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Final Report

Strait of Canso Domestic Use Clean Fuels Strategy

May 6, 2026

PORT HAWKESBURY
EVERWIND
POTLOTEK FIRST NATION
PORT HAWKESBURY PAPER
Cape Breton Partnership
NOVA SCOTIA

Contents

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List of Figures

List of Tables

List of acronyms and abbreviations

Acronym	Definition
AFDC	Alternative Fuels Data Center
AFV	Alternative fuel vehicle
AMTA	Alberta Motor Transport Association
ASTM	American Society for Testing and Materials
ATJ	Alcohol-to-jet
ATVM	Advanced Technology Vehicles Manufacturing
B20	20% biodiesel blend
BC	British Columbia
BEV	Battery electric vehicle
CAA	Clean Air Act
CAD	Canadian dollar
CAPEX	Capital expenditure
CBAM	Carbon Border Adjustment Mechanism
CCS	Carbon capture and storage
CCUS	Carbon capture, utilization, and storage
CEPA	Canadian Environmental Protection Act
CFF	Clean Fuels Fund
CFR	Clean Fuel Regulations
CGF	Canada Growth Fund
CHP	Combined heat and power
CHRI	Charging and Hydrogen Refueling Infrastructure Initiative
CI	Carbon intensity
CIB	Canada Infrastructure Bank
CMAQ	Congestion Mitigation and Air Quality
CNG	Compressed natural gas
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CRP	Carbon Reduction Program
CSA	Canadian Standards Association
DIF	Decarbonization Incentive Fund
DLT	Duurzame Luchtvaarttafel
DOE	Nova Scotia Department of Energy
EA	Environmental assessment
EHB	European Hydrogen Bank
EIP	Energy Innovation Program
EPA	Environmental Protection Agency
ERA	Emissions Reduction Alberta
ES4SE	Energy Storage for Social Equity
ETS	Emissions Trading System
EU	European Union
EU ETS	EU Emissions Trading System
e-SAF	Electrofuels-based sustainable aviation fuel
EV	Electric Vehicle
FC	Fuel Cell
FCEB	Fuel Cell Electric Bus

FCEV	Fuel Cell Electric Vehicle
FEED	Front-End Engineering Design
FEL	Front-End Loading
FID	Final Investment Decision
FT	Fischer–Tropsch
GARDN	Green Aviation Research and Development Network
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GSLTF	Global Solidarity Levies Task Force
GW	Gigawatt
GWh	Gigawatt Hour
H_2-DRI	Hydrogen-Based DRI
HAZID	Hazard Identification Study
HAZOP	Hazard and Operability Study
HEFA	Hydroprocessed Esters And Fatty Acids
HFO	Heavy Fuel Oil
HICE	Hydrogen Internal Combustion Engine
HVO	Hydrogenated Vegetable Oil
IEA	International Energy Agency
IMO	International Maritime Organization
iMHZEV	Incentives for Medium- and Heavy-Duty Zero-Emission Vehicles
IPCEI	Important Projects of Common European Interest
IRA	Inflation Reduction Act
IRR	Internal Rate of Return
ISED	Innovation, Science and Economic Development Canada
ISO	International Organization for Standardization
ITC	Investment tax credit
JAC	J-series Air-Cooled
Jet-A	Standard petroleum aviation turbine fuel
Kg	Kilogram
KPI	Key Performance Indicator
KVH	Klickitat Valley Health
kW	Kilowatt
LCEC	Low Carbon Economy Challenge
LCEF	Low Carbon Economy Fund
LCFPP	Low Carbon Fuel Procurement Program
LCI	Lifecycle carbon intensity
LCFS	Low Carbon Fuel Standard
LETS	Large Emitter Pricing Systems
LNG	Liquefied natural gas
LSFO	Low sulfur fuel oil
M_3	Cubic metre
M&NP	Maritimes & Northeast Pipeline
MDO	Marine gas oil
MGO	Marine diesel oil
MHDV	Medium- and heavy-duty vehicle
MHE	Material-handling equipment
MOCR	Municipality of the County of Richmond
MoU	Memorandum of Understanding

MPa	Megapascal
Mt	Million tonnes
MW	Megawatt
NFPA	National Fire Protection Association
NH_3	Ammonia
NHS	National Health Service
NL	Newfoundland and Labrador
NOx	Nitrogen Oxide
NRCan	Natural Resources Canada
NS	Nova Scotia
NSCC	Nova Scotia Community College
OEB	Ontario Energy Board
OEM	Original Equipment Manufacturer
OPEX	Operational Expenditure
OSV	Offshore Support Vessel
P2G	Power-to-gas
PACE	Powering Affordable Clean Energy
PEM	Proton exchange membrane
PHP	Port Hawkesbury Paper
PIDP	Port Infrastructure Development Program
PJ	Petajoule
PNWER	Pacific Northwest Economic Region
PNWH2	Pacific Northwest Hydrogen Hub
PROTECT	Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation
Psi	Pounds per square inch
PtL	Power to Liquid
QA	Quality Assurance
QC	Quality Control
RACI	Responsible; Accountable; Consulted; Informed
RD	Renewable Diesel
R&D	Research and Development
RFNBO	Renewable Fuels of Non-Biological Origin
RNG	Renewable Natural Gas
RTG	Rubber-Tire Gantry
SAF	Sustainable Aviation Fuel
SDTC	Sustainable Development Technology Canada
SIF	Strategic Innovation Fund
SO_x	Sulfur Dioxide
TRL	Technology Readiness Level
TSSA	Technical Standards and Safety Authority
ULSD	Ultra Low Sulfur Diesel
VLSFO	Very Low Sulfur Fuel Oil
WACC	Weighted Average Cost of Capital
WESI	Waterford Energy Services
ZETT	Zero Emission Truck Testbed
ZEV	Zero-Emission Vehicle
ZEVIP	Zero Emission Vehicle Infrastructure Program

Glossary

This report explores the domestic adoption of clean fuels within the Strait of Canso region, shifting focus from export-oriented projects to local applications that drive economic growth, reduce emissions, and strengthen energy resilience. Given the breadth of technologies involved—such as green hydrogen, ammonia, e-methanol, renewable diesel, and sustainable aviation fuel—and the complexity of associated infrastructure, terminology can vary widely depending on technical background and industry perspective.

To ensure clarity and consistency throughout this report, we provide clear definitions of key technical, commercial, and policy terms. These definitions draw on authoritative sources, including the Government of Canada and leading global organizations such as the International Energy Agency (IEA), to establish a shared understanding of the specialized language used in this strategy.

Term	Definition
Alcohol-to-jet (ATJ)	A process that converts alcohols such as ethanol or isobutanol into jet fuel through dehydration, oligomerization, and hydrogenation or fractionation. When produced from renewable feedstocks, ATJ is recognized as a sustainable aviation fuel (SAF) in Canada.
Ammonia	A compound of nitrogen and hydrogen widely used in hydrogen distribution and increasingly studied as a potential low-carbon fuel, particularly for marine transport. Ammonia can be produced in several ways: **Grey ammonia (conventional):** Produced from natural gas through steam methane reforming, the dominant method in Canada today. **Blue ammonia:** Produced from natural gas with carbon capture, utilization, and storage (CCUS) to reduce emissions. **Green ammonia (also known as e-ammonia):** Produced using renewable electricity to generate hydrogen via electrolysis, then combined with nitrogen from the air. As a fuel, ammonia contains no carbon and therefore produces no direct carbon dioxide emissions when used, but it raises challenges related to toxicity, handling safety, and nitrogen oxide (NO_x) emissions during combustion.
Battery electric vehicle (BEV)	Propelled by electric motors using energy stored in rechargeable battery packs. Unlike hybrid or plug-in hybrid vehicles, BEVs do not use any form of internal combustion engine, making them entirely reliant on electricity for their operation.
Biofuel	A type of low-carbon fuel produced from biomass, derived from plants, algae, animals, or waste materials, which can be used as an alternative to conventional fossil fuels in transportation or energy production.
Biomass	Organic material derived from plants, animals, and microorganisms that serves as a renewable energy source. It includes agricultural residues, forestry waste, dedicated energy crops, animal manure, and organic waste from industries or households. Biomass can be converted into energy through processes such as combustion, gasification, pyrolysis, or biochemical methods like anaerobic digestion to produce electricity, heat, biofuels, or biogas.
Book-and-claim accounting	A model that allows clean fuel producers to "book" emissions savings in one place and customers to "claim" the emissions benefit for climate disclosures in another. It separates the physical product from its climate benefits, enabling organizations to purchase and claim the benefits of sustainable fuels even if they do not physically use the fuel themselves.
Bunkering	Bunkering is the supplying of fuel for use by ships (such fuel is referred to as bunker), including the logistics of loading and distributing the fuel among available shipboard tanks.
Carbon capture, utilization, and storage (CCUS)	A technology designed to reduce greenhouse gas emissions by capturing CO_2 from industrial processes, power generation, or directly from the atmosphere. The captured CO_2 is either transported, typically via pipelines, and stored deep underground in geological formations such as depleted oil and gas reservoirs or saline aquifers or used in another industrial process. There is a technical distinction between carbon capture and storage (CCS) and carbon capture, utilization, and storage (CCUS). Both

	apply the same technologies to capture and store carbon, and the difference lies in what happens to the captured carbon. For simplicity and for the benefit of the reader, we use CCUS throughout.
Carbon intensity (CI)	A measure of the carbon dioxide emissions produced per unit of energy, product, or activity. It is typically expressed in terms of grams or kilograms of CO_2 equivalent (CO_2e) per kilowatt-hour (kWh) of energy, per tonne of product, or per kilometre traveled. In British Columbia, the carbon intensity of hydrogen is typically expressed in terms of gCO2e/MJ.
CHRI	Charging and Hydrogen Refueling Infrastructure Initiative: A financing initiative of the Canada Infrastructure Bank that provides concessional capital to support large-scale clean hydrogen production, storage, transportation, and refueling infrastructure.
Clean Fuel Regulations (CFR)	Federal regulations under the Canadian Environmental Protection Act (CEPA) that require gasoline and diesel suppliers to reduce the carbon intensity of liquid fuels used in Canada. Suppliers comply by reducing the carbon intensity of their operations, blending or producing lower-carbon fuels that generate credits, supporting the use of clean alternatives like electricity, hydrogen, or renewable natural gas, or by trading credits in the compliance market.
Conventional fuel	Conventional forms of primarily non-renewable energy sources such as gasoline, diesel, and other petroleum derived fuels.
Drop-in fuel	Liquid hydrocarbons that are functionally equivalent and as oxygen-free as petroleum-derived transportation fuels that are compatible with existing infrastructure and engines. Examples include Renewable diesel and SAF.
Dual-fuel kit	A retrofit system that allows an internal combustion engine to operate on a blend of conventional fuel (e.g., diesel) and an alternative fuel (e.g., hydrogen), reducing emissions while retaining existing engine hardware.
Electrolysis	A chemical process that uses electricity to split water into its components - hydrogen and oxygen. This is achieved by passing an electric current through water using an electrolyzer containing two electrodes (an anode and a cathode) and an electrolyte to catalyze the reaction.
Electrolyzer	A device that uses electricity to split water into its components—hydrogen (H_2) and oxygen (O_2)—through the process of electrolysis. Electrolyzers have two electrodes (an anode and a cathode) and an electrolyte to catalyze the reaction.
E-SAF	A type of sustainable aviation fuel produced using renewable electricity, carbon dioxide, and water through power-to-liquids pathways.
Feedstock	The raw material or input used in industrial processes to produce energy, fuels, chemicals, or other products. Feedstocks can include fossil-based materials like natural gas, coal, and crude oil; renewable materials such as biomass, agricultural residues, and algae; or non-conventional inputs like captured carbon dioxide or water for processes like electrolysis.
Fischer–Tropsch	A chemical synthesis process that converts syngas (a mixture of hydrogen and carbon monoxide) into liquid hydrocarbons.
Fuel cells	Electrochemical devices that convert the chemical energy of a fuel, such as hydrogen, directly into electricity, heat, and water through an electrochemical reaction, rather than combustion. Fuel cells consist of an anode, a cathode, and an electrolyte membrane, and they operate silently with high efficiency and low environmental impact.
Fuel cell electric vehicles (FCEVs)	Vehicles powered by an electric motor that use electricity generated onboard by a fuel cell. The fuel cell converts hydrogen stored in the vehicle's tank into electricity through an electrochemical reaction, producing only water vapor and heat as by-products.
FuelEU	The FuelEU Maritime Regulation entered into effect on January 1, 2025, to increase the share of renewable and low-carbon fuels used in maritime transport within the European Union.
Future fuels	Emerging energy carriers and fuel types that have the potential to reduce GHG emissions in transportation, including hydrogen, ammonia, synthetic fuels, and advanced biofuels. For this study, future fuels include SAF, biodiesel, renewable diesel, methanol, ammonia, liquefied natural gas (LNG), renewable natural gas (RNG), hydrogen, and battery electric.
Green hydrogen	Hydrogen produced through the electrolysis of water using clean electricity generated from renewable energy sources, such as solar or wind power. Electrolyzers split water into hydrogen and oxygen through an electrochemical reaction, resulting in zero carbon dioxide emissions during the production process.

H_2-DRI	Hydrogen-based DRI is a steelmaking process in which hydrogen or other reducing gases remove oxygen from iron ore in a shaft furnace to produce solid “sponge iron”, which is then typically melted in an electric arc furnace to make steel.
Haber-Bosch	The primary method of producing ammonia from nitrogen and hydrogen.
HEFA based fuels	Hydro processed esters and fatty acids (HEFA) also called hydrotreated vegetable oil (HVO) is a renewable fuel produced from an array of vegetable oils and fats.
HFO	Heavy fuel oil; a low-cost, high-sulphur residual fuel oil traditionally used in large marine engines and industrial boilers, characterized by high emissions of GHGs and air pollutants
Hydrogenation	The chemical process of adding molecular hydrogen to a compound, typically facilitated by a catalyst, to alter its chemical structure and properties.
Indigenous peoples	The term ‘Indigenous Peoples’ includes First Nations, Inuit, and Métis people in Canada. Indigenous Peoples are rights and title holders with constitutionally protected rights under Section 35 of the Constitution Act.
Internal combustion engine (ICE)	A type of engine in which the combustion of fuel occurs within the confined space of a combustion chamber generating high-temperature, high-pressure gases that drive mechanical motion. These engines typically use fuels like gasoline, diesel, natural gas, or biofuels, and are commonly used in vehicles, machinery, and power generation. The two main types are spark-ignition or gasoline engines and compression-ignition or diesel engines.
Jet-A	A widely used petroleum-based aviation turbine fuel for commercial aircraft, Jet-A serves as the baseline fuel against which Sustainable Aviation Fuel (SAF) is blended or substituted
Liquefied natural gas (LNG)	Natural gas that has been cooled to a liquid state for storage and transport. Sometimes referred to as a transition fuel and is used in some heavy-duty truck and marine applications in Canada as a lower-carbon alternative to conventional petroleum fuels.
Long-term	Beyond six years
Low-carbon fuels	Fuels that produce significantly less GHG emissions compared to conventional fossil fuels over their lifecycle. These renewable fuels include biofuels such as biodiesel or ethanol, renewable fuels, synthetic fuels, and hydrogen.
Low-carbon hydrogen	Hydrogen produced using methods that emit significantly lower levels of GHGs compared to conventional production processes. This can include green hydrogen generated through electrolysis powered by renewable energy or blue hydrogen through natural gas reforming with carbon capture and storage.
Medium-term	Two to six years
Methanol	A liquid alcohol fuel that is produced by catalytic synthesis from syngas or hydrogenation of CO_2. Methanol is considered as a marine future fuel due to its flexibility, since different production pathways, feedstocks, and lifecycle carbon intensities can be scaled over time. • **Grey methanol** (conventional): Produced from a natural gas feedstock through steam methane reforming. • **Blue methanol**: Produced from natural gas with the addition of carbon capture, utilization and storage through steam methane reforming. • **Bio-methanol**: Produced from biomass feedstocks such as wood residues, agricultural residues, or municipal solid waste through gasification of biomass or waste, or the catalytic conversion of biogas via reforming and synthesis. • **Green** or **e-methanol**: Produced from renewable electricity and captured CO2 through electrolytic production of green hydrogen.
Mobility fuel	Any energy source used to power vehicles and transportation systems, including cars, buses, trains, ships, and aircraft. Mobility fuels can be conventional fossil fuels like gasoline and diesel, as well as alternative or renewable options such as hydrogen, biofuels, synthetic fuels, and electricity from batteries.
Power-to-liquids	A process that uses renewable electricity to produce synthetic liquid fuels by combining hydrogen with carbon dioxide. Power-to-liquid pathways include e-fuels, such as e-jet, e-methanol, and e-diesel.
Power-to-gas	A process that uses renewable electricity to produce synthetic gaseous fuels by combining hydrogen with carbon dioxide or by generating hydrogen through electrolysis. Power-to-gas pathways include e-fuels such as green hydrogen and synthetic methane.

RACI	A project management framework used to clearly define roles and responsibilities by identifying who performs the work (Responsible), who is ultimately answerable (Accountable), who provides input (Consulted), and who is kept informed (Informed).
Renewable fuels (bio-based)	Fuels produced from naturally replenished resources such as biomass, agricultural waste, algae, or other organic materials. They include sustainable aviation fuel, renewable diesel, and renewable natural gas. In this report, bio-based renewable fuels are a classification of low-carbon fuels but not necessarily the same as synthetic fuels.
Renewable natural gas (RNG)	A sustainable and low-carbon alternative to conventional natural gas, produced from organic waste materials such as agricultural residues, livestock manure, landfill waste, and wastewater biogas. RNG is created by capturing and upgrading biogas through the removal of impurities and increasing its methane content to make it pipeline compatible.
Short-term	Immediate to two years
Stakeholder	Refers to an individual or group that derives benefits from the use of resources, is concerned about a particular issue, and/or holds legal or de facto rights to manage or make decisions. Key stakeholders often include a mix of user groups, industry, different levels of government, and civil society.
Sustainable aviation fuel (SAF)	A lower-carbon alternative to conventional jet fuel, produced from renewable or waste-based feedstocks, or through power-to-liquids processes. SAF is approved for blending into aviation fuel in Canada and internationally.
Synthetic fuels	Liquid or gaseous fuels produced artificially through chemical processes, typically by combining hydrogen with carbon dioxide or carbon monoxide as feedstocks. The hydrogen used in synthetic fuel production is often generated through electrolysis powered by renewable energy, while the carbon is typically captured from biogenic sources or directly from the atmosphere. In this report, synthetic fuels are a classification of low-carbon fuels but not necessarily renewable fuels.
Scale	In the absence of a precise and widely agreed upon definition, achieving “scale” is understood to mean reaching sufficiently high production and market volumes to realize cost reductions, efficiency gains, and market stability. For context, a ZEV is considered to have reached scale when it constitutes 5% of new vehicle sales within a given market segment.
Technology Readiness Level (TRL)	A standardized framework for evaluating the maturity of a technology, ranging from initial concept (TRL 1) to full-scale operational deployment (TRL 9). The scale progresses through stages such as concept formulation, laboratory validation, prototype demonstration, and system qualification in real-world environments. TRL is widely used across industries such as aerospace, energy, and manufacturing to assess the readiness of technologies for commercialization and implementation.
Transitional fuel	A fuel that reduces GHG emissions compared to conventional petroleum fuels and is expected to support Canada’s transition to net-zero emissions but may not be a long-term solution such as renewable diesel or liquefied natural gas.
ZEVIP	Zero Emission Vehicle Infrastructure Program; a federal funding program administered by Natural Resources Canada that supports the deployment of charging and hydrogen refueling infrastructure for zero-emission vehicles across Canada

1. Executive summary

With large-scale projects led by EverWind and other emerging developers, the Strait of Canso region is positioning itself to become one of North America's leading hubs for clean fuels, starting with green hydrogen and ammonia production. Until recently, attention has focused on exporting these fuels to international markets. This *Clean Fuels Domestic Use Strategy* shifts the lens inward, looking at how locally produced clean fuels can be used within the region to drive economic growth, reduce emissions, strengthen energy resilience, and attract new industrial investment.

The strategy was commissioned by the Municipality of the County of Richmond (MOCR), with support from partners across the region and funding from the Government of Nova Scotia. It provides the first comprehensive roadmap for how clean fuels—particularly green hydrogen, ammonia, e-methanol, renewable diesel (RD), and sustainable aviation fuel (SAF)[1]—could be adopted across local industries, marine operations, transportation, municipal services, and future industrial tenants.

Approach

The development of the strategy followed a structured, phased approach to assess and develop a clear and actionable roadmap for the Strait of Canso region's domestic use of green hydrogen and its derivatives. The work built on existing studies, desktop research, and incorporated insights from industry and community engagement and subject matter experts.

The approach was organized around five main steps: i) global insights and literature review, ii) opportunity assessment and industry engagement, iii) future strategic opportunities, iv) infrastructure and community-scale planning, and v) recommendations and actionable roadmap.

This approach ensured the strategy was informed by existing knowledge, grounded in regional context, shaped by key actors' perspectives in the Strait of Canso's industrial ecosystem, considered technical feasibility, and aligned with federal and provincial emissions reduction targets.

A region with strong foundations for clean fuel leadership

The Strait of Canso is home to deep, ice-free ports, existing heavy industrial operations, high-voltage grid connections, extensive marine services, and one of the largest concentrations of proposed renewable energy projects in Atlantic Canada. These assets, combined with strong provincial climate commitments and federal clean fuel incentives, create ideal conditions for a domestic clean fuel market to emerge.

Multiple world-scale clean fuel projects signal confidence in the region's long-term potential. As these developments progress toward final investment decisions (FIDs) the availability of clean hydrogen and ammonia will unlock opportunities for fuel switching across industry, transportation, marine sectors, and public operations.

What the analysis shows

A global review of clean fuel case studies—spanning industrial, marine vessels, transportation, government operations, and utilities—demonstrates that clean fuels are no longer theoretical; many technologies are commercially deployed today, and others are advancing through large-scale pilots. A readiness assessment across all sectors in the Strait indicates:

- **Renewable diesel** is the most immediately deployable option across fleets, public works, marine support vessels, and industrial equipment—requiring no retrofits.

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[1] It is important to note that feedstocks (e.g., fertilizer) were considered out of scope for this study. Additionally, only hydrogen-derived clean fuels were included; ethanol and biodiesel were excluded from the analysis.

- **Hydrogen** shows medium readiness for public transit, freight trucking, port equipment, ferries, and industrial heat, with stronger long-term potential as costs decline and infrastructure expands. Hydrogen blending in natural gas systems is viable in the medium term and could help decarbonize industrial and institutional heat loads.
- **Ammonia and methanol** represent emerging solutions for marine shipping and chemical processing, aligning well with the Strait's port-based industries.
- **SAF** is growing globally and could serve the Allan J. MacEachen Regional Airport, serving the Strait Region and western Cape Breton, with the right supports and supply chain partners.

These insights informed a comprehensive list of 13 practical, geographically relevant opportunities, which were then refined with input from local industry, municipal governments, First Nations, and marine stakeholders.

Opportunities for domestic clean fuel use

Based on this readiness assessment, the strategy prioritizes short-term opportunities where clean fuels can be deployed at scale with limited technical or operational risk. Four sectors emerged as the strongest short-term adopters:

1. **Marine vessels**
    - Drop-in RD for fishing fleets and tugboats.
    - Hydrogen or methanol for shipping and port equipment.
    - Clean bunkering opportunities that position the Strait as a transatlantic refueling hub.
2. **Industrials**
    - Hydrogen for process heat or boiler conversions.
    - e-methanol or ammonia for specific industrial processes.
    - Fuel-switching options at sites such as Port Hawkesbury Paper and regional fabrication yards.
3. **Transportation and government operations**
    - RD for immediate GHG reductions.
    - Hydrogen dual-fuel or fuel-cell buses and service vehicles.
    - Zero-emission freight opportunities aligned with national ZEV targets.
4. **Utilities**
    - Hydrogen blending in natural gas networks.
    - Hydrogen-powered backup systems for hospitals, emergency shelters, and critical infrastructure.

