Summary Paper

Low-Carbon Fuels Potential in Newfoundland and Labrador

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econext

Advancing Newfoundland & Labrador's **Green Economy**

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1. Background and Context

1.1 Low-Carbon Fuels Discussion Papers

In 2025 econext commissioned a study titled *Opportunities for Domestic Clean Fuels Use in Newfoundland and Labrador*[1]. This study explored potential low-carbon fuel use according to various economic sectors within the province.

The outlook for the future adoption of low-carbon fuels is based on many different variables and is difficult to predict – particularly within a localized geography. However, the research did help to advance discussions and outline some of the opportunities and challenges for low-carbon fuels adoption within specific sectors in NL.

It was clear that adoption opportunities were potentially significant in specific sectors, but more analysis with the NL context was required.

Through 2025-26, econext published discussions papers focused on low-carbon fuels adoption potential within its marine transportation, surface transportation, and electricity sectors. econext also published a discussion paper specific to the possible use of available biomass in NL towards low-carbon fuels production – as it quickly became clear that there was a local supply opportunity associated with the emerging demand. Each of these discussion papers were informed by desktop research, key stakeholders, and a series of workshops.

Collectively, these discussion papers are providing new insights into both the possible demand and supply of low-carbon fuels within NL. This paper summarizes what econext has learned throughout this work.

1.2 Summary Paper Purpose

The objective of this paper is to generate discussion and encourage further exploration of the demand and supply of low-carbon fuels within NL.

While every effort has been made to provide sources for information provided, this discussion paper is not an academic publication and is not intended to be. This is a document produced internally by *econext* staff through secondary research via information known to be available in the public domain.

[1] https://econext.ca/discussion-paper-opportunities-for-domestic-clean-fuels-use-in-newfoundland-and-labrador/

econext welcomes all feedback that can help improve the quality and usefulness of this discussion paper. Feedback can be sent to info@econext.ca.

1.3 About econext

econext is a not-for-profit industry association dedicated to advancing environmentally sustainable economic growth in Newfoundland and Labrador. With a network of approximately 200 member businesses, research institutions, governments, and organizations, econext serves as a leading voice for the province's green economy.

econext has four key areas of focus:

Member Opportunities
We connect our members with opportunities to grow their businesses in the green economy.

Public Policy & Advocacy
We identify, analyze, and champion policy frameworks that support sustainable economic growth in NL.

Capacity Building
We equip NL's businesses, communities, and workforce with skills, experience, and knowledge needed to contribute to green economic growth.

Innovation
We identify emerging trends and provide insights that inform policy, investment, and innovation that advance clean growth in NL.

Together, we strengthen NL's green economy by supporting our members and help drive sustainable growth and innovation across the province. Learn more at econext.ca.

2. What Are Low-Carbon Fuels and What are Their Benefits?

What do we mean when we say 'low-carbon fuels?' Low-carbon fuels is a catch-all term which describes fuels that produce lower greenhouse gas (GHG) emissions than traditional (or conventional fossil) fuels on a life-cycle basis[2]. Their increased production

[2] https://natural-resources.canada.ca/energy-sources/clean-fuels/clean-fuels-fueling-future

and use are viewed as being vital in the world's fight against climate change and the pursuit of net zero.

2.1 Categorizing Low-Carbon Fuels

There are many types of low-carbon fuels and there are a number of different terms that are being used to describe them. These terms are often used interchangeably and sometimes incorrectly.

However, in econext's experience, breaking down low-carbon fuels into three categories (biofuels, renewable biofuels, and e-fuels) has proven to be an effective approach to understanding and communicating these fuels.

Biofuels

Biofuels are fuels made from recently living organic matter (biomass) like plants, agricultural waste, or animal fats, offering alternatives to fossil fuels. There are a wide variety of biofuels depending on the type of biomass used and the processes used in their creation. Examples of biofuels include biodiesel and bioethanol. A biofuel can be produced with much lower GHGs than their fossil fuel-based counterparts, and when 'burned' can also be less harmful. However, as they are not chemically identical to their conventional fuel counterpart (i.e., biodiesel vs. diesel), biofuels typically cannot directly replace fuels at a 1:1 ratio without affecting equipment. 'First generation' biofuels are those made from sugar, starch, or vegetable oil. Their feedstocks are those that might have an impact on food supply if used in large quantities. 'Second generation' biofuels are those made from sustainable feedstocks as defined by the feedstock's availability, its impact from a GHG perspective, and land use[3].

Renewable Biofuels

Produced through a different method ('catalytic pyrolysis') than biofuels but with similar feedstocks, 'renewable' biofuels are chemically identical to their petroleum-based counterparts. Examples include renewable diesel (chemically identical to diesel), sustainable aviation fuel or SAF (chemically identical to jet fuel), and renewable natural gas or RNG (i.e., chemically identical to natural gas).

