mw Dispatchable Capacity Resource.* https://www.pubmanitoba.ca/v1/proceedings-decisions/appl-current/pubs/mh-preliminary-estimates/pub-recommendation-on-preliminary-estimate-for-capacityresource-march2025.pdf

[30] The issues of hydrogen and renewable natural gas are noted earlier in this document. The challenges noted with these fuels for the Brandon plant would be even more acute for a plant twice the size of the current one in Brandon.

8 Next Steps

This document does not assert that biodiesel can or should replace natural gas as the primary fuel in Manitoba Hydro's Brandon generating station.

It does, however, argue that the option of biodiesel for these turbines can and should be thoroughly investigated.

The questions that need to be answered include:

- What conversion would be needed for the Brandon plant's existing turbines to use biodiesel instead of natural gas?
- What would the capital cost be for temperature-controlled storage tanks and supply piping to properly store that biodiesel?
- How much biodiesel would be needed per year if it were the primary fuel in these turbines?
- How would the estimated future cost of the biodiesel consumed in these turbines compare to that of natural gas?
- What would be the costs and benefits of a Manitoba biodiesel plant?
- Could this option also be viable for Manitoba Hydro's proposed 500 MW thermal generating plants?

Answering these questions should not be difficult. The research will require engineering and business planning expertise, and will require the participation of multiple stakeholders.

Given the broader economic and environmental implications of this possibility, this study should not be conducted by Manitoba Hydro alone, and its results should be made public. Ideally, this study should be commissioned by the Province of Manitoba.