These opportunities provide potential pathways for decarbonizing existing economic activity while improving reliability, lowering local air pollution, and creating new jobs in operations, maintenance, and clean fuel handling.

Investment attraction opportunities

A credible opportunity is available to use the local production of green hydrogen, ammonia, and other clean fuels to attract new, co-located industrial investment, and foster long-term economic growth.

Today, global demand for hydrogen is dominated by oil refining, ammonia and fertilizer production, and methanol, with nearly all hydrogen currently produced from fossil fuels. Green hydrogen projects that have reached operation or FID[2] are overwhelmingly anchored by these same industries and are deployed as direct, drop-in replacements for fossil-based hydrogen, underscoring the importance of aligning new production with known, continuous industrial demand. This implies that early investment attraction success will depend on co-locating production to a small number of large, continuous industrial users, rather than dispersing efforts across many smaller or speculative applications.

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[2] 510 clean hydrogen projects worldwide have reached FID, are under construction, or are already operational. Global Hydrogen Compass 2025 report (Accessed November 7, 2025).

In the near term, ammonia and fertilizer producers and industrial gas companies offer the most credible first-mover demand for early hydrogen projects. Medium-term opportunities include the production of clean fuels as hydrogen supply scales and regulations tighten along with land-based aquaculture, which uses oxygen and waste heat, byproducts of electrolysis. Green steel and green cement represent a longer-term, transformational opportunity as costs are expected to decline and global markets mature.

Realizing this opportunity will require careful sequencing and early engagement with priority industries. While investment attraction can begin immediately, most anchor tenants will require confidence in local hydrogen supply, making progress toward FIDs on early projects a critical step in unlocking longer-term industrial growth in the Strait of Canso.

What the region should do next (short, medium, and long-term)[3]

The strategy recommends a focused set of actions organized around three core themes: governance, funding, and infrastructure.

First, the region can help mobilize partners by establishing a governance structure to coordinate clean fuel adoption across municipalities, First Nations, industry, utilities, and provincial agencies. This reflects the leadership role the region wants to take—one focused on convening, coordinating, and guiding early action within its sphere of influence. This coordination role is essential to align priorities, share information, sequence decisions, and provide a single forum for overseeing pilot delivery and longer-term planning. Strong governance will help reduce fragmentation, accelerate decision-making, and present a clear and credible signal to industry and investors.

Second, the region should pursue a coordinated funding approach to support early pilots and enabling infrastructure. Short-term clean fuel adoption will require targeted use of provincial and federal programs to offset capital costs and reduce risk for early adopters. As part of its emerging leadership role, the region can help mobilize partners by initiating joint funding efforts and aligning applications with shared regional priorities. By coordinating funding applications and aligning them with agreed regional priorities, partners can improve competitiveness, avoid duplication, and ensure that public funding supports projects that build toward longer-term infrastructure and market development rather than isolated demonstrations.

Finally, the strategy emphasizes careful sequencing of infrastructure investments. Early pilots using temporary or modular assets should be used to generate operational experience and inform decisions on permanent infrastructure such as refueling stations, storage, pipelines, and bunkering systems. Infrastructure planning should be aligned with expected clean fuel production timelines and projected demand growth, ensuring investments are right-sized and scalable. Together, the region's leadership in convening partners and sequencing investments, supported by coordinated governance, targeted funding, and disciplined infrastructure planning, provide a practical pathway for moving from early adoption to sustained clean fuel use, strengthening energy resilience, reducing emissions, and unlocking long-term economic benefits for the Strait of Canso.

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[3] Short term: Immediate to two years; Medium term: Two to six years; Long term: Beyond six years.

2. Introduction

There is an opportunity to aggregate local hydrogen demand and position the Strait of Canso region as a key node in North America's clean energy landscape. While green hydrogen and ammonia facility development plans to date have focused primarily on production for export markets, there is a growing interest to define and realize a domestic offtake strategy that delivers broad-based economic, environmental, and energy system benefits to the region's residents, businesses, and industry.

Recognizing this opportunity, the MOCR, the Town of Port Hawkesbury, Potlotek First Nation, Port Hawkesbury Paper, the Cape Breton Partnership and EverWind, supported by the Government of Nova Scotia through the Clean Fuels Fund (CFF)[4], have come together to jointly assess and prepare for the domestic use of green hydrogen and select derivatives. This collaboration aims to generate a strategy built upon local sector-specific opportunities for clean fuel adoption across industrial, marine vessels, transportation, government operations, and utilities and enabling infrastructure to drive decarbonization, energy resilience, and economic benefits.

2.1 Background

The MOCR, combined with neighbouring Port Hawkesbury, has a total population of approximately 12,200 people.[5,6] With a significant industrial base anchored by the Point Tupper Heavy Industrial Park, the region is home to two proposed large-scale green hydrogen projects, EverWind[7] and Bear Head Energy.[8] While both projects focus on supplying export markets in Europe, there was a recognized need to explore pathways for local clean fuel use that could deliver economic, environmental, and energy system benefits to the region's residents and businesses. These projects are expected to bring significant socioeconomic benefits, such as job creation, infrastructure investment, and increased supply chain activity; however, there remains a clear opportunity to potentially extend these benefits further by establishing local demand and use cases for clean fuels.

Nova Scotia has signalled its commitment through dedicated plans, such as the Green Hydrogen Action Plan[9] and the Climate Change Plan for Clean Growth[10], setting in legislation through the Environmental Goals and Climate Change Reduction Act[11], a target to achieve net-zero by 2050. The CFF was launched in 2023-24 to accelerate the production and adoption of low-carbon fuels, to reduce emissions, attract investment, and advance the clean energy transition.

In May 2025, the MOCR was announced as a recipient of the fund to develop a clean fuels strategy for the Strait of Canso, harnessing the significant potential for local heavy industry. This reflects a recognition that the region's abundant resources, existing production, and industry presence, offer a strong foundation for the domestic use of clean fuels. The region's unique attributes—deep-water ports, industrial land, and growing expertise in energy infrastructure—place it in an advantageous position to support clean fuel adoption.

Realizing this potential, however, will require overcoming several significant barriers. The rural and industrial nature of the region, current dependence on fossil fuels, and limited infrastructure for alternative fuels all complicate decarbonization. Additional challenges include fuel costs, technical requirements for storage and transportation, and inefficiencies in hydrogen-to-electricity conversion. Ensuring adequate distribution and consumption infrastructure, navigating regulatory and policy constraints, and establishing clear timelines, cost estimates, emissions-reduction expectations, and funding pathways will be essential to enable the transition.

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[4] Nova Scotia Clean Fuels Fund (Accessed November 7, 2025)

[5] Town of Port Hawkesbury, 2021 Census of Population (Accessed November 7, 2025)

[6] County of Richmond, 2021 Census of Population (Accessed November 7, 2025)

[7] EverWind Fuels Project Tupper (Accessed November 7, 2025)

[8] Bear Head Energy Green Hydrogen Project (Accessed November 7, 2025)

[9] Still Better Than Carbon Tax (Accessed November 7, 2025)

[10] Nova Scotia's Climate Change Plan for Clean Growth (Accessed November 7, 2025)

[11] Environmental Goals and Climate Change Reduction Act (Accessed November 7, 2025)

In this context, the Domestic Use Clean Fuels Strategy was undertaken to deliver an analysis of the region's clean fuel landscape, identify opportunities for local offtake, particularly for green hydrogen and its derivatives, and support coordinated action. The strategy is designed to position the Strait of Canso region, including MOCR and the Town of Port Hawkesbury, to advance the use of clean fuels across both public and private sectors. By providing a locally focused roadmap, the strategy highlights pathways for integrating clean fuels into key sectors of the regional economy**.**

2.2 Objectives

This assessment will provide an objective analysis of the feasibility, benefits, and infrastructure requirements for clean fuel adoption across five sectors: **industrial, marine vessels, transportation, government operations, and utilities.** It will evaluate how local offtake of green hydrogen, green ammonia, e-methanol, SAF, and RD can advance decarbonization, enhance energy resilience, and strengthen the regional economic case for clean fuel production. The findings will inform both sector-specific pathways and local objectives for sustainability, emissions reduction, and economic development.

Specifically, the report aims to:

1) Analyze global clean fuel applications.
2) Identify priority end-use applications and adoption opportunities in the Strait region.
3) Synthesize research and community/industry input to explore a short-list of opportunities for deeper analysis.
4) Define infrastructure needs and high-level costs for pilot projects and anchor offtakers.
5) Develop actionable plans and recommendations to support implementation.
6) Support economic development efforts to attract new industries.

2.3 Approach

The development of the strategy followed a structured, phased approach to assess and develop a clear and actionable roadmap for the Strait of Canso region's domestic use of green hydrogen and its derivatives. The work built on existing studies, desktop research, and incorporated insights from industry and community engagement and subject matter experts.

The approach was organized around five main steps:

1. **Global insights and literature review:** This initial step included the identification of relevant sectors and fuel users within the Strait region, developing an adoption readiness framework, and conducting desktop research to map out how and where clean fuels are—or aren't—being adopted across the economy. This review[12] captured clean fuel implementations worldwide, extracting lessons applicable to the local context. Based on these insights, a comprehensive list of 13 clean fuel adoption opportunities was developed.

2. **Opportunity assessment and industry engagement:** A targeted engagement process was undertaken to refine a shorter list of clean fuel opportunities. This included identifying regionally relevant options, conducting site visits to assess operational integration and readiness, and holding an industry engagement workshop. The opportunities were also prioritized based on aggregate demand potential, emissions abatement potential, clean fuel availability, and commodity cost considerations.

3. **Future strategic opportunities:** An analysis was conducted to identify potential future anchor tenants and investment attraction opportunities. This step focused on forward-looking prospects that could further drive clean fuel adoption and associated economic growth.

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[12] AI tools were used to support this review by enabling efficient information gathering through smart searches, web-scraping, and task-specific analysis. Their use was consistently guided by Deloitte's comprehensive AI Guardrails, which outline appropriate use of AI technologies and provide clear direction on protecting client confidential information. The Guardrails also emphasize the importance of understanding the limitations of generative AI—reinforcing that these tools are designed to augment, not replace, human expertise, and that all AI-generated outputs must be critically reviewed. This includes guidance on AI tools' limited and non–real-time world knowledge, susceptibility to bias, potential inconsistencies in reliability and accuracy.

4. **Infrastructure and community-scale planning:** High-level infrastructure plans were developed for the short-listed opportunities, with an emphasis on capital cost implications for storage, distribution, and equipment. Potential pilot projects were identified, including estimates of capital expenditures, to support the practical rollout of clean fuel initiatives.
5. **Recommendations and actionable roadmap:** The analysis was translated into strategic recommendations and a corresponding implementation roadmap with short-, medium-, and long-term actions.

This approach ensured the strategy was informed by existing knowledge, grounded in regional context, shaped by key actors' perspectives in the Strait of Canso's industrial ecosystem, considered technical feasibility, and aligned with national and provincial emissions reduction targets.

2.4 Clean fuels explored

Clean fuels are a central pillar in the global effort to decarbonize and foster new economic opportunities. By replacing fossil fuels with low-carbon alternatives such as **green hydrogen, green ammonia, renewable diesel, e-methanol,** and **SAF**, industries can reduce greenhouse gas (GHG) emissions, improve energy security, and stimulate investment in production capacity, infrastructure, and technology innovation. Such a shift presents opportunities for regional economies to position themselves as suppliers to both domestic and international markets.

In Atlantic Canada, these opportunities are particularly pronounced. The region's abundant renewable energy resources, strategic port access to Europe and the eastern seaboard of North America, and established industrial base, provide strong foundations for clean fuel production and export. Ambitions are already underway to develop hydrogen and ammonia at scale, supported by projects targeting both domestic use and international export.

The region is also home to significant refining capacity, including Canada's largest refinery, Irving Oil in Saint John, New Brunswick, and one of the country's largest RD refineries, the Braya Renewable Fuels facility in Come By Chance[13], Newfoundland and Labrador, identified in Figure 1 and Figure 2, respectively. Together, these assets provide an industrial and logistical base that can be leveraged to expand clean fuel production, attract investment, and grow regional economic activity.

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[13] Braya Renewable Fuels Announcement (Accessed November 8, 2025)

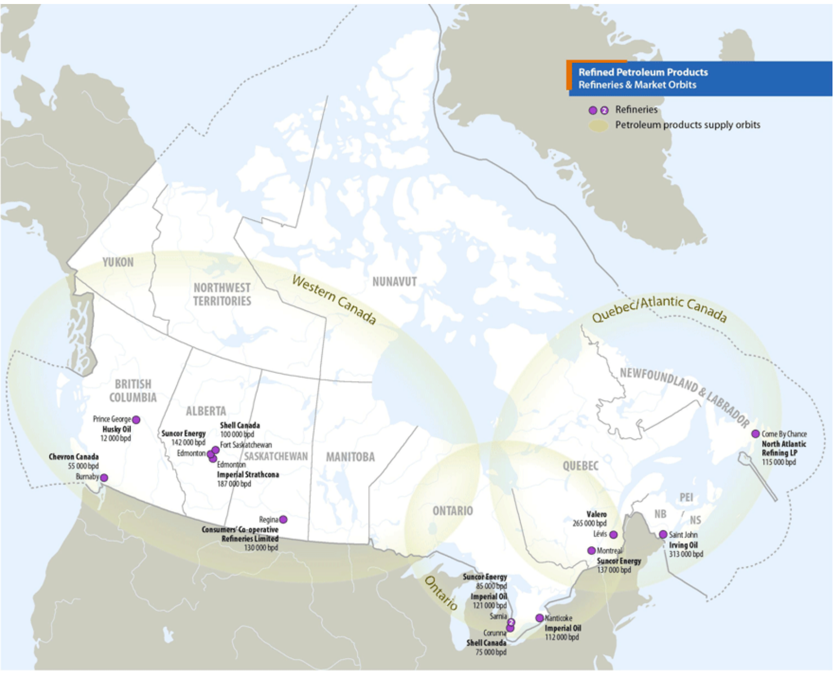

Figure 1: Refined petroleum products and supply orbits[14]

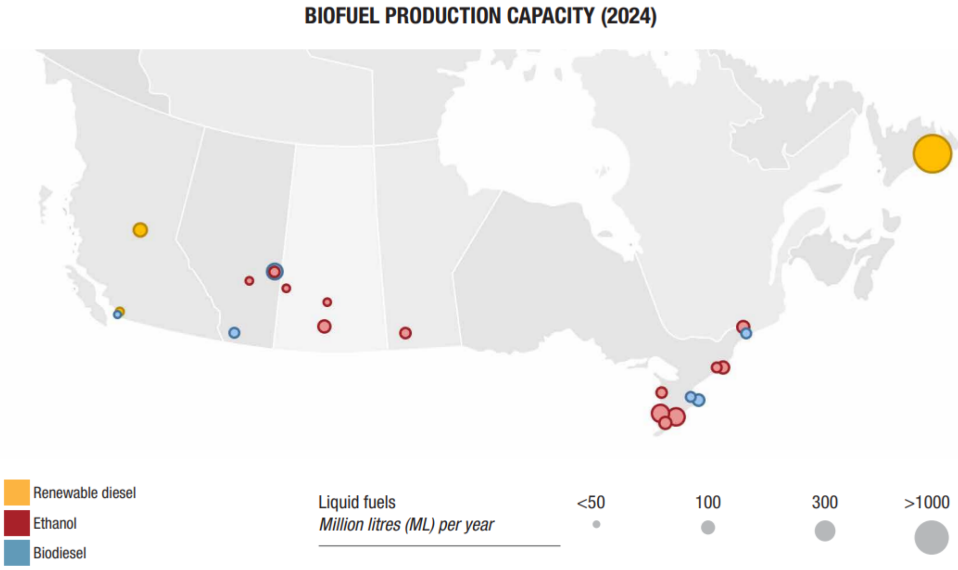

Figure 2: Biofuel production capacity across Canada in 2024[15]

The types of operations currently reliant on fossil-based fuels and the associated potential applications for clean fuels to decarbonize these activities were mapped. This includes identifying fuels that could be produced in Atlantic Canada and supplied to the Strait of Canso, thereby creating local production and supply chain opportunities while advancing emissions-reduction objectives.

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[14] NRCan and NEB Refineries in Canada (barrels per day) (Accessed August 13, 2025)

[15] IEA Bioenergy T39, Biofuel News (Accessed on August 13, 2025)

The assessment considers five clean fuels— **green hydrogen, green ammonia, renewable diesel, e-methanol,** and **SAF** —and their end use applications across different energy and industrial functions, summarized and further defined in Table 1.

Table 1: Summary of end use applications by clean fuel

End use category	Definition	Relevant fuels	Green hydrogen	Ammonia	Methanol	RD	SAF
Process heat	Use of fuel combustion to generate high-temperature heat for industrial operations such as steelmaking, cement production, refining, or chemical processing.	Ammonia and hydrogen can be combusted directly to produce high-temperature heat without direct CO_2 emissions.	Yes	Yes	N/A	N/A	N/A
Mobility fuel	Use of fuels to power vehicles in road, maritime, rail, or aviation transport via internal combustion engines, turbines, or fuel cells.	Ammonia (especially for shipping, with engines adapted). Hydrogen (fuel cells or combustion for heavy transport and buses). Methanol (liquid fuel for shipping and trucks, can be used directly in engines or blended). SAF (drop-in substitute for conventional jet fuel in aviation). RD (drop-in replacement for diesel in trucks, buses, fleets).	Yes	Yes	Yes	Yes	Yes
Electricity	Use of clean fuels to generate electricity through combustion turbines, engines, or fuel cells—typically in backup, off-grid, or balancing applications where direct renewable generation (e.g., wind or solar) is unavailable or intermittent.	Ammonia and hydrogen (direct combustion or in fuel cells for firm or standby power). RD (in existing diesel gensets or turbines).	Yes	Yes	N/A	Yes	N/A
Blending in natural gas lines	Mixing clean fuels into existing natural gas infrastructure for distribution and use, reducing carbon intensity (CI) of end-use heating and power.	Hydrogen (low-level blends feasible today, higher blends require infrastructure modifications).	Yes	N/A	N/A	N/A	N/A
Chemical & industrial feedstock	Use of fuels as building blocks for industrial chemicals, fertilizers, plastics, or synthetic fuels.	Hydrogen (input for ammonia, methanol, refining, steel).	Yes	N/A	N/A	N/A	N/A

The scope of this analysis includes sectors, sub-sectors, and operations with potential to transition to clean fuels (see Table 2, in Section 2.5.2).

By establishing this scope, the analysis defines the boundaries for evaluating clean fuel adoption and positions the discussion on how fuel switching can drive both emissions reductions and regional economic opportunity through production and supply chain development in Atlantic Canada.

2.5 Overview of the Strait of Canso

The Strait of Canso is a strategically significant channel dividing Cape Breton Island and mainland Nova Scotia, as well as connecting the Northumberland Strait to the Atlantic Ocean, which offers a deep-water, ice-free marine passage that is navigable year-round. The region encompasses several municipalities, including the MOCR, the Town of Port Hawkesbury, the Municipality of the District of Guysborough, the Municipality of the County of Inverness, and the Town of Mulgrave.

Figure 3: Strait of Canso region including several potential clean fuels end-users

The Strait has economic, industrial, and transportation significance. The Canso Causeway links Cape Breton Island to the mainland and supports both road and rail traffic, facilitating the movement of goods and people. On the western shore lies the Strait of Canso Superport, which handles bulk commodities and serves as a central industrial and logistics hub.[16] Across the Strait on the eastern side, several private terminal and marine facilities, associated with EverWind, Bear Head Energy, and other industrial operators, complement these capacities. With direct maritime access to North American and European markets via transatlantic shipping routes, existing industrial infrastructure (marine terminals, power generation, rail and highway links), and a workforce experienced in energy, manufacturing, and shipping, the region is well positioned to lead in the energy transition

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[16] Strait of Canso Superport (Accessed August 13, 2025)

2.5.1 Strait of Canso sustainable development opportunities

In early 2025, the MOCR and Town of Port Hawkesbury released its Sustainable Infrastructure Strategy[17] in collaboration with Waterford Energy Services (WESI). The report provides a comprehensive framework for transforming the Strait of Canso into a hub for renewable energy with a focus on hydrogen and low-carbon fuel production, underscoring how the region's strengths position it for the development of hydrogen and ammonia production. With significant wind farm proposals in the Municipality of the District of Guysborough, the strategy emphasizes the potential for these developments to transform the local energy mix and support long-term prosperity. The document also outlines the need for strategic infrastructure upgrades to accommodate upcoming projects, including enhancing port facilities to support hydrogen export and integrating renewable energy sources into local industries.


JANUARY 2025

Strait of Canso Sustainable Infrastructure Strategy

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The strategy identifies several sites within the Strait for potential development, including the Mulgrave Marine Terminal and Melford Atlantic Gateway Terminal, which would be able to support marshalling, fabrication, and assembly activities for wind farms and serve as bunkering sites for green ammonia.

The report also emphasizes the importance of aligning infrastructure development with Nova Scotia Power to facilitate efficient delivery of the large components needed for hydrogen production facilities. It also suggests leveraging the region's industrial parks to support the growing demand for skilled workers and specialized equipment.

Building on these developments and opportunities, the area is also experiencing a convergence of key economic sectors, driven by regional advantages, existing infrastructure, and targeted investment strategies. Renewable energy, led by large-scale hydrogen and ammonia projects by EverWind, can become a cornerstone industry. Transportation and logistics continue to be a focus area, with deepwater port assets along Point Tupper and the proposed Melford Terminal, offering multi-modal capacities. Marine services are also expanding through infrastructure improvements, including low-emission tugboat fleets and upgraded marine terminals, which enhance the Strait's capacity for global trade and clean energy exports.

Additionally, Nova Sustainable Fuel's proposed SAF production facility in nearby Goldboro, could open a new opportunity for both domestic and international supply. The proposed Canso Spaceport[18] has plans to introduce a high-tech aerospace and satellite launch sector, while the recently approved Goldboro Gold Project[19] in MODG could further expand local economic opportunities. For a more detailed overview of sector mapping and potential organizations, please refer to Table 3 (see Section 2.5.2).

2.5.2 Organizations operating in the Strait of Canso region and their use of fuels

To assess the potential for clean fuel adoption, it is first necessary to understand how conventional fuels are currently being used. Table 2 outlines sectors and sub-sectors, providing examples of operations that rely on fuel in their daily, end-use applications.

Table 2: Summary of potential clean fuel end-use applications by sector and subsector

Sector	Subsector	Definition	End use applications
Industrial	Processing plants	Large, multi-facility sites housing energy-intensive operations (e.g., petrochemicals, steel, cement, clean fuels), often integrated with utilities.	Process heat, electricity, and chemical feedstock

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[17] Strait of Canso Sustainable Infrastructure Strategy (Accessed November 8, 2025)

[18] Canso Spaceport Facility Project (Accessed November 8, 2025)

[19] Goldboro Gold Mine Project (Accessed November 8, 2025)

	Light - medium industry	Small to mid-sized industry (e.g., food processing, equipment assembly, workshops & fabrication) with moderate heat/fuel needs.	Process heat and electricity
	Logistics & Maintenance	Entities providing repair, transportation, or handling services across manufacturing sites (e.g., forklifts, warehouse fleets, parts).	Mobility fuel (off-road)
Marine vessels	Fishing fleet	Small to mid-sized vessels used for commercial or community fishing; often owner operated.	Mobility fuel (marine)
	Ferries	Passenger and vehicle transport across water, often regionally or municipally operated.	Mobility fuel (marine)
	Commercial shipping	Large cargo or container vessels operating domestically or internationally.	Mobility fuel (marine)
	Support services & bunkering	Includes tugs, pilot boats, supply ships, service vessels operating near ports or offshore, refueling operations, including storage, blending, and transfer.	Mobility fuel (marine) Mobility fuel (land)
Transportation	Public transportation	Urban buses, commuter rail, and municipal transit systems serving the public.	Mobility fuel (on-road and rail)
	Trucking/freight	Long-haul and regional trucks, including logistics and goods movement vehicles.	Mobility fuel (on-road)
	Aviation	Includes commercial airlines and cargo aircraft; focus is on jet fuel alternatives.	Mobility fuel (aviation)
Government operations	Municipal and First Nations fleets	Local government vehicles used for administration, service delivery, and community support.	Mobility fuel (on-road), and electricity
	Public works	Roads, parks, sewers, and infrastructure maintenance teams and equipment.	Mobility fuel (on-road), and electricity
	Health care facilities	Hospitals and clinics operated by public entities, including backup power and ambulance fleets.	Mobility fuel (on-road), and electricity
Utilities	Natural gas blending	Injection of clean fuels like hydrogen or renewable natural gas (RNG) into existing natural gas distribution systems.	Blending in natural gas lines
	Combustion for power	Use of clean fuels in thermal power generation (e.g., turbines or boilers) to displace fossil fuels.	Electricity

Table 3 provides a detailed, but non-exhaustive, list of sub-sectors and organizations within each sector. This initial list was developed by the Project Steering Committee with additional organizations added for inclusion by Deloitte. These existing sectors and organizations represent potential opportunities where clean fuels could be introduced.