[3] https://econext.ca/wp-content/uploads/2025/06/Biomass-Energy-Potential-NL-Version-1.0-2025-06-11.pdf

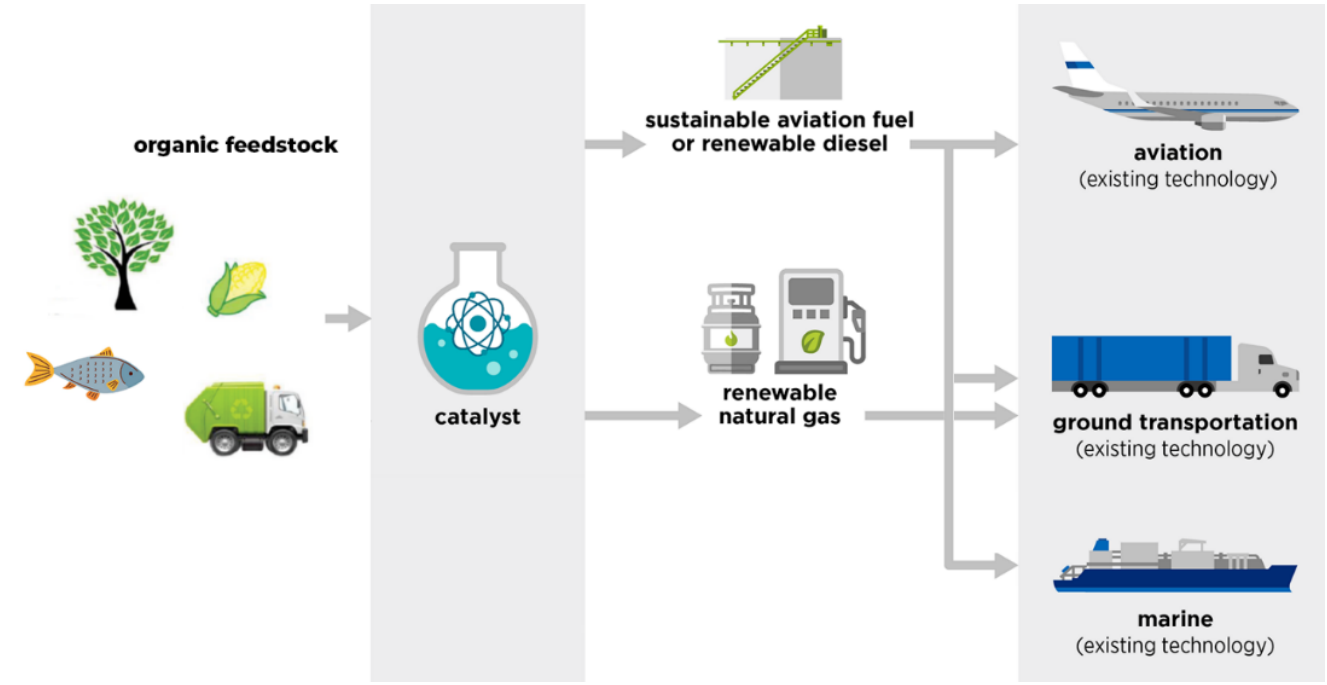

Figure 1: Examples of renewable biofuel pathways

This means that renewable biofuels can potentially be used as a direct replacement (or as a 'drop-in') for conventional fuels in existing technology (i.e., combustion turbines, car/truck/ship engines, other heavy equipment). This also means that existing transportation, storage, and refueling infrastructure can be used for these fuels – simplifying the logistics of decarbonization.

E-Fuels

E-fuels (electro-fuels) are synthetic fuels produced through electrolysis, which splits water molecules into hydrogen and oxygen using renewable electricity[4]. The most commonly discussed e-fuel is hydrogen, but the category includes fuels that have hydrogen as one of the key components. Examples of e-fuels in addition to hydrogen include e-ammonia and e-methanol. E-fuels are viewed as being instrumental in the fight against climate change and the global pursuit of net zero as they generally emit significantly less GHGs than fossil fuel alternatives, and their main component – hydrogen – can be produced using clean energy sources.

[4] https://spectra.mhi.com/energy-transition/what-are-e-fuels-and-can-they-help-decarbonization