Section 3 builds on this foundation by presenting a jurisdictional scan of real-world clean fuel adoption examples across each sector. These case studies highlight how projects have been operationalized elsewhere and offer insights that could inform future adoption pathways in the Strait of Canso region.

Table 3: Strait of Canso organizations, applicable sectors, and operations that could use clean fuels

Sector	**Subsector**	**Strait of Canso businesses and organizations (non-exhaustive)**	**Operations that could use clean fuels** (non-exhaustive)
Industrial	Processing plants	EverWind, Point Tupper Marine Services	Plant operations, electricity generation
		Port Hawkesbury Paper (incl. co-located NSP biomass facility)	Biomass boilers, diesel trucks
		Martin Marietta Materials	Quarry trucks, crushers, conveyors, marine transport
		McNally Construction	Diesel cranes and barges, methanol for marine vessels
	Light - medium industry	Cabot Gypsum	Haul trucks, processing equipment, transport of goods
		McNally Construction	Diesel cranes and barges, methanol for marine vessels
		Samson Enterprises	Construction equipment
		Mulgrave Machine Works	Fabrication equipment, fleet vehicles
		Authentic Seacoast Distillery, Steinhart Distillery, Glenora Distillery	Distillation process, heating, delivery fleet
	Logistics & Maintenance	A.W. Leil Cranes & Equipment	Support vehicles
		Zutphen Contractors	Construction vehicles, loaders, trucks
		Peter Covin Contracting	Dump trucks, excavators, heavy machinery
Marine vessels	Fishing fleet	Samson Enterprises	Fishing vessels
		Richmond County Inshore Fishermen's Organization	Fishing vessels, outboard motors
	Ferries	Northumberland Ferries, Marine Atlantic	Marine vessels
	Commercial shipping	Strait of Canso Superport Corporation tenants	Commercial ship vessels
	Support services & bunkering	Atlantic Pilotage Authority	Pilot boats, launch vessels
		McNally Corporation	Marine vessels
		Mulgrave Marine Terminal, EverWind	Ships, cargo handling equipment
Transportation	Public transportation	Strait Area Transit	Transit buses, vehicles
	Trucking/freight	Geno Polegato Trucking	Long-haul trucks, loaders
	Aviation	Allan J. MacEachen Airport (Celtic Air Services)	Aircraft fuel, ground vehicles
Government operations	Municipal and First Nations fleet	Municipality of the County of Richmond, Town of Port Hawkesbury, Municipality of the District of Guysborough, Town of Mulgrave	Municipal vehicles
		Potlotek First Nation, Paqtnkek Mi'kmaw Nation	Community transport, home heating, boats
	Public works	Municipalities listed above as well as Municipality of the County of Inverness, Potlotek First Nation, Paqtnkek Mi'kmaw Nation	Waste collection, snowplows, maintenance equipment
		Strait Regional Centre for Education	Heating, bus fleets
		Nova Scotia Community College - Strait Area Campus	Heating, backup generators
	Health care facilities	Strait Richmond Hospital	Heating, ambulances, backup generators
Utilities	Natural gas blending	Maritimes & Northeast Pipeline (M&NP)	Natural gas for pipeline distribution, heating
	Energy generation	Point Tupper Generating Station	Coal fired electricity generation with plans for natural gas conversion in 2030

3. Global insights and literature review

The global transition toward clean fuels—particularly green hydrogen and its derivatives—is progressing, though at different speeds across regions, as countries work to decarbonize key sectors and strengthen energy security. Recent findings from the Hydrogen Council[20] indicate that the industry is moving from ambition to early delivery, with more than $110 billion USD in capital commitments across more than 500 projects with a FID, in construction, or in operation, reflecting a ten-fold increase since 2020. At the same time, industry leaders emphasize that significant growth still hinges on decisive government action and continued market activation. In this context, the Strait of Canso region stands to benefit from the experiences of international early adopters by drawing on the practical insights, growth drivers, and lessons learned to advance its own clean fuel domestic ecosystem.

3.1 Objectives and methodology

This literature review was undertaken to systematically identify, assess, and categorize clean fuel applications and enabling conditions, with a focus on those prioritizing five key sectors: **industrial**, **marine vessels**, **transportation**, **government operations**, and **utilities**. The primary objective was to generate insights into clean fuel applications worldwide and to assess the enabling conditions that support their local relevance, by examining projects and end-use cases[21] that had demonstrated success or commercial readiness in diverse settings.

To ensure an actionable analysis, a qualitative adoption readiness assessment framework was used to evaluate real-world, reputable projects, emphasizing operational and commercialized initiatives with publicly available information. Our methodology combined desktop research, consultations with experts, and a review of international and national policy documents, sector-specific decarbonization roadmaps, industry case studies, and insights from Deloitte's Hydrogen and Clean Fuels practitioners. Projects reviewed are in first-mover regions such as Europe, the United States, Asia as well as other Canadian provinces such as British Columbia, Alberta, and Ontario.

The framework itself assessed the adoption readiness

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[20] Communique from Hydrogen Council Global CEO Summit 2025 (Accessed on December 11, 2025)

[21] It is important to note that feedstocks (e.g., fertilizer) were considered out of scope for this study. Additionally, only hydrogen-derived clean fuels were included; ethanol and biodiesel were excluded from the analysis.

of different clean fuels across sectors and subsectors by ranking them qualitatively as low, medium, or high on three dimensions: market deployment, retrofit compatibility, and price competitiveness. These dimension-level rankings were then synthesized into an overall readiness score, which in turn informed a prioritization order for the opportunity analysis in Section 4. It is important to note that this exercise reflects a qualitative and directional view of adoption readiness rather than a precise quantitative measurement.

The literature review encompassed the five in-scope clean fuels, including green hydrogen, green ammonia, e-methanol, RD, and SAF, and analyzed their deployment. Each use case was profiled based on sector application, technology, incumbent and clean fuel types, deployment stage, location, and year, to ensure findings are applicable to the Strait of Canso. Finally, the review examined the policy frameworks and incentives that have enabled clean fuel adoption, as well as lessons learned from alignment with liquefied natural gas (LNG), grid decarbonization, port infrastructure, technology pathways, and market readiness factors.

3.2 End use deployment analysis

This section provides an overview of how clean fuels are being deployed globally, with a breakdown by fuel type, sector, and sub-sector applications. Key trends and insights are highlighted to illustrate the evolving landscape of clean fuel adoption across different industries and regions.

3.2.1 End use applications by sector

The literature review of end use deployment applications focused on five key sectors: industrial, marine vessels, transportation, government operations, and utilities, along with their main sub-sectors and incumbent fuels (Table 4). These sectors and sub-sectors were selected based on their potential to drive local clean fuel offtake demand, reduce GHG emissions (particularly in transportation and heavy industry), and alleviate pressure on the electrical grid by enabling the conversion of renewable electricity into clean fuels. The literature review was conducted sector by sector and sub-sector by sub-sector, allowing for a comprehensive and organized assessment of end-use applications. A definition for each sub-sector is presented to ensure consistency in the categorization and literature review of each example project.

Table 4: Strait of Canso sectors and their applicable incumbent fuels

Sector	Subsector	**Illustrative incumbent fuels** (non-exhaustive)
Industrial	Processing plants	Coal, coke, natural gas, fuel oil, diesel
	Light - medium industry	Natural gas, propane, diesel, heating oil
	Logistics & maintenance	Diesel, gasoline
Marine vessels	Fishing fleet	Diesel, marine gas oil (MGO)
	Ferries	Diesel, MGO, heavy fuel oil (for larger ferries), LNG
	Commercial shipping	Heavy fuel oil (HFO), very low sulfur fuel oil (VLSFO), marine diesel oil (MDO)
	Support services & bunkering	HFO, MDO, MGO
Transportation	Public transportation	Diesel, compressed natural gas (CNG), gasoline
	Trucking/freight	Diesel, natural gas (LNG/CNG)
	Aviation	Jet fuel (kerosene-based, Jet A/A-1)
Government operations	Municipal and First Nations fleet	Gasoline, diesel, propane (light-duty)
	Public works	Diesel (trucks, heavy equipment), gasoline
	Health care facilities	Heating oil, diesel (backup generators), propane
Utilities	Natural gas blending	Fossil natural gas (methane)
	Combustion for power	Coal, natural gas, HFO, diesel (peaking/remote)

3.2.2 End-use applications by clean fuel

The relevant use cases are summarized in Table 5. The resulting matrix offers an overview of specific applications for each clean fuel, along with analysis of example projects and identification of potential opportunities, while enabling comparison of end-use pathways to highlight potential end uses for each fuel type.

Table 5: Summary of in-scope clean fuels and end-use applications

End use category	Green hydrogen	Ammonia	Methanol	RD	SAF
Process heat	✓	✓			
Mobility fuel	✓	✓	✓	✓	✓
Electricity	✓	✓		✓	
Blending in natural gas lines	✓				
Chemical & industrial feedstock	✓				

Process heat: The use of clean fuels (e.g., green hydrogen, RNG, methanol) as a direct source of heat for industrial processes such as steelmaking, cement, pulp & paper, food processing, or other heavy industries where high-temperature heat is required.

Mobility fuel: Clean fuels used to power vehicles, ships, trains, or aircraft, either as a drop-in replacement (e.g., RD, SAF) or in dedicated systems (e.g., hydrogen fuel-cell buses, ammonia-fueled ships).

Electricity: Clean fuels used to generate electricity through combustion (e.g., gas turbines running on hydrogen blends) or fuel cells, providing flexible, dispatchable power to complement renewables like wind and solar.

Blending in natural gas lines: Injecting clean fuels such as hydrogen or RNG into existing natural gas distribution pipelines to decarbonize heating, power, and industrial energy use while leveraging existing infrastructure.

Chemical feedstock: Clean fuels used as an input in chemical production (e.g., hydrogen to produce ammonia, methanol as a base for plastics, fuels, and solvents), enabling decarbonization of the chemicals value chain.

Based on the literature review, hydrogen and ammonia offer a broad range of end-use applications including process heat, mobility fuel, electricity generation, and use as chemical and industrial feedstocks. All five clean fuels can be used as mobility fuels for either on-road or off-road applications.

Hydrogen was identified to be the only fuel suitable for blending into natural gas pipelines[22], enabling integration with existing energy infrastructure. Additionally, methanol, SAF, and RD are primarily used as mobility fuels, with RD also applicable for electricity generation.

These differences in end-use applications highlight the importance of aligning each clean fuel with the most suitable end-use sectoral opportunities.

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[22] Hydrogen blending in natural gas pipelines: A comprehensive review of material compatibility and safety considerations (Accessed November 9, 2025)

3.2.3 Sector and clean fuels end-use applications matrix

Table 6 presents examples of global use cases identified through the literature review[23], consultations with experts, and analysis of global and national policy documents.

Table 6: Summary matrix of clean fuel end use by sector application based on current illustrative global use cases

Sector	Application					Clean Fuels				
	Process heat	**Mobility fuel**	**Electricity**	**Blending**	**Chemical feedstock**	**Hydrogen**	**Ammonia**	**Methanol**	**RD**	**SAF**
1. Industrial										
Processing plants	Yes	-	Yes	-	Yes	Yes	Yes	Yes	Yes	-
Light, medium, industry[24]	Yes	-	Yes	-	-	Yes	-	-	Yes	-
Logistics & maintenance	-	Yes	-	-	-	Yes	-	-	Yes	-
				-						
2. Marine vessels										
Fishing fleet	-	Yes	-	-	-	-	-	Yes	Yes	-
Ferries	-	Yes	-	-	-	Yes	Yes	Yes	-	-
Commercial shipping	-	Yes	-	-	-	Yes	Yes	Yes	Yes	-
Support vessels & bunkering	-	Yes	-	-	-	Yes	Yes	Yes	Yes	-
3. Transportation										
Public transportation	-	Yes	Yes	-	-	Yes	-	Yes	Yes	-
Trucking/freight	-	Yes	Yes	-	-	Yes	-	Yes	Yes	-
Aviation	-	Yes	-	-	-	-	-	-	Yes	Yes
4. Government										
Municipal and First Nations fleet	-	Yes	Yes	-	-	Yes	-	Yes	Yes	-
Public works	-	Yes	Yes	-	-	Yes	-	Yes	Yes	-
Healthcare facilities	-	-	Yes	-	-	Yes	-	-	Yes	-
5. Utilities										
Natural gas blending	-	-	-	Yes	-	Yes	-	-	-	-
Energy generation	-	-	Yes	-	-	Yes	Yes	-	Yes	-

Table 6 illustrates that hydrogen and ammonia present a wide range of end-use applications, with potential uses across process heat, mobility fuel, electricity generation, blending, and as chemical & industrial feedstocks, particularly in manufacturing and utility sectors. Notably, hydrogen is also unique in its suitability for blending with

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[23] Refer to Appendix 8.1 for the list of case studies examined in the literature review.

[24] Light industry includes small-scale operations (e.g., workshops, fabrication shops, distilleries) that typically use low-temperature or low-intensity heat—such as space heating, hot-water processes, or small boilers—reflecting relatively modest fuel needs. Medium industry comprises larger manufacturing or processing facilities (e.g., food processing, equipment assembly, gypsum processing) that depend on moderate, more continuous heat loads, often requiring sustained thermal energy for drying, curing, or mechanical processing. Both remain significantly below the high-temperature, energy-intensive processes found in heavy industry.

natural gas in utility applications, but operational feasibility and safety considerations are still being explored. In comparison, e-methanol is relevant in various manufacturing and transportation applications, especially as a mobility fuel for the marine sector. Meanwhile, SAF and RD are primarily used as mobility fuels, with a key distinction that RD can also support electricity generation across sectors.

Examining sub-sectors reveals additional nuances. Within the manufacturing sector, clean fuels play distinct roles. Hydrogen and ammonia are primarily associated with high-temperature industrial processes, while e-methanol is used mainly in specialty chemical applications, and RD serves as a drop-in fuel for on-site diesel equipment. In the marine sector, ammonia and e-methanol are emerging as lower-carbon options for deep-sea shipping, hydrogen is being piloted for short-range or port-adjacent vessels, and RD remains the most immediately deployable fuel for fishing fleets and port operations. In the transportation sector, SAF is concentrated in aviation, RD provides near-term decarbonization for heavy-duty and municipal fleets, and hydrogen is gaining traction in pilots for transit buses and freight applications. In the utility sector, hydrogen's applicability to blending in natural gas networks and its potential role in power generation contrast with ammonia's emerging use in co-firing scenarios, highlighting the differing pathways for each fuel. These observations underscore the importance of matching fuel characteristics with the specific needs and operational requirements of each sub-sector.

By reviewing select project examples of existing applications, practical insights were gained into where different fuels are being used or piloted. Building on this analysis, the technology and commercial readiness of each fuel type by sector and use case was qualitatively evaluated, providing the necessary context to prioritize actions and guide strategic decision-making for clean fuel deployment.

3.3 Literature review using the adoption readiness framework

3.3.1 Introduction of the adoption readiness framework

A qualitative framework was developed to understand the adoption readiness of clean fuels. Each fuel was ranked as low, medium, or high within a subsector based on three key categories: (1) **market deployment**, (2) **retrofit compatibility**, and (3) **price competitiveness**. The predominant score across these criteria determined the overall ranking. These results inform the opportunity analysis in Section 4. For the purposes of this assessment, it was assumed that each fuel was available, including via imports from other regions such as Quebec. Table 7 lists the high-level ranking criteria across the three categories. The final rating for each application was determined by the average level assigned (for example, if an application received two medium ratings and one high rating, the overall rating was classified as medium).

Table 7: Adoption readiness framework categories and rating definitions

Criteria category	High	Medium	Low
Market deployment *Refers to the extent to which a clean fuel or technology has moved beyond research and demonstration into routine, real-world use across jurisdictions or sectors.*	Routine operational use in multiple jurisdictions and/or sectoral applications with emerging market share.	Only active pilots and demonstrations or small-scale deployments.	Conceptual, research & development or laboratory tests only.
Retrofit compatibility *Refers to the degree to which a clean fuel can be adopted using existing equipment, infrastructure, and operating practices, including the scale of modifications, training, or asset replacement required.*	Clean fuel is considered drop-in[25] and can be used and maintained by the typical operator with current infrastructure or equipment. Can be used in most existing assets with no or minimal modifications; no major operational disruption.	Clean fuel can be used and maintained by a typical operator and allows for interoperability with existing infrastructure or equipment after adjustments and training. Requires moderate modifications or partial fleet/equipment replacement.	Deployment requires extensive operational change, including significant integration requirements or risks to use.[26] Requires full asset replacement or major custom conversions; significant infrastructure and cost barriers.
Price competitiveness *Refers to the relative cost of a clean fuel compared to the incumbent fuel it would displace, considering current pricing and the expected trajectory toward cost parity over time.*	Clean fuel is either currently cost competitive with the incumbent or close to cost-parity and on a trajectory to be cost competitive with the incumbent within five years.	Clean fuel is more than five years away from achieving cost parity with incumbent but is on a clear path to be more cost competitive.	Clean fuel is more expensive than the incumbent and there is no clear pathway to cost competitiveness.

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[25] Drop-in refers to a fuel that can be used in existing equipment and infrastructure without material modifications, while maintaining normal operations, performance, safety, and maintenance practices.

[26] Industry has expressed concern that some aircraft warranties may be voided due to the use of SAF.

3.3.2 Industrial

Clean fuels are increasingly being adopted across a wide range of industrial operations, from clean fuel processing plants and industrial complexes to smaller workshops, fabrication sites, and logistics hubs. These sectors, which have traditionally relied on fossil fuels for heat, power, and mobility, are now beginning to explore the integration of solutions such as green hydrogen, green ammonia, and methanol into their operations.

Table 8: Adoption readiness review of clean fuels in processing plants

Processing plants

Clean fuels are being adopted across industrial complexes—both core process units (e.g., refining, petrochemicals, fertilizers, steel) and site energy uses (backup/peak power, mobile equipment, internal logistics).

Green hydrogen is displacing grey hydrogen in selected refinery and chemical processes, though total low-emissions H_2 remains a small share; economics hinge on policy support, power costs, and electrolyzer scale-up.

Refineries such as TotalEnergies Leauna Refinery in Germany is now using green hydrogen to replace fossil-based hydrogen in refining processes.[27]

e-Methanol and **ammonia** are primarily feedstocks; early pilots are exploring their combustion roles (e.g., ammonia co-firing in kilns/boilers; methanol in industrial boilers/combined heat and power [CHP]) with attention to NOx and safety.

RD isn't a process fuel but is a practical drop-in for onsite diesel uses (gensets, yard tractors, site fleets), enabling immediate Scope 1 GHG emission reductions without retrofits.

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	Low – More for backup gensets, yard equipment, mobile boilers, emergency/ peak power	N/A	N/A
Green hydrogen	Medium – electrolyzer use accelerating; still small vs. total H_2.	Medium – integration at existing ammonia/methanol sites feasible but power-intensive.	Low – decreases in fossil fuel prices have increased the cost gap vs. unabated fossil-based routes.[28]
e-methanol	Medium – first commercial plants online; large 2030 pipeline, but low current share.	Medium – retrofits/new builds need CO_2 capture/supply and H_2 integration.	Medium – cost remains high
Green ammonia	Medium – early pilots at existing sites; growing interest for exports.	Medium – Haber–Bosch can accept green H_2 with notable CAPEX/power needs.	Low – premium over conventional ammonia.

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[27] Germany: TotalEnergies and RWE join forces on green hydrogen to decarbonize the Leuna refinery, TotalEnergies (Accessed August 13, 2025)

[28] IEA. Global Hydrogen Review 2025 (Accessed August 13, 2025).

Table 9: Adoption readiness review of clean fuels in light, medium industry

Light, medium, industry

These sites prioritize low-disruption swaps: RD in service vehicles, diesel forklifts and backup generators; and hydrogen fuel cell systems for backup power or small-scale CHP where resilience or indoor air quality matter. Hydrogen combustion for low-/medium-temperature heat (e.g., boilers) is emerging in pilots; methanol has seen limited use in industrial boilers as a cleaner alternative to coal/LPG. Ammonia and SAF are generally not used.

The International Energy Agency (IEA) notes many industrial heat applications still lack market-ready decarbonization solutions[29]; drop-ins like hydrogenated vegetable oil (HVO) score higher on compatibility but need supportive policy to compete on cost. Fuel-cell forklifts/backup have proven availability/uptime in deployments but require H_2 logistics and add CAPEX. Hydrogen/methanol for heat are cost-constrained; competitiveness improves only with low-cost electricity/CO_2 and incentives.

Examples:

- As seen in Scotland's Project WhiskHy and Arbikie Distillery, are using green hydrogen to power their boilers to generate heat in the whisky distillation process, significantly reducing their carbon emissions produced.[30]
- Deutz Machining & Assembly Centre is piloting an on-site hydrogen combustion generator to power its engine component workshop, showcasing how green hydrogen can directly replace conventional energy sources in industrial facilities.[31]

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	High – piloting use in boilers and fleets, but local supply remains limited despite high import volumes	High – drop-in for diesel use	Medium – slightly higher costs
Green hydrogen	Low – Fuel cell (FC) backup/CHP and some pilots in boilers	Low – retrofit possible with changes	Low – fuel cost premium
e-methanol	N/A	N/A	N/A
Green ammonia	N/A	N/A	N/A

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[29] IEA: Industry Challenges (Accessed November 8, 2025)

[30] Project WhiskHy and Arbikie (Accessed November 8, 2025)

[31] Deutz Green Hydrogen Pilot (Accessed November 8,2025)

Table 10: Adoption readiness review of clean fuels in logistics and maintenance

Logistics and maintenance

This is the most active use case for hydrogen in manufacturing settings: fuel-cell forklifts material-handling equipment (MHE) and hydrogen backup power, with extensive deployments documented by the US Department of Energy/NREL. Where hydrogen isn't practical, operators switch to HVO in diesel MHE/yard tractors and HVO-fueled gensets. Methanol and ammonia have negligible roles; SAF is not applicable.

Hydrogen MHE scales where high throughput and fast refueling beat battery downtime; fleets with 24/7 shifts (e.g., distribution centers, auto plants) are typical early adopters.[32] HVO preserves engine warranties under EN 15940[33], and original equipment manufacturer (OEM) approvals though real-world integration can still involve operational considerations.

Fuel-cell MHE offers strong operational uptime benefits and field durability but requires on-site fueling and often higher total cost of ownership without incentives. HVO is the lowest-friction path with high compatibility; competitiveness varies with credit regimes. Methanol/ammonia remain uncompetitive/unsafe for typical warehouse equipment.

Practical examples:

- DP World is piloting a hydrogen fuel cell RTG crane with integrated battery and regenerative braking at the Port of Vancouver, showcasing advanced hybrid technology for improved efficiency.[34]
- At the Port of Montreal, hydrogen fuel cell-powered terminal tractors and yard machinery are being tested.[35]

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	High– yard trucks, diesel forklifts, gensets	High – drop-in with diesel	Medium – policy-sensitive
Green hydrogen	Med – few forklift pilots exist	Low – forklifts possible with training	Low – still above electrification
e-Methanol	Low – minimal testing only	Low – requires heavy retrofits	Low – expensive vs. diesel and electric
Green Ammonia	Low – no adoption	Low – not feasible	Low – too costly

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[32] DOE: Early Markets: Fuel Cells for Material Handling Equipment (Accessed November 8, 2025)

[33] NEN-EN 15940 Automotive fuels - Paraffinic diesel fuel from synthesis or hydrotreatment - Requirements and test methods (Accessed November 8, 2025)

[34] DP World pilot (Accessed November 8,2025)

[35] Port of Montreal hydrogen powered equipment (Accessed November 8,2025)

Table 11: Case study project: Green hydrogen for distillery operations

Spotlight	**Green hydrogen for distillery operations**
Clean fuel	Green hydrogen
Context and ambition	The Scotch whisky industry is energy intensive and traditionally reliant on fossil fuels, such as natural gas, to provide the high-temperature heat required in distillation. Beam Suntory, one of the world's leading spirits producers, has set ambitious sustainability commitments under its Proof Positive strategy, targeting a 50 percent reduction in GHG emissions by 2030 and achieving net-zero across its value chain by 2040. Within this context, Project WhiskHy[30] was created to demonstrate how green hydrogen can be used as a clean alternative to fossil fuels in whisky distilling. Following a successful feasibility study at the Ardmore distillery, the project has secured funding to advance to an industrial-scale hydrogen trial at the Glen Garioch distillery in Aberdeenshire, aiming to produce approximately 57,000 bottles of whisky distilled entirely with hydrogen. SUPERCRITICAL
Approach and solution	The WhiskHy consortium, led by Supercritical with partners Beam Suntory and the Manufacturing Technology Centre, is deploying a high-pressure, ultra-efficient electrolyzer to produce green hydrogen from water using renewable electricity. Unlike conventional systems, Supercritical's electrolyzer produces hydrogen at pressures exceeding 200 bar, reducing storage and compression requirements and enabling easier integration into industrial operations. The hydrogen is stored on site and combusted directly to fire copper stills, replicating the high-temperature flame characteristics of fossil fuels but without CO_2 emissions. The project builds on a feasibility trial at Ardmore and moves into a 21-month demonstration at Glen Garioch, where the hydrogen-distilled spirit will be monitored for quality as it matures.
Outcomes	• World-first hydrogen-distilled whisky casked for maturation, with finished product expected post-2025. • Scale-up of Supercritical's electrolyzer technology and workforce, creating skilled clean-tech jobs. • Development of UK hydrogen supply chain capacity and partnerships with multiple product and service providers. • Proof of concept for hydrogen as a viable, net-zero fuels for high temperature and direct-fired heating applications.
Enabling organizations	• Supercritical (UK developer of the high-pressure electrolyzer). • Beam Suntory (global premium spirits producer; project host at Ardmore and Glen Garioch distilleries). • Manufacturing Technology Centre (part of the UK's High Value Manufacturing Catapult. supporting process development). • UK Department for Business, Energy & Industrial Strategy (funded via the Net Zero Innovation Portfolio's Green Distilleries Competition).
Alignment to clean fuels in Nova Scotia	The region's distilling industry, though smaller than Scotland's, makes it a potential candidate for clean fuels applications that preserve traditional direct-fired techniques while eliminating carbon emissions. The WhiskHy model shows how this supply can be applied to industrial heat applications, offering distilleries and other producers in the region a route to decarbonization that complements electrification efforts for processes that are more difficult to electrify, such as high-temperature heating.

Table 12: Case study project: Hydrogen fuel cell RTG crane for port operations

Spotlight	**Hydrogen fuel cell RTG crane for port operations**
Clean fuel	Green hydrogen
Context and ambition	At DP World's Vancouver terminal, diesel-powered RTG cranes represent one of the largest sources of fuel consumption and emissions, with 19 operating units accounting for roughly half of the terminal's diesel use and more than 4,200 tonnes of CO_2 annually. To address this, DP World launched a pilot hydrogen fuel cell RTG crane project as part of its broader ambition to explore low- and zero-emission alternatives across a global fleet of approximately 1,500 RTGs. Vancouver was selected as a launch site due to British Columbia's supportive policy environment and emerging hydrogen ecosystem, with the pilot positioned to demonstrate how hydrogen could displace diesel in a high-duty-cycle, mission-critical port application.
Approach and solution	The project retrofitted a conventional diesel RTG with a hydrogen drive-train system that combines a fuel cell power generator, a battery energy storage system, and regenerative braking. The crane's onboard storage system holds up to 135 kg of compressed hydrogen across 15 tanks, which feed the fuel cells that charge the high-voltage battery powering the crane's electric drive. Regenerative braking recovers energy during container lowering operations, further improving efficiency.
Outcomes	• The crane completed initial testing in April 2025 and is now undergoing a year-long field trial to evaluate operational performance, energy efficiency, and hydrogen consumption against a diesel baseline. • From the field trial, DP World has indicated the potential to convert 25 additional RTGs across their Port of Vancouver and Port of Prince Rupert operations, as well as other port terminal assets if performance and economics are feasible.
Enabling organizations	• DP World (project owner/operator). • TYCROP Manufacturing (fuel cell drive train supplier). • HTEC (hydrogen storage and supply). • Corvus Energy (battery supplier). • Vancouver Fraser Port Authority and Government of British Columbia supporting with the Low-Emission Technology Initiative.
Alignment to clean fuels in Nova Scotia	The DP World pilot highlights a pathway directly relevant to container terminals, where yard equipment is a major focus of decarbonization. Halifax has already deployed electric RTGs, demonstrating regional appetite for low-emission technologies. Hydrogen-electric RTGs provide an alternative option for ports where electrical grid connection, operational flexibility, or duty cycles may favour hydrogen supply over fixed electrification. This pilot aligns with Nova Scotia's GHAP, which identified transportation and industrial use cases as drivers for regional hydrogen production projects like EverWind Fuels.

3.3.3 Marine vessels

The maritime sector is undergoing a shift to clean fuel technologies as part of global efforts to reduce emissions and comply with tightening environmental regulations. A key global driver would have been the International Maritime Organization's (IMO's) recently approved Net-Zero Framework, which would have set mandatory fuel-intensity limits and a GHG pricing mechanism for ships over 5,000 gross tonnage (GT), aiming for net-zero emissions by around 2050. Under this two-tier system, vessels that exceed emissions thresholds would have faced penalties of up to \$380 per tonne of CO_2, while low- and near-zero GHG ships would have been rewarded.[36] However, negotiations at the IMO in October 2025 did not result in the adoption of the Net-Zero Framework, as Member States were unable to reach consensus, and the vote was formally deferred for 12 months.[37] As a result, the regulatory package—including the global fuel-intensity standard and the associated pricing mechanism—will not be reconsidered until late 2026, pushing the earliest possible entry-into-force to 2028. This delay has introduced an extended period of uncertainty for shipowners, ports, and fuel suppliers, with industry groups warning that the adjournment is likely to slow investment in cleaner propulsion systems and associated bunkering infrastructure. At the same time, capital for maritime decarbonization remains available and is viewed as even more critical following the failure to secure a global framework, with industry reporting continued investor interest in first-mover projects and transition financing despite the IMO delay.[38]

Traditionally, the sector has relied on HFO and diesel, but now opportunities to deploy alternative fuels including hydrogen, green methanol, green ammonia, and RD are being leveraged across a variety of vessel types, each with distinct operational profiles and emission reduction opportunities. Overall, there are various ongoing marine projects in execution or pilot stages, showcasing the broad development of clean fuel adoption across newly built or retrofitted vessels. E-methanol, hydrogen, ammonia, and RD continue to emerge as key alternatives to traditional marine fuels, while dual-fuel engine technologies are helping bridge the transition by allowing vessels the flexibility to switch between conventional and clean fuels. Regionally, Europe leads in hydrogen and offshore wind applications, North America is advancing RD and hydrogen ferries, and Norway and Australia have an increased interest in ammonia, reflecting an emerging commitment to marine decarbonization. Figure 4 presents the latest global data for the number of ships in operation currently and those on order that will be powered by clean fuels.[39]

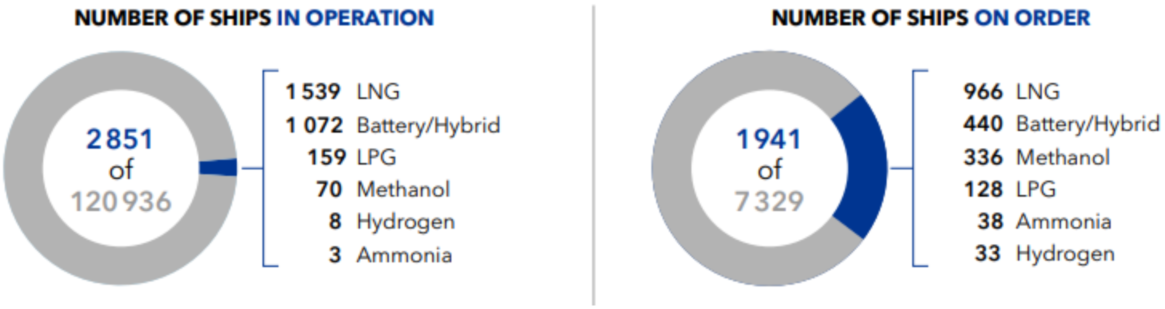

Figure 4: Clean fuel technology uptake by number of ships in operation and on order

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[36] IMO approves net-zero regulations for global shipping, International Maritime Organization (Accessed August 13, 2025)

[37] IMO net-zero shipping talks to resume in 2026 (Accessed January 16, 2026)

[38] Decarbonisation capital still has some wind in its sails even after IMO flop (Accessed January 16, 2026)

[39] Energy Transition Outlook 2025: Maritime Forecast to 2050, DNV (Accessed August 13, 2025)

In the first half of 2025, 151 alternative-fuelled vessels were ordered globally.[40] This marks a shift toward adoption in one of the most commercially exposed and operationally complex sectors, suggesting that alternative fuels are becoming mainstream.

Table 13: Alternative fuel uptake in the global fleet by number of vessels from the first half of 2025[41]

Fuel	Vessels ordered[42]	Gross tonnes	Notes
LNG	87	14.2 million	Dominant fuel, esp. in container segment (81 are container ships, 13.6 M GT).
Methanol	40	4.6 million	Momentum across container, RoPax, tanker, offshore, and car-carrier segments.
Ammonia	3	37,000	Early-stage activity in tanker and general-cargo markets.
Hydrogen	4	114,000	Re-emerging interest; pilot-scale orders.

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[40] Alternative fuels orderbook shows resilience amid overall decline in newmarket build (Accessed October 9, 2025)

[41] Alternative fuels orderbook shows resilience amid overall decline in newbuild market (Accessed November 5, 2025)

[42] DNV's Alternative Fuels Insight platform reports vessel counts and fuel capabilities by fuel type: Because many modern vessels are designed with dual-fuel or multi-fuel propulsion options, totals by fuel type may not directly sum to unique vessels in the orderbook.

Table 14: Adoption readiness review of clean fuels in fishing fleets

Fishing fleets

Fishing fleets remain overwhelmingly dependent on marine diesel, with RD the most viable short-term substitute. Its drop-in properties allow operators to switch fuels without engine replacement, making it attractive where supply exists. Hydrogen and ammonia vessels require full redesign or major retrofits with low compatibility and cost competitiveness. They are currently only at the pilot stage for small vessels; fuel-cell fishing boat demonstrations have been launched in Norway and Japan.

Examples include Norway's MS Skulebas[43] and France's Alba[44] fishing training vessels, which are now running hydrogen-electric hybrid systems, combining proton-exchange membrane (**PEM)** fuel cells or dual fuel-cell setups with batteries for near-zero-emission fishing and training operations.

Adoption is constrained by cost and limited access to alternative fuels in rural/remote ports. RD penetration is medium in niche geographies, while hydrogen and ammonia remain low (pilots only). Methanol is not common in small fishing vessels due to space, handling, and energy density concerns.

Fuel	**Market deployment**	**Retrofit compatibility**	**Price competitiveness**
Renewable diesel	High – drop-in for fishing vessels	High – drop-in for diesel engines	Medium – costlier but supported by mandates
Green hydrogen	Medium – no widespread pilots yet	Low – requires new FC/powertrain	Low – expensive, limited range
Methanol	Low – limited small craft demos	Low – major retrofits required	Low – not cost competitive
Ammonia	Medium – potential in larger boats	Medium – needs ammonia handling infrastructure	Low – still costly

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[43] Norwegian Hydrogen will deliver green hydrogen to the world's first hydrogen-powered fishing vessel (Accessed November 5, 2025)

[44] Alba, the first French fishing hydrogen-powered vessel (Accessed November 5, 2025)

Table 15: Adoption readiness review of clean fuels in ferries

Ferries

Ferries are well suited for early adoption of alternative fuels, due to factors such as predictable routes and centralized fueling infrastructure, which can reduce barriers to testing and scaling new technologies. These characteristics make ferries a common testbed for new marine fuels before broader commercial shipping adoption.

From a technical and operational perspective, RD currently offers the highest readiness, as it is a true drop-in fuel compatible with existing engines and fuel systems. Methanol and hydrogen are technically viable for ferry operations, with multiple pilot projects demonstrating feasibility, particularly on short-to-medium routes. However, both require equipment modifications or new propulsion systems, limiting near-term scalability. Ammonia is being explored primarily as a longer-term option; while it offers zero-carbon potential at the point of use, it presents greater challenges related to safety, fuel handling, and retrofit complexity.

From a cost perspective, RD is generally more competitive than hydrogen, methanol, or ammonia, though it still carries a premium relative to conventional marine fuels. Hydrogen and ammonia remain the most expensive options, driven by fuel production costs and limited supply chains. Methanol costs also remain elevated, though policy support and scaling production are expected to improve competitiveness over time.

Notable examples include Eckerö Line in Finland, which has integrated Neste's RD into its commercial ferry operations,[45] and the New York Department of Transportation, which in June 2025 received its first delivery of 336,000 gallons of RD for the Staten Island ferry in the northeastern US[46]

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	High – RD ferries deployed	High – drop-in	Medium – some cost gap
Green hydrogen	Medium – ferries piloted in Europe	Low – retrofit possible, not widespread	Low – high fuel cost
Methanol	Medium – ferry pilots active	Medium – retrofit possible	Medium – cost remains high
Ammonia	High – ferry pilots emerging	Medium – retrofit difficult	Low – still expensive

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[45] Eckerö Line uses renewable diesel to greenify ferry operations in Baltic Sea, Offshore Energy (Accessed August 13, 2025)

[46] DCAS and NYC DOT Announce First Barge Delivery of Renewable Diesel, Marking the Staten Island Ferry's Full Transition to Cleaner Energy, NYC DOT (Accessed August 13, 2025)

Table 16: Adoption readiness review of clean fuels in commercial shipping

Commercial shipping

Commercial shipping faces higher barriers to clean fuel adoption than ferries due to long voyage distances, high energy-density requirements, and the need for global bunkering availability. These constraints largely rule out hydrogen for deep-sea shipping because of its low volumetric energy density, though fuel-cell applications are being piloted in short-sea and coastal vessels. As a result, hydrogen remains niche for short-haul ferries and passenger vessels, not bulk carriers.

Liquid fuels that can be handled within modified conventional fuel systems—particularly methanol and, longer term, ammonia—are therefore the most viable options for deep-sea shipping. Methanol has advanced most rapidly, supported by available dual-fuel engines and retrofit pathways. Ammonia offers zero-carbon potential at the point of use but faces greater safety, toxicity, and handling challenges, keeping deployment at an earlier stage.

All alternative marine fuels currently carry a significant cost premium relative to HFO. E-methanol rates low to medium on price competitiveness, often more than twice the cost of HFO, while renewable diesel has seen limited uptake due to high costs and constrained supply despite its drop-in compatibility. Ammonia remains low on competitiveness as both fuel production costs and onboard system requirements remain high.

Nevertheless, regulatory momentum is accelerating adoption. The IEA and IMO identify methanol as the fastest-growing alternative marine fuel today already in commercial use, with ammonia expected to follow later in the decade as standards, engine designs, and bunkering infrastructure mature.

The most advanced alternative is e-methanol, with Maersk and others launching methanol-fueled container ships; more than 200 vessels are on order for delivery by 2030.[47]

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	Low – limited uptake in shipping	Medium – engine conversion feasible but space/cost issues	Low – high cost
Green hydrogen	Medium – Pilots	Low – requires new FC/powertrain	Low – expensive
e-Methanol	Medium – first commercial vessels in service and more on order	Medium – engine conversion feasible but space/cost issues	Medium – still costly vs oil
Green Ammonia	High – multiple global pilots underway	Medium – requires special engines/tanks	Low – not yet cost competitive

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[47] Methanex corporate presentation (Accessed, November 8, 2025)

Table 17: Adoption readiness review of clean fuels in support vessels and bunkering

Support vessels and bunkering

Support craft are early adopters of hydrogen fuel cells (e.g., hydrogen-powered ferries and pilot boats in Norway, California) and RD (used in tugs and workboats where supply chains support it). Methanol is gaining interest for offshore supply vessels, with orders for methanol-capable offshore support vessels (**OSVs)** underway. Ammonia is still experimental in this class.

Because support vessels operate near ports, hydrogen and methanol are attractive, refueling infrastructure can be centralized, and voyage profiles suit lower-energy-density fuels. RD adoption is also growing due to its simplicity as a drop-in. Ports are beginning to adapt bunkering infrastructure to support these fuels, with e-methanol expanding fastest in locations such as Singapore and Rotterdam. RD is occasionally bunkered for workboats, while hydrogen bunkering remains limited to pilot facilities, and ammonia bunkering is still in planning and demonstration phases due to safety and toxicity considerations.

Hydrogen currently shows low to medium competitiveness, with its most practical near-term applications concentrated in short-range vessels, where its operational profile is most suited. E-methanol demonstrates moderate retrofit feasibility, making it a viable option for existing tonnage in the medium term. It also leads today in bunkering penetration and retrofit compatibility, giving it a comparatively stronger position among emerging fuels. RD is the closest to cost-competitive, though primarily within specific niche geographies, and it remains a limited-scope product in bunkering markets. Ammonia remains too early stage for a fair competitiveness assessment, but it has strong long-term potential, particularly as safety standards and handling protocols mature. At present, however, both ammonia and hydrogen score low on bunkering availability and relative competitiveness compared with methanol.

Inland and nearshore vessels, such as the Netherlands' H2 Barge 1[48] & 2[49] and Belgium's Hydrotug 1, have successfully been converted from diesel to hydrogen fuel cells and batteries/dual fuel engines, proving hydrogen's viability for shorter-range, heavy-duty port and waterway operations.

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	High – used in support vessels	High – drop-in for diesel engines	Medium – costlier but supported by mandates
Green hydrogen	Medium – some pilots exist	Low – requires new FC/powertrain	Low – expensive
e-methanol	Medium – bunkering projects underway	Medium – engine conversion feasible but space/cost issues	Medium – costs above diesel
Green ammonia	High – active bunkering pilots	Medium – required dedicated infrastructure	Low – expensive

Table 18: Case study project: Prince Rupert Port Authority's adoption of renewable diesel

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[48] HYDROGEN Barge 1 (Accessed November 8, 2025)

[49] HYDROGEN Barge 2 (Accessed November 8, 2025)

Spotlight	Prince Rupert Port Authority’s transition to renewable diesel
Clean fuel	Renewable diesel (RD)
Context and ambition	The Prince Rupert Port Authority (PRPA) sought to reduce emissions from its marine and landside operations while maintaining reliable and efficient service. Each year, approximately nine million litres of diesel are used across port activities, presenting a significant opportunity for decarbonization. Recognizing the short-term availability of RD and its compatibility with existing diesel engines, PRPA identified it as a practical, low-barrier solution to reduce emissions without requiring major capital investments. In Q2 2024, PRPA formally launched its Renewable Diesel Initiative, aiming to transition Gateway partners from petroleum diesel to a lower-emissions alternative.[50]
Approach and solution	As part of the Renewable Diesel Initiative, PRPA collaborated with a Canadian supplier to secure a reliable supply of RD—a drop-in fuel that requires no engine or infrastructure modifications. In its first phase, 13 Gateway partners opted into the pilot project, collectively consuming 1.2 million litres of RD across a wide range of applications, including on-dock cargo-handling equipment, locomotives, tugboats, and transport trucks. The fuel was deployed using existing fueling infrastructure, and PRPA reinforced adoption through procurement policies and coordination with service providers. The phased, collaborative rollout demonstrated a scalable and operationally seamless approach to decarbonizing port-related emissions.
Outcomes	• Early operational data indicates up to 90% lifecycle GHG reductions compared to petroleum diesel. • Port operations continued without disruption, validating the operational and supply chain reliability of RD in cold-weather and high-utilization environments. • PRPA’s success can create a model for other ports and terminals, with contractors and service providers increasingly exploring similar fuel shifts.
Enabling organizations	• Prince Rupert Port Authority (project lead) and 13 port partners. • CleanBC, BC Low Carbon Fuel Standard (LCFS), and Canada’s Clean Fuel Regulations (CFR) are policy drivers encouraging lower-carbon fuel uptake in transportation, increasing RD supply. • Tidewater Refinery producing and distributing the RD from their refinery in Prince George.[51]
Alignment to clean fuels in Nova Scotia	This case illustrates how drop-in fuels like RD can offer an immediate and practical decarbonization pathway for hard-to-abate sectors, particularly in regions where new infrastructure deployment may take time. The PRPA example shows how coordinated fuel procurement and policy incentives can accelerate clean fuel adoption at scale, especially for multi-user industrial hubs like ports. It also demonstrates how low-carbon fuels can be deployed alongside longer-term electrification or hydrogen strategies, offering a transitional solution that reduces emissions today while broader infrastructure and supply chains continue to develop.

Table 19: Case study project: Biodiesel and RD for lower-emission marine transport

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[50] Prince Rupert Port Authority Community Annual Report 2024 (Accessed August 13, 2025)

[51] Tidewater hails new diesel regulations aimed at levelling playing field - Prince George Citizen (Accessed August 13, 2025)

Spotlight	***BC Ferries Clean Futures Plan - Biodiesel and RD for Lower-Emission Marine Transport***
Clean fuel	Renewable diesel (RD) and biodiesel
Context and ambition	BC Ferries is committed to reducing its GHG emissions and achieving net zero, recognizing that 98% of its emissions come from vessel fuel combustion. The Clean Futures Plan aims to lower emissions by at least 27% from 2008 levels by 2030, while meeting the needs of a growing population and increasing service demand. The company is taking a multi-faceted approach, focusing on renewable and alternative fuels, electrification, operational efficiencies, advanced technologies, and fleet modernization.[52]
Approach and solution	BC Ferries has accelerated its emissions reduction strategy by increasing the use of B20 biodiesel (blending up to 20% biodiesel with 80% petroleum-based diesel) and trialing RD in its fleet, in partnership with Parkland Corporation. Notably, the Queen of Oak Bay operates on B20 biodiesel, while the Queen of Surrey is testing RD, both of which can be used in existing diesel engines without modifications. These low-carbon fuels are derived from vegetable oils, animal fats, and similar feedstocks, offering a drop-in solution for immediate emissions reductions. Alongside biofuels, BC Ferries is deploying hybrid battery-electric ferries and LNG-powered vessels and is exploring future fuels like renewable natural gas and green methanol. The Clean Futures Plan integrates these fuel innovations with broader operational and technological improvements to drive progress toward net zero.
Outcomes	• Trials of B20 biodiesel and RD eliminated 13,200 tonnes of GHG emissions between October 2021 and June 2022, equivalent to removing approximately 2,800–3,000 cars from the road for a year. • No operational impacts were observed in vessel performance during the transition to higher biodiesel blends and RD. • BC Ferries' GHG emissions in 2022 were 5% below 2008 baseline levels, with further reductions targeted. • The company has received environmental recognition, including the Blue Circle Award.
Enabling organizations	• BC Ferries (project lead and operator); Parkland Corporation (low-carbon fuel supplier); Vancouver Fraser Port Authority (Blue Circle Award); Prince Rupert Port Authority (Green Wave Award); Green Marine (environmental certification program)
Alignment to clean fuels in Nova Scotia	BC Ferries' Clean Futures Plan demonstrates the practical application of biodiesel and RD as immediate, scalable solutions for marine decarbonization, while also investing in electrification and other advanced clean fuels. The initiative aligns with Atlantic Canada's broader climate goals and showcases an integrated path to net zero that leverages both existing and emerging technologies, supporting sustainability in marine transportation.