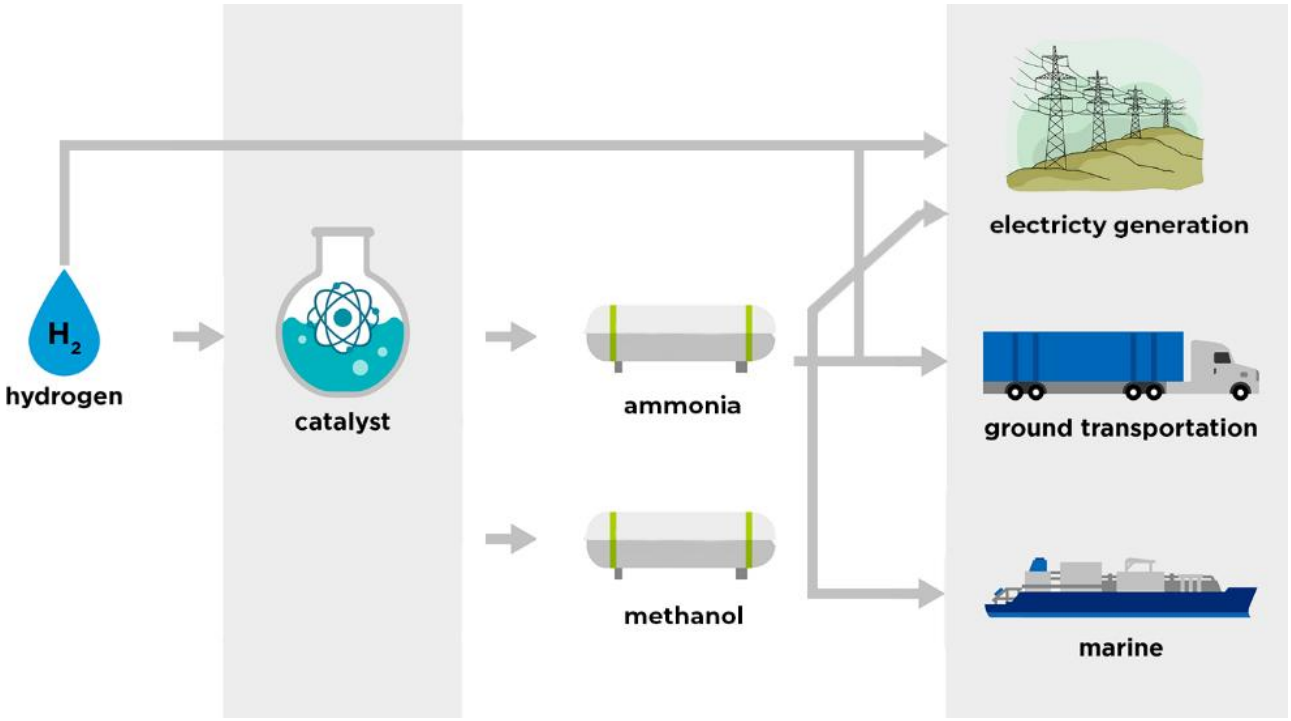

Figure 2: Examples of e-fuel pathways

Fuel Blending

Fuel types do not necessarily need to be homogeneous or used exclusively. As alluded to above, fuels can often be blended.

Blending allows for the realization – even if in part – of the benefits to low-carbon fuel use. In some situations, fuel blending is necessary for adoption. This is the case with biodiesel which typically cannot fully replace diesel use in engines but can be blended with diesel. Most of Canada is required to incorporate renewable fuel content within gasoline and diesel. It is becoming common for gasoline to feature 10% or more ethanol, and for diesel to feature 5% or more diesel. These requirements do not apply within NL.

There are many different blending scenarios involving conventional fuels, biofuels, renewable fuels, and e-fuels – often multiple at the same time. Fuel blending is likely to become more important globally over time as (a) pressures continue to mount worldwide to lower the carbon intensity of fuels produced and consumed, while (b) the availability of low-carbon fuels to meet this demand is likely to be in short supply.

2.2 Benefits of Low-Carbon Fuels

There are a number of benefits to the adoption of low-carbon fuels.

Decreased GHGs: The use of low-carbon fuels allows for lifecycle GHG reductions. These reductions will either be associated with the direct use of the fuel (e.g., a low-carbon fuel will produce fewer GHGs when used) and/or the displacement of conventional fossil fuels. The amount of GHGs replaced will depend on the low-carbon fuel used, how it is produced, and what it is displacing.

Reduced air pollutants: The use of low-carbon fuels often results in a reduction of other air pollutants such as particulates (tiny particles of solid matter that lodge in the lungs and deposit on buildings), carbon monoxide, sulfur dioxide, hydrocarbon, and other air toxins[5]. Each low-carbon fuel and the process used in their deployment will result in unique reductions. The amount of air pollutants reduced will depend on the low-carbon fuel used, how it is produced, and what it is displacing.

Energy security: Many low-carbon fuels can be produced using local renewable resources (i.e., biomass, electricity, etc.) Even when locally produced fuels are blended with conventional fuels, this: (1) displaces the volume of fuel that must be imported; (2) protects against supply and supply chain disruptions caused by geopolitical events; (3) protects against price volatility of globally traded commodities; and (4) provides for domestic fuel production and supply capabilities that can be called on when needed in an emergency. For example, a diesel fuel blended with 30% locally produced biodiesel and renewable diesel displaces 30% of the required diesel to be imported, and the geopolitical impacts on that import which are out of the user's control.

Valorization of wasted resources: Oftentimes organic waste material (e.g., household organic waste, forestry residues, fishing and aquaculture discards, agricultural waste) are sent to landfill. This is the case in NL. This 'waste' is a resource which has value and can be considered as feedstock for low-carbon fuels production. Moreover, the diversion of these waste streams away from landfills reduces the harmful GHGs that are caused by the decomposition of biomass.

Economic development and growth: The production and distribution of low-carbon fuels (including the diversion of biomass from landfills) creates jobs, wealth, and improved environmental outcomes for communities. Many low-carbon fuels have value and opportunity domestically, while also are tradeable commodities on a regional, national, and global scale. As various biomass-derived fuels are interoperable with their e-fuel counterparts, there are opportunities for the scaling of production utilizing electricity as an additional feedstock.

[5] https://advancedbiofuels.ca/net-zero

3. Low-Carbon Fuels in NL and Greenhouse Gas Emissions

It has been stated that low-carbon fuels have the potential to reduce GHGs in NL – but how is this the case? Understanding of the sources of GHGs in NL is helpful in answering this question.