3.3.4 Transportation

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[52] News Release - BC Ferries Clean Futures Plan Biodiesel's role along the path to "net zero" (Accessed August 13, 2025)

Transportation and logistics companies play a pivotal role in the clean fuel energy transition, serving as the link between upstream production and end consumers. Deploying sustainable transport solutions, can accelerate the adoption of low carbon fuels and technologies while fostering coordinated progress across the entire value chain.

These technologies are being implemented across key modes of transport including public transportation, trucking/freight, and aviation. Notable industry trends include the growing deployment of hydrogen fuel cell systems being used in city transit, trucking, and aviation, while RD offers minimal infrastructure changes to existing engine configuration. Within aviation, SAF deployment is fuelled by government mandates with companies exploring ways to blend SAF with existing jet fuel to reduce carbon emissions.

Table 20: Adoption readiness review of clean fuels in public transportation

Public transportation

Pilots are underway showcasing the potential of hydrogen fuel cells. In Germany, Solaris busses are offering 350 km of range paired with a refuelling time of less than 15 minutes.[53]

Closer to home, the City of Mississauga is advancing a hydrogen ecosystem initiative anchored by a MiWay Hydrogen Fuel Cell Electric Bus (FCEB) pilot, launched in May 2024. As part of this program, MiWay plans to deploy 10 hydrogen fuel cell buses (model Xcelsior CHARGE FC) in 2026, supplied by New Flyer Industries.[54]

Halifax Transit is piloting a hydrogen dual-fuel system integrated with diesel to reduce carbon emissions within its bus fleet.[55] Injecting the hydrogen into the diesel itself will reduce emissions up to 74% while not requiring any engine modifications. RD is also proving effective as a drop-in fuel, notably in California's Twin Rivers school bus transition project which required no engine modifications.[56]

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	High – drop-in for transit fleets	High – drop-in fuel, works with existing diesel engines	Medium – slightly higher cost
Green hydrogen	Medium – global Hydrogen bus pilots	Medium – retrofit possible for fleets	Low – costly vs electric
Methanol	N/A	N/A	N/A
Ammonia	N/A	N/A	N/A

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[53] Solaris buses (Accessed November 8, 2025)

[54] MiWay bus pilot (Accessed November 8, 2025)

[55] Halifax dual fuel pilot (Accessed November 8, 2025)

[56] Twin Rivers school bus transition program (Accessed November 8, 2025)

Table 21: Adoption readiness review of clean fuels in trucking/freight

Trucking/freight

Within the trucking industry, hydrogen fuel cell electric trucks are slowly being deployed. The 2025 Hyundai Xcient has a projected range of 725 km.[57]

RD has already seen widespread adoption across North America and Europe, working seamlessly with existing diesel engines as a drop-in fuel. While slightly more expensive than conventional diesel, it allows fleets to reduce emissions without major retrofits.

Walmart's fleet of Nikola hydrogen fuel cell Class 8 semi-trucks would have been the first of its kind in Canada. These zero-emission trucks, offering an 800 km range, were planned for use in Ontario on longer-haul routes and were projected to save 97 metric tonnes of carbon emissions annually. While Nikola recently filed for bankruptcy, this example remains illustrative of the potential for hydrogen fuel cell technology in reducing emissions in commercial transportation.[58]

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	High – trucks deployed in North America and Europe	High – drop-in fuel, works with existing diesel engines	Medium – slightly higher than diesel
Green hydrogen	Medium – truck pilots in North America and Europe	Medium – retrofit possible, not widespread	Low – costly vs. diesel
e-methanol	N/A	N/A	N/A
Green ammonia	N/A	N/A	N/A

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[57] 2025 Hyundai XCIENT (Accessed January 16, 2025)

[58] Walmart Canada Becomes the First Major Retailer in Canada to Introduce a Hydrogen Fuel Cell Electric Semi-Truck, Nikola (Accessed August 13, 2025)

Table 22: Adoption readiness review of clean fuels in aviation

Aviation

From a technical perspective, aviation faces more constrained decarbonization options than other transport modes due to long aircraft lifespans, safety requirements, and limited feasibility of electrification beyond short haul. While hydrogen and electric propulsion may play a role in regional or private aviation over the next 15–20 years, they are not considered viable pathways for mainstream commercial flight in the near to medium term. As a result, SAF remains the only technically feasible option to achieve material emissions reductions across the existing global fleet without requiring new aircraft designs or engine architectures.

From a cost and supply perspective, SAF remains early in deployment and is currently produced in very limited volumes (constituting well under 1% of total global jet fuel consumption). High production costs—often 3-4 times[59] those of conventional kerosene—and limited feedstock availability are primary barriers to near-term adoption, with many industry analysts noting that scaling SAF production will require significant policy support and investment.

The International Civil Aviation Organization has committed to net-zero CO_2 emissions from international aviation by 2050, supported by the Carbon Offsetting and Reduction Scheme for International Aviation. In parallel, regulations such as the European Union's ReFuelEU Aviation mandate are accelerating SAF uptake by requiring minimum blending levels that increase through 2050 starting with a minimum of 2%.[60] Influenced by these measures, Airbus Canada is piloting an initiative at Mirabel Airport in Montreal to blend Jet-A1 fuel with SAF to reduce carbon emissions by around 400 metric tonnes (30% SAF ratio).[61]

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	N/A	N/A	N/A
Green hydrogen	Low – demonstration project still underway to prove effectiveness of fuel cells	Low - requires significant retrofit or new fuel cell aircraft designs	Low – extremely costly
Methanol	N/A	N/A	N/A
Ammonia	Low – R&D stage	N/A	N/A
SAF	High - regulatory mandates like ReFuelEU driving adoption – routine use is growing	Medium	Low - costs remains considerably higher than kerosene

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[59] IEA: Delivering Sustainable Fuels Pathways to 2035 (Accessed December 2025)

[60] ReFuelEU aviation (Accessed August 13, 2025)

[61] Airbus Canada rolls out sustainable aviation fuel, unlocking 100% SAF capacity across all delivery centres worldwide (Accessed November 8, 2025)

Table 23: Case study project: BioPortYVR (Vancouver International Airport)

Spotlight	BioPortYVR (Vancouver International Airport)
Clean fuel	SAF
Context and ambition	As Canada's second busiest airport, Vancouver International Airport (YVR) was committed to reducing the environmental impact of air travel. While SAF was identified as a potential solution, it was not widely available in Canada at the time of the project's launch. To address this challenge and support both provincial and federal climate action commitments, YVR partnered with the Green Aviation Research and Development Network (GARDN), SkyNRG, and Waterfall Group to launch BioPortYVR—an industry-led initiative focused on assessing and enabling a regional SAF supply chain in British Columbia. The project's ambition is to develop a made-in-B.C. solution that provides a scalable framework for SAF adoption at YVR and airports across Canada, helping the aviation sector align with the International Air Transport Association's (IATA) 2050 emissions reduction goals.[62]
Approach and solution	BioPortYVR's first phase focused on a comprehensive feasibility study focused on SAF development and airport sustainability. The study examined the technical, economic, and logistical viability of implementing an integrated SAF supply chain to serve YVR and surrounding airports, with a vision to establish "BioPorts" as regional demand centres. The project considered sustainable feedstocks such as organic waste streams, agricultural residues, and plant oils, with SAF certified for blending with conventional jet fuel and requiring no changes to aircraft or airport infrastructure. Partners engaged with industry, government, and the community to develop actionable recommendations for SAF introduction, aiming to ensure scalability, regulatory compliance, and cost-effectiveness. The collaborative approach sought to align airline demand with supply-side readiness, leveraging the expertise of SkyNRG (global SAF leader), Waterfall Group (renewable fuels development), and YVR's sustainability leadership.
Outcomes	• The feasibility study established a clear roadmap for developing a regional SAF supply chain. • SAF offers up to 85% lifecycle CO_2 emissions reductions compared to conventional jet fuel. • The project catalyzed cross-sectoral collaboration and industry engagement, resulting in recommendations for policy, procurement, and infrastructure alignment. • The initiative positioned YVR and partners as leaders in sustainable aviation, creating a template for other Canadian airports and regions.
Alignment to clean fuels in Nova Scotia	BioPortYVR illustrates how industry-led collaboration, supported by government policy and technical expertise, can accelerate the adoption of sustainable fuels in hard-to-abate sectors like aviation. The project demonstrates the practicality of "drop-in" SAF as an immediate decarbonization pathway, leveraging existing infrastructure and regulatory frameworks. By establishing a regional supply chain model and actionable recommendations, BioPortYVR paves the way for broader SAF deployment across Canada, supporting national and international climate targets while maintaining reliable air connectivity. The approach exemplifies how transitional fuels can complement longer-term strategies such as electrification or hydrogen, enabling meaningful emissions reductions today as the industry evolves.

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[62] Industry-led Partnership to Advance the Availability of Sustainable Aviation Fuel in Canada (Accessed August 13, 2025)

Table 24: Case study project: Transport Canada's Zero Emission Truck Testbed

Spotlight	Zero Emission Truck Testbed
Clean fuel	Hydrogen
Context and ambition	Medium- and heavy-duty vehicles (MHDVs) account for roughly 27 percent of Canada's transportation sector GHG emissions, prompting the federal Emissions Reduction Plan to mandate that 35 percent of new sales be zero-emission by 2030 and 100 percent by 2040. In this context, the Zero Emission Truck Testbed (ZETT)[63] project was launched to evaluate real-world performance of heavy-duty battery electric vehicles (BEVs) and hydrogen fuel cell electric vehicles (FCEVs) across Alberta and British Columbia. By testing both technologies under varied geographic conditions, load types, and driver profiles, the project seeks to generate Canadian data on cost, reliability, and performance, to support fleet investment decisions, inform policy, and accelerate adoption of clean freight solutions. **ZETT Partners** Transport Canada / Transports Canada AMTA Alberta Motor Transport Association Deloitte.
Approach and solution	The ZETT testbed is structured around four major fleet operators—Sutco Transportation Specialists, Bison Transport, Trimac Transportation, and Arrow Transport—who will deploy Class 8 BEVs and FCEVs on two freight corridors in Alberta and British Columbia. Vehicles will be operated through Canada's four seasons to test performance in diverse climate and terrain conditions. Supporting activities include technical training for drivers, mechanics, tow operators, and first responders to ensure safe operation and maintenance, while also strengthening permitting and regulatory readiness. Deloitte Canada is overseeing stakeholder engagement, project implementation, and reporting, while the Alberta Motor Transport Association (AMTA) provides operational leadership based on its prior experience trialling FCEVs and BEVs with over 30 member carriers. Transport Canada's involvement ensures alignment with federal policy and emissions reduction goals.
Outcomes	• First large-scale Canadian dataset on cost, performance, and operational reliability of zero-emission trucks in commercial freight duty cycles. • Insights for fleet operators to inform future capital investment in BEVs and FCEVs. • Evidence for policymakers to refine regulations and infrastructure strategies to enable market adoption. • Broader industry readiness through training of operators, mechanics, and emergency responders. • Acceleration of the transition away from diesel in freight, contributing to Canada's 2035 and 2040 sales targets for zero-emission trucks.
Enabling organizations and initiatives	• AMTA: project lead; providing operational expertise, safety training, and advocacy. • Transport Canada: funder and national policy lead ensuring project integration with federal emission reduction goals. • Fleet participants: Sutco, Bison Transport, Trimac Transportation, Arrow Transport. • Supporting ecosystem: OEMs, infrastructure developers, hydrogen fueling, and charging providers.
Alignment to clean fuels in Nova Scotia	The ZETT project offers a transferable model for the region's freight sector, where heavy-duty trucking also represents a major source of emissions and is essential to regional trade corridors. Lessons from Alberta and British Columbia, including real-world performance data, seasonal impacts, infrastructure requirements, and workforce training approaches, can directly inform how local fleets, ports, and governments pursue deployment.

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[63] Zero Emission Truck Testbed (ZETT) (Accessed August 13, 2025)

3.3.5 Government operations

While policymakers are instrumental in setting the foundation for the clean energy transition and establishing the regulatory framework for clean fuels, local governments have their own operations which can drive early domestic demand through the early adoption of low-carbon fuels. Municipal fleets, waste management, public works, and health care facilities are beginning to adopt clean fuels, with green hydrogen and RD emerging as leading solutions. These initiatives, spanning from pilot projects to full-scale execution, highlight a broad commitment to integrate clean fuels into critical infrastructure and public services.

Table 25: Adoption readiness review of clean fuels in municipal and First Nations fleets

Municipal and First Nations fleets

RD is the most advanced in this segment, with mature supply chains and immediate compatibility with existing diesel engines. New York City converted its 12,500-vehicle heavy-duty fleet (including administrative vehicles, service trucks, and emergency units) to RD by late 2024, avoiding approximately162 million pounds of CO_2 emissions annually.[64] Several Canadian municipalities and First Nations, such as the Haíłzaqv Nation in British Columbia, have piloted R99 RD for service vehicles, demonstrating strong drop-in adoption potential.[65]

Hydrogen use is emerging[66], with early municipal fleet pilots in California, British Columbia, and Europe using hydrogen fuel cell buses and light-duty service vehicles, though cost and fueling infrastructure remain limiting factors. Methanol and ammonia are not yet in fleet service but hold potential for future retrofits or dedicated new builds in regions with strong production bases.

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	High – widespread municipal adoption in NA & EU; multiple full fleet conversions	High – drop-in use, no retrofit needed	Medium – slightly higher than diesel
Green hydrogen	Medium – pilots are underway	Medium – retrofit possible for vehicles	Low – costly vs diesel
Methanol	N/A	N/A	N/A
Ammonia	N/A	N/A	N/A

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[64] Mayor Adams Announces Full City Fleet has Completed Transition to Renewable Diesel (Accessed November 8, 2025)

[65] Haíłzaqv Renewable Diesel Pilot Project (Accessed November 8, 2025)

[66] While not all municipal hydrogen fleet pilots currently operate on green hydrogen, most rely on a mix of hydrogen sources during early deployment. However, policy commitments and public funding programs in California and British Columbia explicitly aim to transition fleets toward clean or renewable hydrogen, including green hydrogen, over time. Europe is farthest along in this transition, with many municipal hydrogen bus programs already using green hydrogen or planning for an imminent shift to 100% renewable hydrogen, in line with evolving EU regulatory requirements.

Table 26: Adoption readiness review of clean fuels in waste management

Waste management

Heavy-duty refuse trucks and recycling vehicles are prime candidates for RD due to the engine's **torque** benefits and zero-retrofit requirement. NYC's sanitation fleet and several U.S. West Coast municipalities have already adopted it fleet-wide.

Green hydrogen has early trials in refuse trucks, such as the Aberdeen City Council (UK) hydrogen waste truck pilot[67], that could suit routes requiring long range with zero tailpipe emissions, though higher CAPEX and fueling infrastructure build-outs slow scaling. Ammonia and e-methanol are not yet in use in waste management fleets. Ammonia's handling hazards and e-methanol's lower energy density make them less attractive without purpose-built vehicles.

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	High – routine use in NYC and several West Coast cities; mature supply (e.g., garbage trucks)	High – direct drop-in for diesel trucks; no retrofit needed	Medium – near-cost parity
Green hydrogen	Medium – Limited deployments (e.g., Aberdeen waste truck); infrastructure gaps remain	Medium – Requires new fuel cell vehicles or major retrofits; possible but expensive	Low – still costly
Methanol	N/A	N/A	N/A
Ammonia	N/A	N/A	N/A

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[67] Aberdeen City Council adds UK's first hydrogen fuel cell waste truck to the fleet (Accessed November 8,2025)

Table 27: Adoption readiness review of clean fuels in public works

Public works

Public works departments (roads, parks, sewers, infrastructure) often operate mixed fleets of graders, excavators, pickup trucks, and snowplows. RD again dominates short-term adoption potential with proven performance in cold weather and seamless integration.

Alberta and U.S. Midwest municipal equipment fleets have begun incorporating RD for graders and maintenance vehicles. Green hydrogen could serve heavy off-road machinery, where longer operation time between refueling is critical but requires custom fuel cell or hydrogen-combustion designs, making it more likely in long-term replacement cycles. Methanol's role here is minimal at present. Ammonia could emerge as a storage medium for hydrogen in remote depots if bunkering safety standards mature.

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	High – established use in Alberta and U.S. Midwest graders, plows, pickups; mature supply	High – drop-in for diesel engines; no modifications needed	Medium – near-cost parity
Green hydrogen	Medium – limited deployments and some ongoing pilots in fleets	Medium – requires purpose-built fuel cell or hydrogen-combustion engines; possible but expensive	Low – expensive
Methanol	N/A	N/A	N/A
Ammonia	N/A	N/A	N/A

Table 28: Adoption readiness review of clean fuels in health care facilities

Health care facilities

Public-sector health care facilities are using clean fuels mainly for backup power and fleet operations. RD is most advanced, with ambulance fleets in California, Minnesota, and Washington adopting it for drop-in compatibility, cold-weather performance, and immediate emissions cuts.

Green hydrogen is emerging for stationary backup power, as in Klickitat Valley Health's 2024 project using PEM electrolyzers and fuel cells.[68] While still early-stage, these projects benefit from mature supply chains in select regions like California, Japan, and Western Europe.

Other fuels remain in pilots with long-term potential. Methanol offers high energy density and easy handling, tested in CHP systems in Europe and China, but with <1% penetration in North America. Ammonia could supply low-carbon heat and power but faces safety and infrastructure hurdles in dense urban settings. SAF has little direct role in facilities but could cut emissions in air ambulance services.

Adoption is driven by cost, retrofitting needs, and supply chain maturity. RD is most competitive today, while hydrogen is more viable in incentive-rich regions despite high capital costs. Methanol faces price volatility and equipment needs, ammonia is limited by safety risks, and SAF remains costly.

Overall, the sector is early stage for all fuels except RD, with uptake concentrated where clean fuel supply chains and funding programs are strongest.

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	Medium – used in stationary gensets (e.g., Klickitat Valley Health) and vehicle fleets	Medium - drop-in for existing diesel generators and vehicles	Medium – near-cost parity
Green hydrogen	Medium – examples include Viamed San José Hospital (Spain) and other resilience projects; supply chains developing	Medium – retrofitting backup systems remains tough	Low – high costs
Methanol	N/A	N/A	N/A
Ammonia	N/A	N/A	N/A

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[68] Kohler and Toyota partner on hydrogen fuel cell for U.S. hospital (Accessed November 8,2025)

Table 29: Adoption readiness review of clean fuels in emergency services

Emergency services

National Health Services (NHS) in the UK initiated the ULEMCo ambulance pilot project. The ambulance has a hydrogen fuel cell with a 300-mile range and can be refuelled quickly.[69] By adopting this zero-emission technology, the NHS can cut pollution, improve public health, and inspire wider adoption of clean fuels within critical services.

It is important to note that due to the life safety aspect of ambulances, these types of vehicles are typically among the last to be converted to new technologies. It is recommended that such applications be explored once the technology has been proven in other duty cycles. Including this consideration helps ensure that patient safety and operational reliability remain the highest priorities as new technologies are introduced. For this reason, insights on market penetration and deployment, retrofit compatibility, and relative competitiveness for this sub-sector were not included. These factors can be considered once the technology demonstrates proven performance and safety in less critical government operations segments.

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	High – works in police/fire fleets	High – drop-in with diesel	Medium – slightly more costly
Green hydrogen	Low – pilots are rate but there are few fire truck pilots	Low – retrofit difficult	Low – high costs
Methanol	N/A	N/A	N/A
Ammonia	N/A	N/A	N/A

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[69] ULEMCo Shows World's First Hydrogen Powered Ambulance Prototype at COP26 (Accessed November 8,2025)

Table 30: Case study project: Klickitat Valley Health hydrogen fuel cell for hospital power

Spotlight	**Klickitat Valley Health hydrogen fuel cell for hospital power**
Clean fuel	Hydrogen
Context and ambition	Klickitat Valley Health (KVH), a 25-bed rural critical-access hospital in Washington state, has installed a 100-kW hydrogen fuel cell system composed of two 50-kW Toyota solid polymer (polymer electrolyte membrane) modules integrated into a turnkey package by Rehlko.[70] The system generates electricity with only water and heat as by-products and is designed for prime, peak-shaving, or emergency operation. Faced with aging electrical infrastructure, KVH adopted a microgrid approach to improve resilience during community emergencies and reduce reliance on diesel, while pursuing grants and loans for broader utility upgrades. Supported as a state demonstration project and aligned with a community preparedness microgrid initiative, the installation supplements essential power during outages today and provides a real-world pathway toward diesel-free hospital backup in the future.
Approach and solution	The Rehlko/Toyota fuel cell system is tied directly into the main electrical service of KVH's medical-surgical wing, allowing grid-connected demand reduction and stand-alone operation with load-shedding coordinated through the building automation system. While the 100-kW unit is not yet sized to run KVH's full 350-kW essential electrical system, it supplements normal power circuits during outages and supports peak shaving and demand response. KVH navigated permitting and safety using National Fire Protection Association (NFPA) 70, NFPA 55, and NFPA 853 and instituted staff and first-responder training for hydrogen systems.
Outcomes	• System installed and commissioned activities underway: ribbon-cutting and project milestone recognized in November 2024 as part of the Energy Storage for Social Equity (ES4SE) partnership; hospital utility upgrades advanced in parallel. • Operational roles: configured for backup, peak shaving, and demand response; first stationary deployment of Toyota Mirai fuel-cell technology reported for this application. • Next steps and limits: additional storage/runtime and capacity would be needed to fully replace diesel (e.g., 36-hour backup requirement), but the project demonstrates feasibility and integration in a live hospital setting.
Alignment to clean fuels in Nova Scotia	This hospital-grade hydrogen fuel-cell model is directly transferable to critical-infrastructure sites (hospitals, emergency shelters, data hubs) that face outage risks from severe weather and aging grids. Local production combined with hospital microgrid planning, create conditions to replicate KVH's approach: start with supplemental/peak-shaving fuel-cell capacity integrated into existing electrical systems and scale toward diesel-free resilience as local green-hydrogen supply and storage mature.

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[70] Revolutionizing Mission-Critical Power (Accessed August 13, 2025)

Table 31: Case study project: Edmonton Region Hydrogen Hub and Strathcona County pilot

Spotlight	Edmonton Region Hydrogen Hub and Strathcona County pilot
Clean fuel	Hydrogen
Context and ambition	Edmonton Transit Service and Strathcona County Transit are jointly running a 42-month hydrogen bus demonstration (June 2021–January 2025) to evaluate the feasibility of hydrogen as a replacement for diesel in heavy-duty municipal bus fleets.[71] The pilot includes one bus in each fleet and is supported by $4.6 million CAD from Emissions Reduction Alberta (ERA), alongside research by the University of Alberta's Energy Mechatronics Laboratory. The project was launched in the context of Canada's tightening emission reduction policies and rising diesel costs, with the goal of testing hydrogen in real-world cold-weather, high-utilization conditions. Edmonton and Strathcona see hydrogen as a promising alternative to address the limitations of electric buses in cold climates and to support the regional economy through the Edmonton Regional Hydrogen Hub. The pilot uses hydrogen FCEBs manufactured by New Flyer.
Approach and solution	The buses entered fare service in October 2023 after initial testing that simulated passenger loads with sandbags and "shadowed" diesel buses to benchmark range. The pilot deliberately exposed the buses to Edmonton's cold climate to identify technical and operational issues early, such as valve leaks due to freezing and minor casing defects in high-voltage wiring. Hydrogen refuelling is currently supplied through a Suncor facility in Sherwood Park, though Edmonton has issued a request for proposals for a dedicated station to handle production, delivery, and maintenance. Safety protocols were developed with regulators, though Canadian hydrogen transit standards are still emerging; both transit agencies contribute to the Canadian Standards Association (CSA) advisory panels shaping these codes.
Outcomes	• Buses demonstrated range and performance comparable to diesel buses, including in cold-weather conditions, with early data suggesting advantages over battery-electric buses for range resilience. • Operational challenges included refuelling outages, valve freezing, and wiring safety checks, but were resolved through maintenance • Safety learnings contributed to Canada's emerging hydrogen standards through CSA engagement. • Upon project completion in 2025, the pilot buses will be redeployed to Calgary Transit and Roam Transit (Banff/Canmore)
Enabling organizations and initiatives	• Edmonton Transit Service and Strathcona County Transit — project leads and operators. • ERA — provided $4.6 million CAD in funding. • University of Alberta – Energy Mechatronics Laboratory — leading performance research and evaluation. • Suncor — partner for hydrogen refuelling during the pilot. • New Flyer — manufacturer of the fuel cell electric buses. • Edmonton Region Hydrogen HUB — broader regional initiative aligning supply and demand. • CSA — working group developing hydrogen transit safety standards, with pilot participants contributing.
Alignment to clean fuels in Nova Scotia	This project demonstrates the viability of hydrogen buses in cold climates, a relevant lesson for the Strait where winter conditions pose a challenge to electrification. The pilot highlights hydrogen's advantage over battery-electric buses in range, refuelling speed, and resilience during cold weather—critical considerations for transit fleets in Nova Scotia. The project underscores how pilot-scale deployments, tied to regional hydrogen strategies, can accelerate municipal fleet decarbonization in Nova Scotia.

3.3.6 Utilities

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[71] City of Edmonton and Strathcona County trial hydrogen buses (Accessed August 13, 2025)

Table 32: Adoption readiness review of clean fuels in utilities

Natural gas blending

Utilities in Europe, Australia, and North America are piloting the injection of green hydrogen into existing natural gas grids, at blends of 2–20%. These projects test impacts on pipelines, appliances, and end-user safety. Renewable gases such as RNG are more established, but among the five fuels in scope, hydrogen is the most relevant. Methanol, ammonia, RD, and SAF are not blended into gas networks because of their physical/chemical properties.

According to the IEA's Global Hydrogen Review 2025[72], hydrogen blending into natural gas networks is being explored through pilots in multiple jurisdictions, with blend limits generally set on a project- and network-specific basis (in some cases reaching up to around 20% by volume). There are small-scale pilots underway in California and Ontario through SoCalGas and Enbridge respectively. Most utilities see blending as a transitional step, not a long-term solution, because high blends (>20%) often require appliance retrofits.

Market penetration potential is medium, active pilots are spreading, but routine large-scale blending is not yet established. Retrofit compatibility is medium, existing networks can handle modest blends but require costly appliance changes for higher shares. Competitiveness is low: electrolytic hydrogen is still less than 2–3 times the cost of natural gas on an energy basis, so blending is viable only where subsidized or mandated.

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	N/A	N/A	N/A
Green hydrogen	High – many 2–20% blending pilots underway globally	Medium – retrofit possible in pipelines	Low – less than2–3 times cost of NG without subsidies but declining slowly
Methanol	N/A	N/A	N/A
Ammonia	N/A	N/A	N/A

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[72] IEA Global Hydrogen Review 2025 (Accessed on October 17, 2025)

Table 33: Adoption readiness review of clean fuels in energy generation

Energy generation

Fuel	Market deployment	Retrofit compatibility	Price competitiveness
Renewable diesel	Medium – RD power gens used in microgrids	Medium – compatible for backup	Medium – slightly higher costs
Green hydrogen	High – turbine pilots at 20–50% blends	Medium – retrofits possible with modifications	Low – less than 2 times NG cost
Methanol	Low – not common	Low – not applied	Low – cost prohibitive
Ammonia	Low – ammonia co-firing emerging	Low – needs new infrastructure	Low – not cost competitive

Utilities are experimenting with hydrogen co-firing in gas turbines and ammonia co-firing in coal/thermal boilers. GE, Siemens, and Mitsubishi[73] turbines have operated with 20–50% hydrogen blends, with targets to reach 100% hydrogen-capable turbines this decade. Japan has led ammonia co-firing demonstrations in coal power stations (up to 20% ammonia)[74]. RD and methanol are rarely used in large-scale utility power generation due to fuel cost and limited volumes.

Hydrogen combustion for power is expanding fastest in Europe, Japan, and the US, supported by gas-turbine OEM commitments and utility pilots. Ammonia is seen as a potential long-term solution in Asia for repurposing coal assets. Methanol has been tested in dual-fuel engines for small-scale distributed generation but not utility-scale turbines.

Hydrogen in turbines has medium market penetration at pilot scale and medium retrofit compatibility (existing turbines can take low blends; new builds required for 100%). Relative competitiveness is low because hydrogen fuel remains much costlier than natural gas, though blending may work with policy credits. Ammonia co-firing is at low penetration and faces safety, NOx emissions, and cost barriers.

RD/methanol are technically feasible but uncompetitive and scarce for large-scale power.

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[73] Georgia Power tests 50% hydrogen blend in a natural gas turbine (Accessed November 8, 2025)

[74] JERA on track for 20% ammonia co-firing at Hekinan coal power plant 20%. Reuters (Accessed January 19, 2026)

Table 34: Case study project: Hydrogen blending in natural gas grid in Markham, Ontario

Spotlight	**Hydrogen blending in natural gas grid in Markham, Ontario**
Clean fuel	Green hydrogen
Context and ambition	The Markham Energy Storage Facility, developed by Enbridge Gas in partnership with Hydrogenics (now part of Cummins), was commissioned in 2018 as North America's first utility-scale power-to-gas project to convert surplus renewable electricity into hydrogen for storage and use. Building on this foundation, Enbridge launched a pilot in 2021 to blend green hydrogen, produced via electrolysis at the Markham facility, into the local natural gas distribution network at low concentrations, reducing the CI of delivered gas without requiring changes to customer equipment. Through this demonstration, Enbridge aims to show that hydrogen can be integrated safely and reliably into existing energy infrastructure while fostering public and regulatory confidence in its role as a clean fuel for residential and commercial use.[75]
Approach and solution	The blending project involves a 2.5 MW PEM electrolyzer[76], capable of producing up to 500 normal cubic metres of hydrogen per hour. The hydrogen is injected into a designated section of the natural gas grid in Markham at a blend of up to two percent by volume. This concentration was selected to ensure safety and compatibility with existing end-use appliances. The pilot is carried out in collaboration with the Ontario Energy Board (OEB) and Technical Standards and Safety Authority (TSSA) to validate codes, standards, and regulatory pathways. The project also generates operational data on hydrogen blending, informing future scale up to higher blend levels or wider geographic coverage.
Outcomes	• First hydrogen blending project in Ontario's natural gas system. • Demonstrated safe and reliable injection of hydrogen into the existing pipeline infrastructure. • Enabled development of regulatory and safety frameworks for hydrogen blending in Canada. • Positioned Enbridge to explore expanded blending pilots and higher penetration rates in the future.
Enabling organizations and initiatives	• Enbridge Gas — project lead and operator of the Markham Energy Storage Facility. • Hydrogenics (now Cummins) — technology provider for the PEM electrolyzer system. • OEB& TSSA — regulatory oversight. • Natural Resources Canada (NRCan) & Sustainable Development Technology Canada (SDTC) — funding and program support for the original power-to-gas (P2G) facility. • Markham municipal government — host community for the project.
Alignment to clean fuels in Nova Scotia	Hydrogen blending into natural gas systems represents a short-term pathway for emission reductions in the region, where natural gas serves industrial and commercial customers. Like Markham, blending projects could help reduce the CI of delivered fuel while long-term electrification and hydrogen conversion strategies mature. Regulatory and safety learnings from the Ontario pilot are directly transferable, particularly around permissible blend levels, customer appliance performance, and pipeline integrity. As the region develops green hydrogen supply from projects like EverWind, blending offers an early domestic use case that supports market development alongside export ambitions.

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[75] Hydrogen News: North America's First Major Power-to-Gas Energy Storage Facility Now Open (Accessed November 8, 2025)

[76] North America's First Multi-Megawatt Power-to-Gas Facility Begins Operations (Accessed November 8,2025)

Table 35: Case study project: Mitsubishi Power hydrogen co-firing in grid connected gas turbine

Spotlight	Mitsubishi Power hydrogen co-firing in grid connected gas turbine
Clean fuel	Hydrogen
Context and ambition	Mitsubishi Power is advancing the use of hydrogen co-firing in advanced-class gas turbines as a pathway to lower the CI of grid power, having already demonstrated 30% hydrogen by volume on a grid-connected turbine at its T-Point 2[77] validation plant in Japan and up to 50% blending at Georgia Power's Plant McDonough-Atkinson.[78] Building on these demonstrations, the Intermountain Power Project (IPP) Renewed program in Utah is replacing coal generation with an 840 MW combined-cycle facility equipped with Mitsubishi Power turbines designed to begin commercial operation on approximately 30% hydrogen in 2025, with a roadmap to 100% hydrogen no later than 2045.[79]The project is integrated with the Advanced Clean Energy Storage (ACES Delta) hub[80], which will convert renewable electricity into hydrogen and store it in salt caverns (initially approximately 100 tonnes per day and more than 300 gigawatt hours (GWh) of storage, creating one of the world's first pathways to large-scale, dispatchable, carbon-free power.
Approach and solution	Mitsubishi Power validates combustor stability and low-NOx performance for hydrogen blends on a full-scale, grid-synchronized turbine where hydrogen production, storage, and use are integrated in the Takasago Hydrogen Park. Testing has confirmed 30% hydrogen co-firing from partial to full load with low NOx combustion. In parallel, utility-scale trials like Plant McDonough-Atkinson have proven up to 50% hydrogen blending after hardware and controls upgrades, providing real-world data across load points. Commercial projects such as IPP Renewed apply this know-how to grid assets, beginning with 30% co-fire and ramping hydrogen content as supply and storage scale via ACES Delta.
Outcomes	• 30% hydrogen co-firing achieved on a grid-connected turbine at T-Point 2 with verified low-NOx and stable combustion; plans include further testing at higher blends. • 50% hydrogen blending demonstrated at Georgia Power's McDonough-Atkinson plant, the largest advanced-class gas-turbine hydrogen blend test to date, cutting CO_2 approximately 22% versus 100% natural gas during the trial. • IPP Renewed began commercial operation in July 2025 with hydrogen-capable turbines and a target trajectory to 100% hydrogen by 2045, enabled by ACES Delta's large-scale hydrogen production and storage.
Alignment to clean fuels in Nova Scotia	Hydrogen co-firing offers a pathway to decarbonize existing gas-fired assets while firming variable renewables, an approach aligned with Nova Scotia's Green Hydrogen Action Plan, which cites hydrogen for peak power generation and blending, and with NS Power's 2025 10-Year System Outlook, which explicitly tracks hydrogen-fueled combustion turbines as an emerging option. Potential early candidates for future co-firing strategies include natural-gas units such as Tufts Cove Generating Station (NS), subject to detailed engineering, permitting, and fuel-supply readiness. The IPP/ACES template, hydrogen-ready turbines paired with large-scale storage, provide a potentially transferable model for dispatchable, lower-carbon power in the region.

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[77] Mitsubishi Power Successfully Operates an Advanced Class Gas Turbine with 30% Hydrogen Fuel Co-Firing at Grid-Connected T-Point 2 (Accessed November 8,2025)

[78] 50% hydrogen blend testing successfully completed at Georgia Power's Plant McDonough-Atkinson (Accessed November 8,2025)

[79] Mitsubishi Power delivers Hydrogen-Ready Gas Turbines to "IPP Renewed" Project in Utah to meet Decarbonization Goals in the Western US (Accessed November 8, 2025)

[80] ADVANCED CLEAN ENERGY STORAGE Site (Accessed November 8,2025)

3.4 The balance between electrification on clean fuels adoption

Electrification is a recognized pathway for decarbonizing transportation, with electric vehicles (EVs) offering clear emissions benefits. The transition to EVs, however, involves a range of infrastructure considerations. Widespread adoption requires investment in charging networks, upgrades to the electrical grid to accommodate increased demand, and the development of fast-charging capabilities to support operational needs. Unlike dual-fuel solutions, which use existing fuel infrastructure, electrification typically involves constructing and modernizing public and private charging facilities, including in rural and remote areas where grid capacity may be limited. Fleet operators also need to assess the costs and logistics associated with installing depot charging solutions and managing vehicle charging schedules. The scale and complexity of these infrastructure requirements may influence the pace of drop-in clean fuel adoption, particularly in hard-to-electrify sectors such as heavy-duty or long-haul transport and manufacturing. These factors should be considered alongside the adaptability and lower upfront costs associated with retrofitting existing fleets with dual fuel or drop-in fuel technologies.

3.5 Summary of the adoption readiness matrix

The resulting qualitative adoption readiness assessment (

Table 36), identifies RD as the most broadly adoption-ready clean fuel across multiple sectors in the Strait of Canso region. RD demonstrates high readiness in applications such as light and medium industry, logistics and maintenance, public transportation, trucking/freight, government fleets, waste management, public works, emergency services, and support vessels. Hydrogen resulted in an overall high rating for natural gas blending within utilities and a medium rating in processing plants, logistics, public transportation, trucking, ferries, and several government operations. Ammonia and methanol generally resulted in lower overall ratings, with their primary applications concentrated in marine sectors; both received medium ratings for commercial shipping, ferries, and support vessels, with ammonia also receiving a medium rating for fishing fleets. SAF is currently assessed as having a medium readiness rating for aviation, though adoption is limited by cost and scaling factors.

Clean fuel use cases with overall qualitative adoption readiness ratings of “medium” or “high” were prioritized to generate a list of clean fuel opportunities. In contrast, use cases rated as “low” were recommended to be paused or held at this time These opportunities will be mapped to relevant sectors, sub-sectors, and organizations in subsequent sections to further assess their applicability to the local context.

Table 36: Summary clean fuel adoption readiness matrix

Sector	**Hydrogen**	**Ammonia**	**Methanol**	**Renewable diesel**	**SAF**
1. Industrial					
Processing plants	Medium	Low	Medium	Low	N/A
Light, medium, industry	Low	Low	Low	High	N/A
Logistics and maintenance	Medium	Low	Low	High	N/A
2. Marine vessels					
Fishing fleet	Low	Medium	Low	Low	N/A
Ferries	Medium	Medium	Medium	High	N/A
Commercial shipping	Low	Medium	Medium	Medium	N/A
Support vessels and bunkering	Medium	Medium	Medium	High	N/A
3. Transportation					
Public transportation	Medium	Low	Low	High	N/A
Trucking/freight	Medium	Low	Low	High	N/A
Aviation	Low	Low	Low	Low	Medium
4. Government operations					
Municipal and First Nations fleets	Medium	Low	Low	High	N/A
Waste management	Medium	Low	Low	High	N/A
Public works	Medium	Low	Low	High	N/A
Healthcare facilities	Low	Low	Low	Medium	N/A
Emergency services	Low	Low	Low	High	N/A
5. Utilities					
Natural gas blending	High	Low	Low	Low	N/A
Energy generation	Medium	Low	Low	Medium	N/A

3.6 Review of enabling policy and incentive levers

Clean fuels typically cost more than the fossil fuels they are intended to replace. This price disparity, often referred to as the “value gap”, is driven by higher production costs for clean fuels and a limited willingness to pay among end users. Bridging this gap is essential for widespread adoption and requires coordinated action across the entire value chain.

3.6.1 Overview of global trends

The clean fuels market is fundamentally policy driven. Without supportive policies, incentives, regulations, and infrastructure investment, the value gap between conventional fossil fuels and clean alternatives remains too large for market forces alone to close. Jurisdictions worldwide have acknowledged this challenge and are implementing a mix of enabling measures, with supply-side and demand-side policy frameworks forming critical building blocks (Figure 5):

- **Supply-side measures:**
  These include production tax credits, grants, and regulatory frameworks such as British Columbia or California’s Low Carbon Fuel Standard (LCFS). A LCFS incentivizes the production, blending, and use of low-carbon fuels, helping to move prices toward parity with fossil fuels.

- **Demand-side measures:**
  On the asset side, demand-side policies focus on reducing the cost of adoption for end users. Examples include vehicle subsidies for electric buses, trucks, and other fleet assets, which lower the upfront switching costs. These incentives are particularly important for technologies requiring new engines or vehicles.

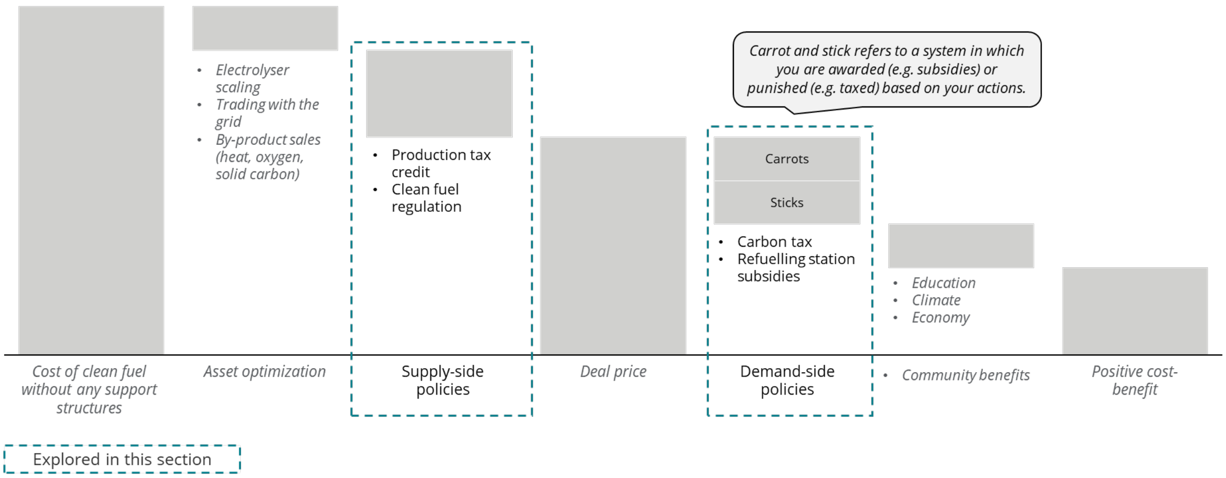

Figure 5: Clean fuel adoption enablers

Broad adoption requires support across the entire value chain. However, for the Strait of Canso, we will highlight emerging trends that may effectively close the value gap for domestic use and support clean fuel offtake.

3.6.2 Key types of policy and incentive levers at the federal level

Broadly, according to the Pacific Northwest Economic Region (PNWER) Alberta Hydrogen Analysis 2025, these levers can be classified into four categories to operationalize government policies and strategies:[81]

1. **Strategic finance**: Governments can deploy financial mechanisms such as grants, low-interest loans, public-private partnerships, or direct investments to support clean fuel projects. Strategic finance helps reduce the upfront costs and risks for businesses and consumers, accelerating adoption and scaling of clean fuel technologies.

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[81] Alberta Hydrogen Analysis 2025 (Accessed August 13, 2025)

2. **Tax credits or exemptions:** Offering tax credits or exemptions (e.g., for purchasing electric vehicles, installing solar panels, or producing renewable fuels) creates financial incentives. These levers lower the effective cost, making clean fuels more attractive compared to conventional options and encouraging market uptake.
3. **Targeted programming:** Targeted programming includes specific initiatives such as pilot projects, R&D grants, public awareness campaigns, or training programs for clean fuel technologies. These programs address barriers, build capacity, and stimulate demand in strategic sectors or populations.
4. **Regulatory frameworks:** Establishing a regulatory framework involves setting standards (e.g., emissions limits, fuel quality requirements), mandating clean fuel adoption (e.g., renewable fuel standards), and ensuring compliance through monitoring and enforcement. This creates a predictable environment for investment and drives industry-wide transition.

Strategic finance national-level examples[82]

Governments are increasingly turning to strategic finance mechanisms to share investment risks and enable early deployment of clean fuel technologies. In the United States, the Regional Clean Hydrogen Hubs (H2Hubs)[83] program had allocated more than $7 billion USD in federal funding to establish geographically diverse hydrogen hubs; however, due to recent changes in political support, both the Arches[84] and Pacific Northwest Regional Hydrogen Hub (PNWH2)[85] have been defunded, leaving no further active hydrogen hubs. These hubs were intended to demonstrate integrated value chains, while testing different production pathways and end-use applications under public–private partnership models.

In the EU, the Innovation Fund channels revenues from the EU Emissions Trading System (EU ETS) into large-scale demonstration projects in hydrogen, carbon capture, renewable fuels, and industrial decarbonization. By targeting first-of-a-kind and early commercial projects, the Fund is designed to address financing gaps that often prevent technologies from moving beyond the pilot stage.

In Canada, the Canadian Infrastructure Bank's (CIB) Charging and Hydrogen Refueling Infrastructure Initiative (CHRI)[86] provides support for private-sector delivery of large-scale charging and hydrogen refueling stations, with eligible project costs starting at $20 million CAD and funding that extends to operation and maintenance. Taken together, these cases illustrate how strategic finance is being applied at the national level, with different jurisdictions emphasizing hub-scale demonstrations, commercialization support, or enabling infrastructure.

Drawing from these models, the Strait of Canso can benefit by advocating for and leveraging similar strategic finance mechanisms, such as public-private partnerships and infrastructure investment programs, to reduce risk for early-stage clean fuel projects, particularly for hydrogen and marine fuel infrastructure.

Tax credits or exemptions national-level examples[87]

Tax-based incentives remain one of the most widely applied policy tools to lower the cost of clean fuels relative to conventional options. In the EU, adjustments to the Emissions Trading System (ETS), such as zero-rating or transitional exemptions for certain low-carbon fuels, function as indirect tax relief by lowering compliance costs for eligible producers and users.

In Canada, the federal government has introduced a series of clean investment tax credits (ITCs) covering areas such as clean hydrogen, clean technology adoption, and carbon capture, utilization, and storage. These credits are designed to reduce upfront capital costs for businesses, with eligibility criteria tied to project type and technology. Importantly, the amount of money received is tied directly to emissions reductions. Collectively, these measures show how tax credits and exemptions are being

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[82] Refer to Appendix 7.2 for the detailed policy levers review.

[83] Regional Clean Hydrogen Hubs (Accessed November 8, 2025)

[84] California Pauses Hydrogen Hub Activities Amid Federal Funding Changes (August 13, 2025)

[85] PNWH2 Statement on DOE Funding Cuts (Accessed August 13, 2025)

[86] Charging and Hydrogen Refuelling Infrastructure Initiative (Accessed August 13, 2025)

[87] Refer to Appendix 7.2 for the detailed policy levers review.

used to influence investment decisions, though their effectiveness depends on market design, credit values, and the predictability of policy over time.

By understanding and aligning with these national tax credit frameworks, project proponents, suppliers, and community members in the Strait of Canso can unlock additional financial support for clean fuel projects, making investments in advanced fuels and related infrastructure more economically viable for local businesses.

Targeted programming national-level examples[88]

Targeted programming has become a cornerstone of national strategies to accelerate decarbonization, foster innovation, and enable the transition to low-carbon economies. In the United States, the Clean School Bus Program stands out as a highly targeted and impactful initiative. It offers funding for the replacement of existing school buses with clean, alternative fuel or zero-emission buses, prioritizing high-need, low-income, rural, and Indigenous communities.[89] By covering up to 100% of the cost for new vehicles and charging infrastructure, the program not only reduces emissions and improves air quality for students and communities but also stimulates the domestic market for electric and alternative fuel vehicles (AFVs).