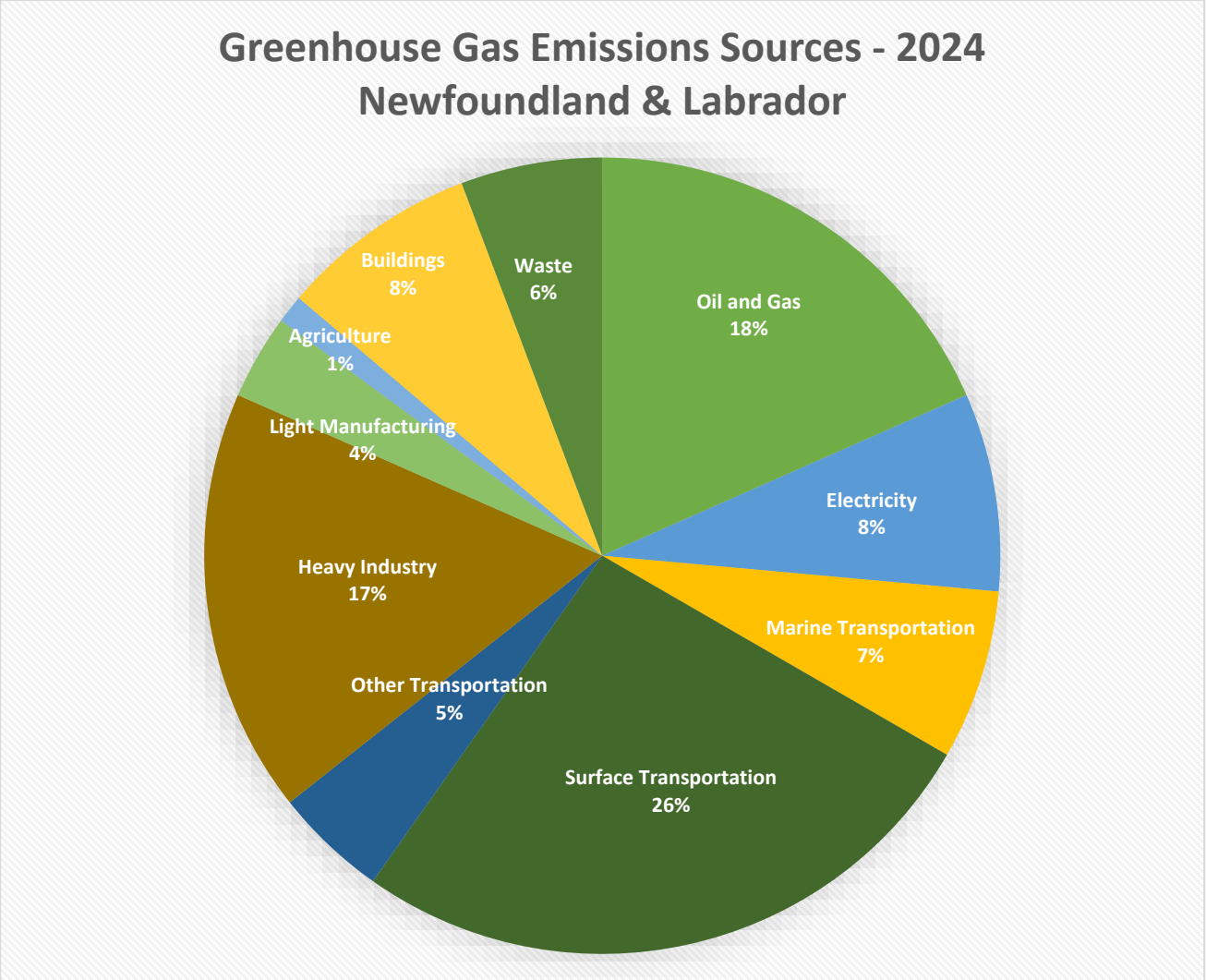

Figure 3 – GHG Sources in Newfoundland and Labrador 2024[6]

Low-carbon fuels can be used in concert with or in direct replacement of fuels that are currently used in equipment. This can include vehicles, tractors, heavy equipment, generators, ships and vessels, and more.

[6] With information from https://www.gov.nl.ca/eccc/occ/greenhouse-gas-data/

This type of equipment is used prevalently in some of the GHG categories noted below.