The EHB represents a forward-looking financial mechanism designed to facilitate the growth of the clean hydrogen economy across the EU. Managed by the European Commission, the EHB uses auction-based systems to provide fixed-price premiums, de-risking investments and supporting the build-out of hydrogen production, infrastructure, and import terminals. This targeted programming is critical to meeting the EU's ambitious renewable energy and decarbonization targets, while also fostering innovation and cross-sectoral collaboration.

These examples illustrate a broader trend toward strategic, sector-specific interventions that address both supply and demand barriers. Current targeted programming emphasizes inclusivity (supporting a wide range of applicants and technologies), scalability (funding projects that can catalyze broader market transformation), and co-benefits (such as job creation, air quality improvements, and community resilience). Looking ahead, successful targeted programming will likely continue to blend financial incentives, regulatory support, and innovation partnerships to accelerate the deployment of low-carbon technologies at scale.

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[88] Refer to Appendix 7.2 for the detailed policy levers review.

[89] Clean School Bus Program (Accessed on August 13, 2025)

Regulatory framework national-level examples[90]

National-level regulatory frameworks are increasingly central to accelerating decarbonization and shaping investment in clean fuels and technologies. Four prominent examples demonstrate how binding targets and market-based mechanisms are driving progress toward net-zero goals.

The IMO's carbon-target and pricing mechanism was not adopted in October–November 2025; Member States deferred the vote for 12 months, with talks scheduled to resume in 2026[91]. As a result, the proposed global fuel-intensity standard and GHG-pricing framework for ships over 5,000 Trigonally envisaging penalties up to $380/tonne CO_2 under a two-tier system, remain prospective rather than in force, with the earliest feasible entry-into-force now pushed to 2028. This deferral extends policy uncertainty but does not eliminate the underlying opportunity - if adopted in 2026, the framework would strengthen price signals for cleaner fuels and propulsion which would catalyze significant shifts in fuel choices and operational practices, reinforcing global decarbonization drivers and aligning shipping with net-zero ambitions.[92]

In the European Union, the EU Emissions Trading System (ETS) and Carbon Border Adjustment Mechanism (CBAM) stand out as leading regulatory frameworks. The EU ETS is a cap-and-trade system that sets a declining cap on GHG emissions for key sectors, including energy and industry, and now aviation and maritime transport. Companies must hold allowances for every tonne of CO_2 emitted, with carbon prices expected to reach €100–135/tonne by 2030. The CBAM complements this by imposing a carbon price on certain imports, ensuring fair competition and preventing carbon leakage. These mechanisms create strong, predictable price signals that drive investment in clean technologies and incentivize emissions reductions across the economy.

In the United States, prior to the current administration, the Clean Air Act (CAA) GHG Emissions Standards provided a robust regulatory foundation for decarbonization. The Environmental Protection Agency (EPA) had established sector-specific GHG emissions standards for vehicles, power plants, and industrial sources. These standards were progressively tightened, requiring automakers to produce cleaner vehicles and utilities to transition toward low-carbon power generation. The CAA framework had proven effective in driving innovation, reducing emissions, and supporting the growth of clean energy markets at scale.

In Canada, the CFR require fuel suppliers to reduce the lifecycle carbon intensity (LCI) of liquid fuels, incentivizing the development and blending of clean fuels such as biofuels, RD, and hydrogen. The CFR uses a credit trading system to provide flexibility while maintaining stringent emissions reduction targets. Notably, decarbonization targets under the CFR become more stringent over time but drop after 2035 when LNG is no longer considered an eligible clean fuel, creating an opportunity for additional focus on advanced biofuels, hydrogen, and other emerging solutions.

These regulatory frameworks reflect a global shift toward market-based mechanisms and binding standards that internalize carbon costs and guide investment, though with differing levels of certainty. The IMO's pricing mechanism now remains prospective following the 2025 deferral, while the EU ETS and CBAM are fully operational and continue to set the pace for carbon pricing and border adjustments. The U.S. and Canadian frameworks illustrate how sector-specific standards and flexible compliance pathways can drive progress, even as U.S. federal rules face increased uncertainty under the proposed repeal of power-sector GHG standards.

3.6.3 Other supportive mechanisms at the provincial and municipal level

Provincial and municipal governments in Canada and abroad play a critical role in accelerating clean fuel adoption by complementing national policies with locally tailored initiatives. These approaches address unique market conditions, infrastructure requirements, and community priorities, bridging the gap between federal ambitions and on-the-ground implementation. Their effectiveness lies in the ability to respond to local economic realities, geographic constraints, and stakeholder needs, creating a more nuanced and comprehensive framework for clean fuel deployment.

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[90] Refer to Appendix 7.2 for the detailed policy levers review.

[91] IMO net-zero shipping talks to resume in 2026 (Accessed January 16, 2026)

[92] IMO approves net-zero regulations for global shipping (Accessed August 13, 2025)

Policy and incentive stacking

British Columbia's LCFS and Quebec's Renewable Fuel Standard serve as examples of comprehensive provincial clean fuel policies. BC's LCFS mandates increasing volumes of renewable fuels, including RD and SAF, with specific volumetric targets for jet fuel starting at 1% in 2028.[93] Quebec requires minimum renewable content in gasoline and diesel and supports local production facilities through preferential procurement.[94] When combined with federal instruments such as Canada's Clean Fuel Regulations[95], investment tax credits, and risk-sharing mechanisms under the Canada Growth Fund, these provincial policies demonstrate the power of incentive stacking, where demand-side compliance markets, capital support, and carbon credit mechanisms reinforce one another.

For the Strait of Canso, aligning local enabling actions (e.g., permitting, infrastructure access, or targeted pilot support) with provincial and federal programs can materially improve project economics, reduce investor risk, and strengthen the business case for clean fuels adoption without relying on any single policy lever.

Non-monetary support and regulatory harmonization

Experience from other jurisdictions shows that non-monetary support can be as critical as financial incentives in accelerating clean fuel adoption. The Green Freight Program in Ontario and Quebec exemplifies non-monetary support by providing technical guidance, hands-on operational assistance, and help with integrating hydrogen and RD vehicles into fleets. Nova Scotia's Clean Technology Accelerator offers technical assistance and regulatory navigation, with a focus on marine applications. Manitoba's support for agricultural biofuels addresses sector-specific adoption through equipment compatibility guidance and supply chain logistics.

Offering tailored technical support, training, and regulatory harmonization is essential for successful clean fuel adoption. This approach can help local fleets, marine operators, and other relevant sectors overcome practical challenges and support regionally appropriate implementation.

3.7 Lessons learned from LNG

Large energy transition projects share common characteristics regardless of end market: long development timelines, high upfront capital requirements, complex permitting, and the need to align infrastructure, policy, and market demand over many years. Canada's LNG experience, most notably LNG Canada, offers relevant lessons not because domestic clean fuel initiatives will replicate its scale, but because it illustrates how timing, coordination, and credibility shape outcomes for host communities and investors alike.

LNG Canada is a large-scale, $40 billion CAD liquefied natural gas export facility located in Kitimat, British Columbia, and represents the largest private-sector investment in Canadian history.[96] Developed by a consortium led by Shell, the project includes upstream gas supply, a liquefaction terminal, and supporting marine and utility infrastructure, and reached first LNG production in 2024 after more than a decade of development, permitting, and construction.

For regions pursuing domestic clean fuel use, the LNG experience underscores the importance of sequencing development carefully, managing expectations over long timelines, and ensuring that early actions create tangible local value rather than speculative momentum.

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[93] IETA: BC's LCFS at a glance (Accessed August 17, 2025)

[94] Government of Quebec: Regulation respecting the integration of low-carbon-intensity fuel content into gasoline and diesel fuel (Accessed August 17, 2025)

[95] Government of Canada: What are the Clean Fuel Regulations? (Accessed August 17, 2025)

[96] Government of British Columbia: Premier celebrates first LNG Canada shipments to Asia (Accessed January 2026)

Table 37: Key lessons from British Columbia's LNG Canada experience

Theme	Lessons	Description
Market	Market conditions and priorities can shift within community planning horizons	A central lesson from LNG Canada is that commercial conditions and investment priorities can change materially while projects are still advancing through permitting and construction. Public reporting on LNG Canada's Phase 2 indicates that global market dynamics and portfolio considerations influenced investment timing.[97] For domestic clean fuel strategies, this reinforces the importance of anchoring early initiatives in real, near-term demand rather than future projections alone. Communities benefit most when early pilots are sized to existing fleets, facilities, or utilities, and when scale-up decisions are tied to demonstrated utilization rather than aspirational timelines. This reduces the risk of stranded infrastructure and avoids community fatigue from repeated "announce–pause" cycles.
Infrastructure	Infrastructure readiness and competitiveness shape local outcomes	LNG projects demonstrate that enabling infrastructure, particularly electricity supply, land access, and port interfaces, can become binding constraints that affect project scope and timing. In British Columbia, electricity system impacts associated with LNG expansion have required careful trade-offs and long-term planning. For clean fuels intended for domestic use, the implication is clear: fuel production, distribution, and end-use must be planned together. Local benefits accrue when infrastructure investments are modular, scalable, and aligned with realistic demand growth. This is especially important in smaller communities, where overbuilt systems can crowd out other priorities and underutilized assets can become long-term liabilities.
Transparency	Credibility and transparency matter for community trust	LNG Canada illustrates how large projects can face sustained scrutiny around emissions, environmental impacts, and alignment with climate objectives, even when positioned as lower-emissions alternatives. For domestic clean fuel initiatives, the lesson is not to overpromise. Communities respond better to projects that clearly distinguish between relative improvements and absolute outcomes, explain lifecycle assumptions transparently, and frame early pilots as learning exercises rather than final solutions. This is particularly relevant for fuels such as SAF, hydrogen, and ammonia, where lifecycle accounting and certification frameworks are still evolving.
Indigenous partnerships	Partnership structures influence timelines and local value creation	Unlike previous failed projects, LNG Canada secured support from all 20 First Nations along its pipeline route.[98] The developer moved beyond duty consult, to award contracts to Indigenous and local businesses. The Wet'suwet'en Hereditary Chiefs did not support the project, citing violations of Wet'suwet'en law, environmental concerns, and rights, having never authorized the project to proceed on unceded, traditional territory. This led to national rail blockades, police interventions, and ongoing litigation. The project proceeded despite this opposition; however, legal questions and authority over unceded Indigenous land remain.

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[97] Reuters: Shell's decision on Phase 2 of LNG Canada will depend on other opportunities, exec says (Accessed January 2025)

[98] All First Nations agreements now in place for Coastal GasLink pipeline (Accessed January 2025)

		For domestic clean fuel strategies, early partnerships with Indigenous Communities can improve project certainty by ensuring that benefits reflect Communities' priorities through early relationship development. Partnerships must be founded on trust and collaboration, grounded in longer-lead times for relationship development, and ensuring that engagement is not a late-stage or parallel process
Coordination	Coordination reduces delay and rework	Canada's experience with LNG reinforces that fragmented permitting and misaligned regulatory processes increase schedule risk and redesign costs. While assessment frameworks continue to evolve, early engagement and coordination across regulators remain critical, particularly for emerging fuels where codes, standards, and safety frameworks are under development. For domestic clean fuel pilots, proactive coordination helps ensure that supply-side readiness, demand-side preparedness, and permitting timelines evolve together, reducing the risk that communities invest ahead of regulatory clarity.

Implications for the Strait of Canso

The LNG experience reinforces a core strategic insight for the Strait of Canso. Market conditions, policy frameworks, and investment priorities can shift within the same time horizon as community planning and infrastructure development, making flexibility and sequencing essential. Local value is maximized when early initiatives are anchored in real, near-term demand; when infrastructure is modular and scaled alongside utilization; and when emissions claims, costs, and risks are communicated transparently. Equally important, early and well-structured partnerships with Indigenous Communities, municipalities, utilities, regulators, and industry, build trust,create early project support and acceptance with meaningful engagement in process, and help set appropriate timeline expectations. Treating clean fuels as a coordinated regional transition rather than a set of isolated projects allows communities to manage uncertainty, avoid stranded assets, and sustain momentum while positioning the region to attract future investment as markets and technologies mature.

3.8 Summary of insights and next steps

Chapter 3 has established the foundation for prioritizing domestic clean fuel opportunities in the Strait of Canso by combining global evidence with a structured, locally relevant screening approach. It first set the international context for clean fuels, highlighting that progress is uneven and highly policy-driven, then translated global experience into a practical framework for the region by defining relevant sectors, mapping end-use applications by fuel type, and reviewing real-world deployments across leading jurisdictions. Using this evidence base, the chapter applied a qualitative adoption readiness framework,(market deployment, retrofit compatibility, and price competitiveness), to distinguish near-term deployable pathways from those that remain constrained by cost, infrastructure, or maturity. It also summarized the enabling policy and incentive mechanisms most used to close the value gap and reinforced through Canada's LNG experience that long timelines, infrastructure dependencies, and improves accountability for communities make sequencing and coordination decisive.

This chapter has applied a consistent adoption readiness framework to screen a broad scope of clean fuel and end-use combinations, narrowing the focus to those applications that demonstrate the strongest alignment with technical feasibility, operational fit, policy direction, and community context. The result is a refined set of clean fuel opportunities, summarized in Table 38 and

Table 39—that prioritize 13 potential end-use applications rated "medium" or "high" readiness, while explicitly deprioritizing lower-readiness pathways that remain constrained by cost, infrastructure, or regulatory uncertainty.

Importantly, this prioritization is not intended to signal long-term exclusion, but rather to guide near-term effort and resource allocation toward options most likely to deliver tangible local benefits, credible learning outcomes, and scalable pathways. The

LNG experience reinforces why this discipline matters: momentum is sustained when early actions are sized to real demand, infrastructure is staged deliberately, and decision-making remains flexible as conditions evolve.

Building on this foundation, the next section shifts from analytical screening to market validation. Section 4 applies targeted industry engagement and bottom-up analysis to test these prioritized opportunities against local asset bases, operational realities, and stakeholder interest. This engagement is used to further refine opportunity rankings, identify practical pilot candidates, and inform the sequencing that underpins the investment attraction, infrastructure planning, and implementation roadmap developed in subsequent chapters.

Table 38: Potential clean fuel opportunities based on the adoption readiness framework

	Process heat	**Mobility fuel (on-road)**	**Mobility fuel (aviation)**	**Mobility fuel (marine)**	**Electricity**	**Blending in natural gas lines**	**Heavy machinery**	**Chemical feedstock**
Hydrogen	Explore	Explore	Hold	Explore	Explore	Explore	Explore	Explore
RD	Hold	Explore	Hold	Explore	Explore	Hold	Explore	Hold
E-methanol	Hold	Hold	Hold	Explore	Hold	Hold	Hold	Hold
Ammonia	Hold	Hold	Hold	Explore	Hold	Hold	Hold	Hold
SAF	Hold	Hold	Explore	Hold	Hold	Hold	Hold	Hold

Table 39: Potential clean fuel opportunities organized by sector

Sector	**Sub-sector**	**End use application**	**Prioritized fuel**
Industrial	Processing plants	Process heat	Hydrogen
		Electricity	Hydrogen; RD
		Chemical feedstock	Hydrogen
	Light, medium, industry	Process heat	Hydrogen
		Electricity	Hydrogen; RD
	Logistics and maintenance	Mobility (on-road)	Hydrogen; RD
Marine vessels	Fishing fleet	Marine applications	Hydrogen; RD; methanol; ammonia
	Ferries	Marine applications	Hydrogen; RD; e-methanol; ammonia
	Commercial shipping	Marine applications	Hydrogen; RD; methanol; ammonia
	Support services and bunkering	Marine applications	Hydrogen; RD; methanol; ammonia
		Mobility (on-road)	Hydrogen; RD
Transportation	Public transportation	Mobility (on-road)	Hydrogen; RD
	Trucking/freight	Mobility (on-road)	Hydrogen; RD
	Aviation	Mobility (aviation)	SAF
Government operations	Municipal and First Nations fleets	Mobility (on-road)	Hydrogen; RD
		Electricity	Hydrogen; RD
	Public works	Mobility (on-road)	Hydrogen; RD
		Electricity	Hydrogen; RD
	Healthcare facilities	Mobility (on-road)	Hydrogen; RD
		Electricity	Hydrogen; RD
Utilities	Natural gas blending	Blending in natural gas lines	Hydrogen
	Power generation	Power	Hydrogen; RD

4. Industry engagement and opportunity analysis

4.1 Objectives and methodology

Based on the adoption readiness assessment and a supporting literature review, 13 clean fuel applications rated as “medium” or “high” readiness were identified for further exploration. Each opportunity from the initial list was analyzed using a bottom-up approach that incorporated available current-state fuel consumption data and asset analysis, and industry insights gathered through engagement with local organizations. These opportunities were ranked using seven criteria designed to assess local market, policy, and operational readiness as shown in Figure 6. The thirteen clean fuel end-use combinations were assigned a number for clarity.

Table 40: Ten short-listed opportunities categorized by fuel type

Hydrogen	Renewable Diesel	Methanol	Ammonia	SAF
Opportunity #1: Hydrogen for process heat	**Opportunity #7:** RD for mobility (on-road)	**Opportunity #11:** Methanol for marine applications	**Opportunity #12:** Ammonia for marine applications	**Opportunity #13:** SAF for mobility (aviation)
Opportunity #2: Hydrogen for mobility (on-road)	**Opportunity #8:** RD for marine applications			
Opportunity #3: Hydrogen for marine applications	**Opportunity #9:** RD for electricity			
Opportunity #4. Hydrogen for electricity	**Opportunity #10:** RD for heavy equipment			
Opportunity #5: Hydrogen for blending in natural gas lines				
Opportunity #6: Hydrogen for heavy equipment				

Criteria definition for opportunity analysis

To consistently evaluate each of the potential opportunities, seven criteria were defined and categorized:

Market readiness

- **Potential aggregate demand:** evaluates the potential aggregate fuel consumption volume.
- **Cost competitiveness**: considers commodity costs, based on estimates of the required end-user fuel switching cost.
- **Industry interest:** represents the level of interest and engagement from potential end-users.

Policy readiness

- **Incentive availability:** assesses whether there are support mechanisms in place to potentially reach cost parity or align with the willingness-to-pay model.
- **Alignment with decarbonization targets**: allows for the identification of the level of CO_2 abatement associated with the opportunity.

Operational readiness

- **Site readiness:** looks at the level of operational change required in terms of storage, infrastructure, logistics and distribution, and equipment.
- **Value chain capability:** evaluates the extent to which the opportunity aligns with available local clean fuel supply.

Figure 6: Description of the seven criteria used to evaluate each short-listed opportunity

Each potential opportunity was evaluated against seven criteria and assigned a score: 1 = Low; 1.5 = Low–Medium; 2 = Medium; 2.5 = Medium–High; and 3 = High. Scores were summed in Table 54 to produce a total ranking, where a higher score indicates a greater opportunity and higher priority. This structured, criteria-based approach supports a relatively objective analysis, that is tailored to the local context, drawing in insights from site visits and in-person engagement sessions. Where direct data was unavailable, such as undisclosed fuel usage, estimates were derived from publicly disclosed reports or scaled from comparable organizations. Where applicable, these assumptions were validated during site visits and through workshop discussions. Consequently, findings and recommendations should be interpreted with an understanding of these data limitations.

Methodology for assessing the potential aggregate demand:
Aggregate demand estimates were derived from point-in-time fuel consumption data provided in response to the request for information or proxies. Data and proxies were used to estimate total energy demand by summing the energy content of conventional fuels used in each application. The energy density of the clean fuel was then applied to calculate the quantity of alternative fuel required to meet the same energy needs. This process is shown in Equations 1 and 2. Note that these estimates are indicative of current fuel demand and should not be interpreted as projections. They are based on static assumptions and do not account for future changes in demand.

In cases where blending or co-firing was considered, because full substitution with clean fuel is not feasible, the volume of conventional fossil fuel still required was calculated based on the blending percentage. Where substitution is measured by energy rather than volume, fuel and energy density were used to adjust the calculations accordingly.

$$Current\ energy\ content\ \left(\frac{MJ}{year}\right) = \sum \begin{matrix} Current\ fuel\ consumed \\ by\ end\ use\ application \end{matrix} \left(\frac{unit}{year}\right) \times Energy\ density_{Incumbent\ fuel} \left(\frac{MJ}{unit}\right) \tag{1}$$

$$Potential\ aggregate\ demand\ \left(\frac{unit}{year}\right) = Current\ energy\ content\ \left(\frac{MJ}{year}\right) \div Energy\ density_{Clean\ fuel\ alternative}\ \left(\frac{MJ}{unit}\right) \tag{2}$$

In addition to activity-based scaling, which estimates aggregate demand for municipal organizations using reported revenue, gross domestic product (GDP), or population shares, specific fuel consumption data for various fleets and heavy machinery was used to calculate potential aggregate demand. This simplified approach is detailed in Equation 3.

$$Current\ fuel\ consumption\ \left(\frac{unit}{year}\right) = Asset\ specific\ fuel\ consumption\ \left(\frac{unit}{distance}\right) \times Distance\ travelled\ \left(\frac{distance}{year}\right) \tag{3}$$

Methodology for assessing the cost competitiveness:
Cost competitiveness was calculated using point-in-time delivered costs (CAD/unit) and the potential aggregate demand calculated as shown in Equation 4. The cost used for comparison reflect the typical delivered price of the incumbent or clean fuel, inclusive of commodity cost, transmission, and distribution charges, but excludes appliance or infrastructure costs. Note that these estimates are indicative of current point-in-time fuel costs and should not be interpreted as projections due to potential price volatility. They are based on static assumptions and do not account for future market changes.

$$Cost\ of\ clean\ fuel\ alternative\ \left(\frac{CAD}{year}\right) = Clean\ fuel\ volume\ \left(\frac{unit}{year}\right) \times Commodity\ cost\ \left(\frac{CAD}{unit}\right) \tag{4}$$

Methodology for assessing Industry interest:
Inferred from conversations with industry and community during site visits, workshop, and project steering committee meetings.

Methodology for assessing the incentive availability:
Inferred from a review of available and applicable policy supports and incentives at the municipal, provincial, and/or federal level.

Methodology for assessing the alignment with decarbonization target:
CO_2e abatement potential was estimated using the potential aggregate fuel demand, energy density (MJ/unit) and the LCI (kgCO_2e/MJ). Note that these estimates are indicative of CO_2e emissions from current fuel consumption and should not be interpreted as projections. They are based on static assumptions and do not account for future changes in fuel consumption.

$$\begin{aligned} Emissions\ \left(\frac{kg\ CO_2e}{year}\right) &= Clean\ fuel\ volume\ \left(\frac{unit}{year}\right) \times Energy\ density_{Clean\ fuel\ alternative}\ \left(\frac{MJ}{unit}\right) \\ &\times Lifecycle\ carbon\ intensity\ \left(\frac{kgCO_2e}{MJ}\right) \end{aligned} \tag{5}$$

Methodology for assessing the site readiness:
Inferred from site visit observations and WESI SME insights.

Methodology for assessing the value chain capability:
Inferred from a review of announced plans for clean fuel production facilities in the region and current production facilities and supply chain in North America.

4.2 Industry engagement

Request for Information

A questionnaire was distributed to a range of fuel users across the Strait of Canso to collect baseline data on energy consumption patterns, current fuel usage, decarbonization initiatives, infrastructure readiness, and organizational perspectives on clean fuels. It also helped identify knowledge gaps and areas requiring further investigation in subsequent engagement phases. The request for information was sent to all organizations listed in Table 3 (see Section 2.5.2) and six organizations responded: MOCR Public Works, Town of Port Hawkesbury Public Works, Mulgrave Machine Works, Marine Atlantic, Nova Scotia Community College – Strait Area Campus, and Port Hawkesbury Paper. For organizations that did not respond, data was estimated using publicly disclosed reports from comparable entities and specialized studies. Detailed assumptions for each opportunity analysis are provided in section 3.3. Where reasonable estimates could not be made and data was not provided or unavailable, the organization was excluded from the analysis.