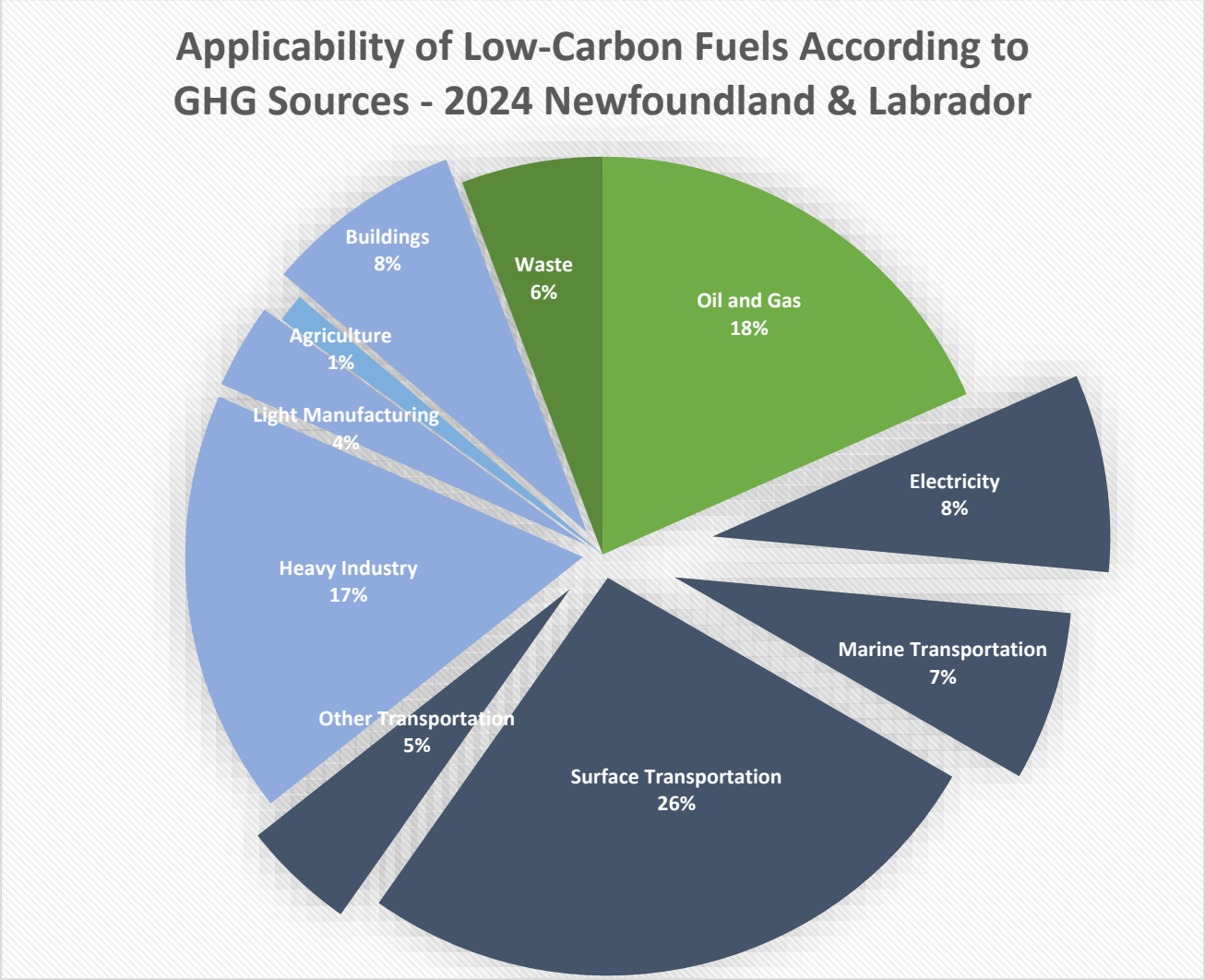

Figure 4 – Applicability of Low-Carbon Fuels According to NL GHG Sources 2024[7]

The sectors coloured in **dark blue** represent segments of the economy where the adoption of low-carbon fuels have the potential to achieve **significant** GHG reductions. The most likely paths to decarbonization in these sectors involve continued fuel combustion of one type or another for decades to come.

The sectors coloured in **light blue** represent segments of the economy where the adoption of low-carbon fuels have **some** potential to reduce GHGs. Paths to decarbonization in these sectors have the potential to include low-carbon fuels – in some cases in significant quantities – however electrification is likely to feature more prominently. Note that low-carbon fuels still have relevance in electrification scenarios as they can be used to decarbonize the use of combustion turbines and generators.

[7] With information from https://www.gov.nl.ca/eccc/occ/greenhouse-gas-data/

The remaining sectors (waste and oil and gas) are sectors within which the adoption of low-carbon fuels is **not** expected to play a significant role in decarbonization.

Roughly, 46% of NL's GHGs can be significantly reduced via the adoption of low-carbon fuels with an additional 30% having some potential.

Therefore, from the perspective of climate change mitigation and the pursuit of net zero by the year 2050, it is clear that the adoption of low-carbon fuels is an area that deserves significant attention in NL.

4. Predicting Future Demand for Low-Carbon Fuels in NL

In any given use case, a variety of low-carbon fuels could be considered for adoption with different local and global circumstances in play which could impact that adoption. Predicting the future demand for low-carbon fuels in NL is not (and cannot be) an exact science.

In some sectors, adoption trends will be driven by decisions made by multi-national companies. For example, large international shipping companies will make their own decisions on technology adoption. NL is not in a position to heavily influence these decisions or dictate outcomes. Moreover, international events such as global conflicts and trade disputes can have a direct impact on adoption decisions, their timing, and the speed of their implementation.

Thus, obtaining certainty about what fuels will be demanded when and where is not realistic.

4.1 Changing Circumstances

However, developments and evolving circumstances since 2019 provincially, nationally, and globally are creating some clear trends which are impacting the demand for low-carbon fuels and can help to inform decision-making. These changing circumstances include:

- Increased national focus on **energy security**. Geopolitical events and disruptions are driving a renewed priority on the local production of energy (including fuels) to meet local demands.
- Increased focus on climate change mitigation and **the pursuit of net zero** GHG emissions. Tackling climate change has become an international, national, and provincial priority with policies and incentives being put in place.

- Biomass energy **technologies have advanced** and are maturing, possibly addressing the geographic and economies-of-scale challenges that have inhibited production and adoption in places like NL.
- **Policy and market forces** – within NL and abroad – are creating new demands for low-carbon fuels and are creating new domestic and export opportunities for biomass energy. The International Energy Agency (IEA) is predicting annual demand growth rates of 11% per year between 2023-2030[8], while region-specific regulations in the European Union and Canada are creating incentives for adoption.
- Biofuels are now common alternatives in transport fuels either through full replacement or **blending** with conventional (petroleum-based) fuels.
- **New incentives** (such as investment tax credits) have been put into place to support biomass energy projects.
- Large low-carbon fuels are **online and producing product**[9] or are making their way through regulatory processes towards final investment decisions[10], resulting in new potential synergies with the private sector.

There are also some segments of the economy where the province does have the ability to make independent decisions. For example, the Government of NL could dictate future low-carbon fuel use in electricity generation (combustion turbines and generators) and within its ferry fleet.

4.2 Predicted NL Demand

Recent research and analysis exploring low-carbon fuels demand in marine transportation, surface transportation, and the electricity sector has allowed econext to come to some conclusions about the most likely low-carbon fuels adoption scenarios:

- Conventional fuels like diesel and gasoline are expected to be in use in NL for a long time to come. This means that efforts to decarbonize these fuels will be meaningful in the short, medium, and long terms.

- Diesel is used in almost all sectors of NL's economy. This presents opportunities for introducing the use of **biodiesel** (as a blend) and **renewable diesel** (either as a blend or as a replacement) economy-wide.

- Passenger vehicles account for a significant share of NL's GHGs. This presents opportunities for the use of **ethanol** (as a blend).

[8] https://www.iea.org/energy-system/low-emissions-fuels/biofuels
[9] https://econext.ca/econext-celebrates-first-commercial-production-of-clean-fuels-in-newfoundland-and-labrador/
[10] https://northatlantic.ca/green-energy-hub/phase-1/

- **Natural gas** (and Liquefied Natural Gas - LNG) has promise for adoption within electricity and marine transportation sectors – presenting opportunities for **renewable natural gas** and **green hydrogen** (or low-carbon hydrogen) blending.

- Global trends in the marine transportation sector suggest that **green methanol** is going to be a low-carbon fuel of choice in the long term. Green methanol production requires **green hydrogen** and **C02** as inputs. In addition, other low-carbon hydrogen and **ethanol** can be blended with methanol.

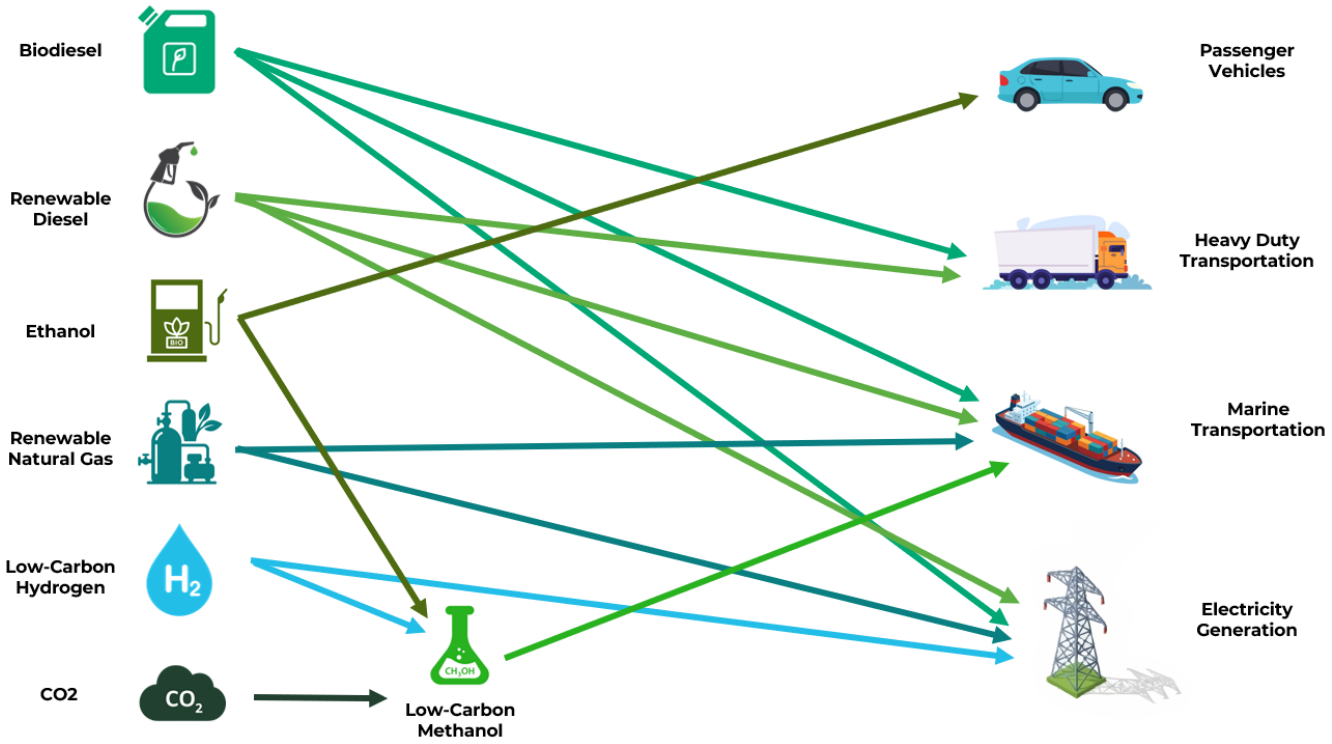

Figure 5: Potential low-carbon fuel adoption pathways in Newfoundland and Labrador

It is important to observe that biomass can play an important role in the production of all low-carbon fuels identified as having opportunity for adoption in NL. Biomass is the primary input for biodiesel, renewable diesel, ethanol, and renewable natural gas. Meanwhile, it can be used as one of the inputs for low-carbon hydrogen and/or low-carbon methanol. The process of producing these fuels via biomass also creates CO2 – a component which can be captured and utilized elsewhere (such as in the production of green methanol).

5. Low-Carbon Fuels Production Potential in NL

With an understanding of what low-carbon fuels might be demanded in NL, attention turns to how these fuels can be supplied. In order for NL to fully realize the benefits of low-carbon fuels adoption, it should strive to be a producer and supplier of them as well.

Given that biomass is required to produce some of the highest-potential low-carbon for adoption in NL – and is an input/feedstock in others – can **locally available biomass** be used to help create supply to meet emerging demand?

Biomass resources in NL are currently underutilized. It is estimated that the total waste disposed in NL is 351,417 MT annually[11]. Up to 30% of the waste generated in NL is organic[12], and less than one percent of organic waste is being diverted from landfills[13].

In addition, there are industrial sources of biomass produced as a byproduct from fisheries, aquaculture, forestry, and agricultural industries. Many of these waste streams are either landfilled or otherwise disposed of.

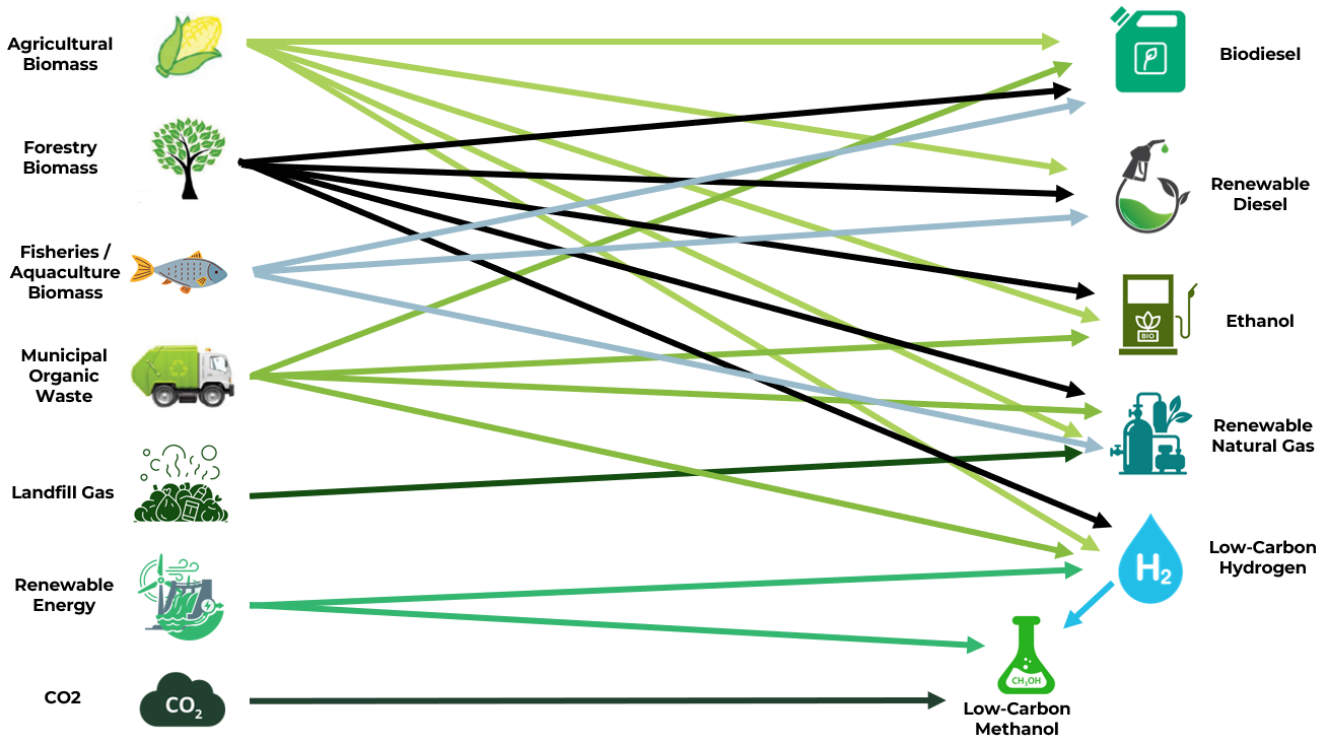

Figure 6: Potential low-carbon fuel production pathways in Newfoundland and Labrador

There are many different possible fuel production pathways using each of a variety of different feedstocks. As each available biomass feedstock in NL is relatively low and distributed over a large geography – work will be required to understand where efforts and materials are best committed to maximize potential.

The use of low-carbon fuels itself will have positive environmental impacts in NL – and their local production can yield even more. Waste management, exclusive of associated

[11] https://mmsb.nl.ca/wp-content/uploads/2025/04/2019-Waste-Report-Card.pdf
[12] https://mmsb.nl.ca/education/composting/
[13] https://www.gov.nl.ca/eccc/files/waste-management-final-report-review-pswms.pdf

transportation, is responsible for 6-7% of NL's GHG emissions[14]. The vast majority of these GHGs are caused by the decomposition of organic waste that is landfilled. In addition, there are industrial waste streams not disposed of in landfills which are having similar environmental impacts. The diversion of these waste streams will help avoid GHGs associated with their decomposition.

Lastly, even if all future organic wastes are fully diverted away from landfills in NL, landfills will continue to produce GHGs for many more years due to the decomposition of organic materials that have been collecting for decades. This gas (methane) can be captured and factor as an input into various low-carbon fuels.

There are geographic, economic, and logistical challenges to be overcome in pursuing bio-based low-carbon fuels production in NL. However, there are also economic benefits associated with significant waste diversion and the growth of a new industry spanning the province.

It should be noted that renewable diesel is already being produced in NL, albeit exclusively as an export product. Meanwhile, it is expected that green hydrogen will be produced domestically by the early 2030s (again, for export). These are opportunities for the province to capitalize from the local production of these fuels in terms of how they can be used locally and how they can be used in the production of other fuels.

6. What are the Next Steps in Growing NL's Low-Carbon Fuels Economy?

In its analysis, econext has come to a number of sector-specific recommendations pertaining to low-carbon fuels adoption within its marine transportation, surface transportation, and electricity sectors.

This research was accompanied by an analysis of biomass sources that may be available in NL, and the economic and policy incentives that are available that could support domestic low-carbon fuels production.

Through this work there are **three** recommendations, which appear in all mentioned discussion papers, that are highlighted here.

[14] https://www.gov.nl.ca/ecc/occ/greenhouse-gas-data/

6.1 Define best use cases for available biomass in NL and techno-economic feasibility of low-carbon fuels production

There are multiple fuel production pathways using locally available biomass with potential adoption in NL. Moreover, there are numerous different sources of biomass that each has their own characteristics influencing how they would be best used in fuel production. A techno-economic analysis is required to determine the best end uses at a provincial level for each of these organic waste materials (in addition to landfill gas) and the feasibility of low-carbon fuel production and adoption business cases. Special attention should be placed on technologies that can incorporate various feedstocks to improve economies of scale and simplify logistics, while the use of 'mobile' units should be considered to overcome geographic and transportation challenges. This study should include research identifying the best available commercial technologies that align with best use cases and for use within the NL context – as well as consideration for the various supports and frameworks (i.e., ITCs, CRF, CER, waste diversion, etc.) that can impact project economics.

6.2 Align provincial climate and energy strategy with domestic production capabilities

Biomass is a natural resource that should be utilized to its maximum economic potential. Given the clear potential for low-carbon fuels production in NL, biomass should be incorporated into the province's long term energy strategy. At the same given, given the potential that low-carbon fuels have to decrease GHGs in NL, they should factor significantly into the province's long-term climate change strategies. Lastly, as low-carbon fuels have the potential to increase energy security in the province, their local production should factor into the province's defence and sovereignty priorities. The fact that renewable diesel is already in production in NL should drive low-carbon fuels adoption decision-making in the near term as it is directly compatible with all existing generation assets and equipment. Meanwhile, if and when final investment decisions are made on hydrogen production projects in NL, this advancement should drive low-carbon fuels adoption decision-making in the medium and long term. Hydrogen is present – in one shape or form – in a variety of low-carbon fuels adoption pathways and has the potential to play a significant role in future industrial growth opportunities for the province.

6.3 Invest in fuel blending/testing research and infrastructure

To overcome industry risk aversion with the adoption of new technologies, adequate research and development capabilities in terms of equipment and personnel is required. These capabilities must be relevant to the NL context and accessible to industry. Blending

and testing capabilities are understood to be few in numbers and difficult to access in Canada, presenting an opportunity for the province to create facilities that would be in-demand and attract interest and investment. The testing of biodiesel and renewable diesel blends in real-world NL scenarios should be an immediate priority, followed by hydrogen and relevant derivates.

7. Conclusion

In econext's research and analysis, it has become clear that there are significant low-carbon fuels production and adoption opportunities in NL.

We encourage readers to explore our discussion papers on this topic. This series includes publications which focus on the potential for low-carbon fuels adoption in the marine transportation, surface transportation, and electricity sectors. The series also includes a deeper exploration on the potential for local biofuels production in NL, and the skills and safety considerations that need to be taken into account as new technologies are deployed and different fuels are used in NL. The analysis in these publications forms the basis for each of the conclusions drawn in the summary paper.

It is our hope that our series of discussion papers on this topic inspire and advance new discussions that lead the province in this direction – to the benefit of its economy, environment, security, and communities.