Webinar

On September 9, 2025, a public webinar[99] was hosted by the Atlantic Hydrogen Alliance with Deloitte, WESI (responsible for the infrastructure components of this analysis), and the MOCR to announce the project to industry and community members. The objectives of the session were to raise awareness of the project and to promote industry and community engagement.

The webinar opened with overview of the Alliance's role. building awareness, supporting domestic applications and hydrogen hubs, supporting export projects, and enabling policies/standards. The Warden of the Municipality of the County of Richmond framed the "why"—ensuring clean fuel development delivers local benefits—decarbonizing local sectors and attracting new industry, alongside jobs, infrastructure investment, and tax-base growth.

Deloitte outlined the workplan and methodology and industry engagement approach, while WESI described the infrastructure lens inclusive of storage, handling, siting, safety/regulatory considerations, and distribution options for both demonstration-scale and commercial-scale use.

Questions raised by participants included:

- **Technical and economic barriers:** What are the biggest technical barriers to domestic adoption (and how much is "technical" versus "economic/value gap")?
- **Best-fit early adopters:** Which specific Strait of Canso industries are best positioned to adopt hydrogen, ammonia, methanol, or renewable diesel (e.g., shipping/ferries, freight, fishing fleets, industrial heat, airport/SAF, municipal fleets)?
- **Infrastructure beyond production:** If production happens locally, what other infrastructure is still needed to use these fuels (storage under pressure, siting/safety setbacks, refueling/bunkering, handling requirements, regulatory readiness, etc.)?
- **Policy for domestic demand:** How do federal/provincial/municipal policies support domestic offtake, and what demand-side tools could help create "pull," not just supply-push?
- **Scaling beyond the Strait:** Can this kind of demand-aggregation assessment be expanded to other Atlantic regions (Saint John, NB was raised as an example, including the idea of hydrogen hubs/corridors)?
- **Electricity and offshore wind:** Has electricity demand been modeled for clean fuel production and use locally, and what's the connection between offshore wind electrons, grid constraints, and electrolyzers?
- **Turning a study into action:** What are the concrete next steps after the report so it doesn't sit on a shelf. who "owns" implementation, and how will recommendations translate into feasibility studies and real projects (including workforce/housing readiness as broader enablers)?

Site visits

Following the desktop analysis of fuel use data and discussions with the MOCR, the project team conducted in-person site visits to 10 facilities on October 14-15, 2025, including:

- EverWind, Point Tupper Marine Services
- McNally Construction
- MOCR
- Mulgrave Machine Works
- Mulgrave Marine Terminal operated by Strait of Canso Superport Corporation

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[99] Strait of Canso Clean Fuels Domestic Use Strategy Webinar (Accessed November 8, 2025)

- Nova Scotia Power – Point Tupper Generating Station
- Point Tupper Heavy Industrial Park
- Potlotek First Nation
- Town of Port Hawkesbury
- Allan J. MacEachen Airport (Celtic Air Services) (virtual visit)

Initial perspectives on their end-use applications, current fuel data consumption, costs, potential clean fuel alternatives, and operational changes required for adoption were prepared and validated on site. These visits enabled the team to observe operational processes firsthand, assess any infrastructure constraints and opportunities, and engage in detailed discussions with facility managers and technical staff. Insights from these visits provided critical context that would not have been accessible through quantitative data alone, allowing for a grounded understanding of site and infrastructure readiness for clean fuel adoption opportunities.

Workshop

The final phase of industry engagement was a workshop which took place on October 16, 2025, bringing together a diverse group of organizations including industry representatives, government officials, First Nations, utilities, and environmental organizations. Attendees represented the following organizations, including:

- Atlantic Hydrogen Alliance
- Cape Breton Partnership
- EverWind
- Marine Atlantic
- Municipality of the District of Guysborough
- Municipality of the County of Richmond
- Nova Scotia Department of Energy
- NSCC – Strait Area Campus
- Port Hawkesbury Paper
- Potlotek First Nation
- Town of Port Hawkesbury and Landrie Lake Utility
- WESI

4.3 Opportunity analysis

Insights gathered were integrated into the desktop bottom-up analysis to inform the industry interest and site readiness criteria. A detailed analysis of each opportunity is presented in the following sub-sections.

Opportunity #1: Hydrogen for process heat

This opportunity focuses on replacing incumbent fossil fuels used for process heat with hydrogen, leveraging hydrogen-ready (up to 100%) burners/boilers or retrofit packages for low- and medium-temperature steam and hot-water services. The analysis considered:

- Authentic Seacoast Distillery
- EverWind's Point Tupper Marine Terminal
- Mulgrave Marine Terminal
- Steinhart Distillery

Although Port Hawkesbury Paper could use hydrogen for process heat, the associated incumbent fuel (natural gas) consumption from their large boiler for process steam generation was categorized under Opportunity #5 "Hydrogen for blending with natural gas" because the plant currently receives natural gas via an existing pipeline to the mill fence line where custody transfer occurs.[100]

Table 41: Detailed assessment of Opportunity #1: Hydrogen for process heat

Market readiness	**Potential aggregate demand**	Existing heat needs at each site were approximated from current fuel use (heating oil, propane) and operating patterns, then converted to hydrogen equivalents. For the terminals, energy use was scaled from a comparable Atlantic port[101]; for the distillery, annual production and typical energy needs for continuous distillation were applied. Under the working assumption of 100% hydrogen substitution for process heat, an assumption that reflects the theoretical technical potential under ideal conditions, a combined requirement of approximately 37 tonnes of hydrogen per year was estimated[102], with most demand at the terminals and a modest share at the distillery.
	Cost-competitiveness	A like-for-like fuel-only comparison (excluding facility upgrades, storage, safety systems, and installation) estimated an approximately four to five times premium for delivered hydrogen versus heating oil/propane at this scale.[103] Producer-side policy enabling supports may improve upstream economics and be reflected in offtake pricing, but without multi-site aggregation and strong utilization the premium may remain high.[104] It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated into this cost-premium estimate. This application alone is unlikely to anchor hydrogen offtake volumes at scale. Instead, it may become a beneficiary of regional hydrogen production that is primarily driven by larger anchor loads like mobility, export, or heavy industry. In the near term, delivered hydrogen for small industrial heat loads will remain costly due to logistics challenges such as small lots and trucking. As regional supply scales and infrastructure mature, the cost of hydrogen for process heat could decline, enabling broader adoption in smaller industrial applications. This underscores the need for multi-sector coordination and aggregated demand strategies to unlock cost-effective hydrogen access. However,

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[100] Although the fuel consumption could reasonably fall under either Opportunity #5 or Opportunity #1: "Hydrogen for process heat," it was assigned to one category (Opportunity #5) as it most closely aligns with the existing infrastructure and prevents double counting.

[101] The Port of Halifax.

[102] Deloitte detailed Excel analysis

[103] Deloitte detailed Excel analysis

[104] For low-temp loads (e.g., hot water, space heat, distillation near 100 °C), electric boilers and heat pumps are often simpler and cheaper than hydrogen if grid capacity allows; for medium-temp steam (<~200 °C), electric resistance/boilers are mature, but economics depend on electricity price and demand charges. Near term, electrification may outcompete hydrogen, with GHG benefits tied to grid carbon intensity, which generally improves as grids decarbonize.

		achieving parity will still depend on very low LCI, low-cost supply, and high, and incentives/policy.
	Industry interest	Industrial has expressed cautious interest in hydrogen as a clean fuel for process heat. Heavy industrial operators, particularly those with continuous operations, recognize the potential socioeconomic benefits (such as supporting local producers) and emissions reductions. However, concerns remain around governance (e.g., asset ownership vs. operational control), costs, and operational risks associated with retrofitting existing systems. The need for specialized equipment, such as hydrogen-compatible burners, storage vessels and safety systems, increases complexity. Light industrial and fabrication businesses, while generally supportive of clean energy transition, are more open to pilot testing, provided technical and financial supports are available. Community-based organizations emphasized the importance of local engagement, training, and water security, especially where hydrogen intersects with either auxiliary socioeconomic benefit (i.e., job creation, revenue creation, investment opportunities) and environmental concerns. Overall, interest is contingent on ensuring cost competitiveness and minimizing disruption.
Policy readiness	**Incentive availability**	Federal and provincial clean fuel supports are in place to help narrow the cost gap for hydrogen. At the federal level, a refundable Clean Hydrogen ITC[105] has been announced, with credit amounts tied to the certified LCI of the hydrogen produced. If accessed by producers, these incentives could translate into lower offtake prices in supply contracts. At the provincial and regional level, Nova Scotia offers planning and pilot-oriented funding, suggesting that early use cases in the Strait of Canso could be supported. Taken together, these mechanisms may support a willingness-to-pay model and, in favorable scenarios, bring certain applications closer to fuel cost parity.
	Alignment with decarbonization targets	Annual emissions reductions of up to approximately 250 tonnes of CO_2e could be achieved if green hydrogen replaces heating oil and propane, based on estimated fuel consumption.[106] Actual abatement will depend on the LCI of the delivered hydrogen. This pathway aligns with Nova Scotia's Climate Change Plan for Clean Growth, including clean fuel pilots and industrial decarbonization. Notably, EverWind precertification for Renewable Fuels of Non-Biological Origin (RFNBO)[107] indicates compliance with stringent import standards, increasing the likelihood of bankable, low-LCI hydrogen supply.
Operational readiness	**Site readiness**	Full hydrogen conversion requires new storage, pressure control and venting, gas detection, ventilation, hazardous-area electrical upgrades, and hydrogen-capable burners and controls designed for flame speed, stability, and NOx management such as staged combustion and flue gas recirculation. These needs go beyond a simple drop-in and increase integration complexity, especially in older buildings or sites near public areas. Additionally, hydrogen-capable burners and boilers are commercially available, but operating on 100% hydrogen typically requires project-specific engineering and support from OEMs or specialized integrators. In contrast, blending a small percentage of hydrogen with the existing natural gas network may be accomplished with comparably fewer changes. For short-term opportunities, prior to a fully developed regional hydrogen network or merchant distribution for small industrial loads, short-term supply strategies should consider the assumption that green hydrogen production will occur locally. If production and offtake are co-located within an industrial park, economies of scale

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[105] Clean Hydrogen Investment Tax Credit (Accessed November 8, 2025)

[106] Deloitte detailed Excel analysis

[107] EverWind Completes Pre-Certification with CertifHy™ for Canada's First Green Hydrogen and Ammonia Production (Accessed November 8, 2025)

		could be achieved, reducing the need for conversion, storage, and handling at each individual site. This integrated approach would simplify infrastructure requirements compared to trucked hydrogen (gaseous or liquid) and decentralized storage, which adds capital and operational complexity for modest, intermittent thermal demand. Until large scale production is established, a pilot program to produce hydrogen could supply some local consumers.
	Value chain capability	EverWind Point Tupper facility has announced plans to produce up to one million tonnes of green hydrogen per year,[108] with an initial phase targeting 240,000 tonnes[109] annually. However, there is no established hydrogen network serving small industrial heat loads. Short-term operations would rely on gaseous or liquid deliveries, with inventory-management risk heightened by modest, intermittent demand. A hub-and-spoke model could improve utilization, but only with a multi-site offtake; enabling programs may assist with depot/storage readiness, but logistics certainty remains low until aggregate demand is contracted.

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[108] Canadian company cleared to build $6B green hydrogen facility with 2 GW wind farm (Accessed November 8, 2025)

[109] EverWind Fuels Announces Completion of FEED for its 1st Phase 240,000 Tonne per Annum Green Hydrogen-to-Green Ammonia Plant (Accessed November 8, 2025)

Opportunity #2: Hydrogen for mobility (on-road)

This opportunity focuses on replacing diesel and gasoline with hydrogen, supplied through appropriate refueling solutions for fleets, municipal services, institutional vehicles, transit, heavy-duty trucks, and freight locomotives. Given the limited OEM offerings for heavy trucks today, this would primarily involve dual-fuel retrofits, typically diesel–hydrogen blending, rather than full OEM hydrogen platforms with fuel cell or hydrogen internal combustion engine (HICE) powertrains. Targeted applications include:

- **Road fleets:** Commercial delivery trucks, service vehicles, and logistics operators. This includes medium- and heavy-duty commercial vehicles, primarily Class 4–6 delivery and Class 7–8 tractors for regional/linehaul freight where back-to-base refueling is feasible.
- **Municipal services:** Vehicles operated by local governments, such as waste collection trucks, snowplows, and utility vans.
- **Institutional vehicles:** Transportation operated by schools, hospitals, and other public institutions.
- **Transit:** Public buses and other regional passenger transport.
- **Freight locomotives:** Trains used for goods movement.

The aim would be to enable a transition to zero-emission mobility across market segments, leveraging shared infrastructure and coordinated demand to improve cost-effectiveness and utilization. The analysis considered:

- Atlantic Pilotage Authority
- Central Nova Scotia Railway
- EverWind and Point Tupper Marine Services
- Geno Polegato Trucking
- McNally Construction
- MOCR
- Mulgrave Machine Works
- Mulgrave Marine Terminal
- Municipality of the District of Guysborough
- Nova Scotia Community College - Strait Area Campus
- Paqtnkek Mi’kmaw Nation
- Port Hawkesbury Paper
- Potlotek First Nation
- Strait Area Transit
- Town of Mulgrave
- Town of Port Hawkesbury

Table 42: Detailed assessment of Opportunity #2: Hydrogen for on-road mobility

Market readiness	**Potential aggregate demand**	A blended methodology was used to estimate the aggregate demand, where fuel data were provided (e.g., public works, institutions, named firms), those figures were used directly. Where data was unavailable, activity-based scaling was applied using revenue, GDP, population shares, indicative fleet sizes, duty cycles, and sector benchmarks for trucking, municipal services, transit, and freight locomotives. Under these assumptions, which reflect the theoretical technical potential under ideal conditions, a combined requirement of approximately 370 tonnes of hydrogen per year was estimated[110] across identified entities. Potential demand was expected to be led by regional and long-haul trucking, followed by freight locomotives fueled entirely by hydrogen, municipal/public works fleets, transit, and institutional fleets. Results are sensitive to

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[110] Deloitte detailed excel analysis

		assumptions regarding duty cycles, average daily mileage, and back-to-base behavior, as these parameters influence refueling logistics and hydrogen utilization.
	Cost-competitiveness	A like-for-like fuel-only comparison was performed, comparing current diesel/gasoline spend with the cost of delivered hydrogen required to provide comparable service for the assumed duty cycles. [111,112] Vehicle procurement, depot/public refueling infrastructure, installation, and facility upgrades were not included. At this scale and mix, a fuel-only premium of approximately two to three times that of incumbent fuels was estimated. [113] The fuel cost premium could be lower for depot-based heavy-duty operations with predictable back-to-base refueling such as regional trucking where higher station utilization and multi-year contracts could improve pricing. The premium may trend higher for dispersed or seasonal municipal/institutional duty cycles where utilization is uncertain. Depot-based fleets with back-to-base refueling can help solve this by concentrating demand and improving station throughput and lower logistics costs of hydrogen delivery. Outcomes are most sensitive to delivered hydrogen price, achievable station throughput, and the ability to aggregate multi-fleet demand under firm offtake. Producer-side policy and incentive support may help narrow the effective cost gap but are unlikely to fully eliminate it in the near term. It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated into this cost premium estimate.
	Industry interest	Interest in hydrogen for on-road applications is positive, yet nascent. Light industrial operators that own fleets, along with municipalities, have expressed openness to future hydrogen applications if cost parity is achieved, including for testing. However, full fleet conversion is viewed as impractical in the near term due to the relatively new age of existing vehicles, high hydrogen fuel costs, and the lack of refueling infrastructure. There is also uncertainty around the role of smaller municipalities in leading adoption, with many seeking additional funding, incentives, and guidance on operational feasibility.
Policy readiness	**Incentive availability**	Several federal and provincial programs are available that could be leveraged to help close the fuel-cost gap for hydrogen mobility: • Clean Hydrogen ITC[114]: Refundable 15–40% federal credit (through 2034) for eligible clean-hydrogen production property; producer-side support that can flow through to lower offtake prices via contracts. • Transport Canada iMHZEV[115]: Point-of-sale incentives up to $200,000 CAD per eligible MHDV, including hydrogen fuel-cell truck classes. • NRCan ZEVIP[116] (infrastructure) and CIB CHRI:[117] Funding/financing for hydrogen refueling infrastructure; ZEVIP typically up to approximately 50% cost share; CHRI targets larger projects.

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[111] Battery-electric vehicles are currently the most mature option for short, repeatable, back-to-base routes, offering lower energy costs and simpler depot infrastructure than hydrogen. Limitations include charging dwell time, site power upgrades, and reduced payload/range in cold or hilly conditions. Hydrogen suits longer routes, multi-shift operations, fast refueling, and cold-weather auxiliary loads but involves higher fuel costs and more complex infrastructure.

[112] For locomotives, battery-electric switchers with opportunity charging may be suitable for yard and short-haul service. While mainline overhead electrification is the efficiency benchmark, it is unlikely to be deployed locally due to very high capital costs. Hydrogen fuel-cell locomotives offer a zero-tailpipe emission alternative without the need for catenary infrastructure, but they require a reliable hydrogen supply, onboard storage solutions, and currently face higher fuel costs. Selection among these options should be based on route length, terrain, fueling or charging opportunities, available site power, and long-term emissions goals.

[113] Deloitte detailed Excel analysis

[114] Clean Hydrogen Investment Tax Credit (Accessed November 8 ,2025)

[115] Transport Canada iMHZEV (Accessed November 8, 2025)

[116] NRCan ZEVIP (Accessed November 8, 2025)

[117] Canada Infrastructure Bank CHRI (Accessed November 8, 2025)

		Together, these mechanisms may support early deployments and, in favourable cases, move priority duty cycles closer to fuel-only cost parity, subject to eligibility, intake timing, stacking rules, and contracting outcomes.
	Alignment with decarbonization targets	An estimated aggregate CO_2 reduction of approximately 3,700 tonnes per year was estimated[118] for the current scope, assuming diesel and gasoline are displaced by low-carbon hydrogen. Actual abatement will depend on the certified LCI of the supplied hydrogen, as well as realized duty cycles and vehicle conversion pathways. This trajectory aligns with broader decarbonization objectives, including federal net-zero targets and provincial clean-fuel strategies, with additional reductions possible as more fleets and duty cycles are integrated and low-LCI supply is maintained. To ensure credible claims, metered hydrogen receipts, batch-level CI documentation, and duty-cycle logs linking hydrogen consumption to service are required. Policy alignment is strong with programs such as iMHZEV[115] (vehicles) and ZEVIP[116]/CHRI[117] (depots).
Operational readiness	**Site readiness**	Hydrogen is not yet commercialized for heavy off-road equipment. HICE powertrains and dual-fuel conversions are at pilot or early commercial stages, with unresolved issues around NO_x control, durability, and transient performance for certain duty cycles. Hydrogen would be supplied through appropriate refueling solutions, which could include mobile or fixed hydrogen fueling stations, or on-site production like electrolysis at EverWind. Hydrogen is expensive to move and store; unlike diesel, it requires compression, specialized tanks, and safety systems. The aim is to enable a transition to zero-emission mobility across multiple segments, leveraging shared infrastructure and coordinated demand to improve cost-effectiveness and utilization. A mobile unit could be established in the Strait area to support refueling for heavy vehicles. For rail applications, hydrogen would likely still need to be transported to the rail station, unless the fueling site is strategically located to serve both rail and road fleets efficiently. In the near term, if a unit is not established, merchant hydrogen for road and rail would rely on trucked deliveries, via tube trailers or liquid hydrogen, to depot-based stations serving high-consumption, back-to-base fleets. There is currently no public hydrogen station network. Siting would require trailer access, storage, compression and conditioning, and safety systems for detection, ventilation, and emergency procedures. Early engagement with authorities will be needed to address permitting and code compliance, including hazardous-area classification, electrical standards, and fire codes. Given limited OEM Class 8 offerings, the focus is on diesel–hydrogen blending retrofits rather than full hydrogen platforms. For locomotives, fuel-cell electric pilots would require hydrogen storage/tender solutions, yard fueling procedures, and crew and maintenance training. Combustion or co-firing with hydrogen was not considered ready for standard deployment. Asset reuse is limited but remains possible. While existing diesel vehicles cannot be converted into full hydrogen platforms, there are transitional options such as dual-fuel retrofit kits that can extend the life of current assets and reduce emissions. Yards, maintenance bays, and routes can still be retained, and some refueling logistics parallel current depot operations.

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[118] Deloitte detailed Excel analysis

Value chain capability	EverWind's Point Tupper facility has announced plans to produce up to 1 million tonnes of green hydrogen per year.[119] However, there is no established hydrogen network serving small industrial heat loads. Short-term operations could rely on trucked gaseous or liquid hydrogen to a shared depot; no public hydrogen network exists. A dedicated pipeline to a strategically located fueling station could be considered to reduce delivery costs and improve reliability.

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[119] Canadian company cleared to build $6B green hydrogen facility with 2 GW wind farm (Accessed November 8, 2025)

Opportunity #3: Hydrogen for marine applications

This opportunity focuses on replacing marine diesel used for local marine applications with hydrogen through two pathways: 100% hydrogen fuel-cell propulsion where suitable, and hydrogen co-combustion in conventional engines.[120] The analysis considered:

- Atlantic Pilotage Authority
- EverWind and Point Tupper Marine Services
- Marine Atlantic
- Martin Marietta Materials
- McNally Construction
- Mulgrave Marine Terminal
- Northumberland Ferries
- Nova Scotia Community College - Strait Area Campus
- Potlotek First Nation

The scope included tug and barge services, small workboats, a scheduled passenger ferry, and training/instructional craft associated with the Strait of Canso. It is important to note that aggregate demand may be even higher since direct fuel use at marine terminals is minimal, but their third-party fuel sales to commercial fishing vessels represent significant volumes which were not included in this estimate due to data availability.

Table 43: Detailed assessment of Opportunity #3: Hydrogen for marine applications

Market readiness	**Potential aggregate demand**	A blended methodology was used to estimate aggregate demand. For the scheduled ferry, annual sailing hours were derived from the published timetable and typical crossing times; specific fuel consumption and installed engine power were applied to estimate an hourly fuel rate, which was multiplied by annual hours to estimate annual fuel use. For other operators (tug/barge services, fishing/workboats, training vessels), fuel consumption was scaled from benchmark companies using revenue/activity proxies. The assumed technology split was applied (100% fuel cell where suitable; approximately 80% hydrogen co-combustion for tugs/barges/fishing; approximately 20% blend for one cargo-vessel case). Under these assumptions, which reflect the theoretical technical potential under ideal conditions, up to approximately 1,350 tonnes of hydrogen per year was estimated[121] for marine applications. The largest opportunity was for the scheduled ferry and the remainder distributed across tug/barge services, fishing/workboats, and training craft. Results are sensitive to realized operating hours and seasonal activity; assumptions reflect the theoretical technical potential under ideal conditions.
	Cost-competitiveness	A fuel-only, like-for-like comparison was conducted to estimate the cost of delivered hydrogen versus current marine-diesel expenditures for equivalent service under the assumed pathways.[122] Vessel procurement or retrofits, portside bunkering/refueling infrastructure, storage, safety systems, and installation were excluded. At the modeled scale and operational mix, a fuel-only premium of approximately two to three times[123] versus marine diesel was indicated. For predictable, high-utilization duty cycles like the scheduled ferry with back-to-base bunkering, the premium could trend lower. For dispersed or seasonal duty cycles such as many fishing or service vessels, the premium may trend higher due to lower station utilization and more complex logistics. Hydrogen

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[120] Assumed approximately 80% hydrogen for tug, barge, and service vessels; approximately 20% hydrogen for a cargo-vessel use case

[121] Deloitte detailed Excel analysis

[122] For short, repeatable routes, battery-electric or hybrid-electric ferries have been deployed and may deliver lower total cost and simpler operations if charging power and turnaround times are adequate. These alternatives should be weighed against hydrogen for the specific duty cycles present.

[123] Deloitte detailed Excel analysis

		co-combustion reduces the hydrogen quantity relative to full fuel-cell substitution, but a premium is still expected on a fuel-only basis in the near term. It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated in this cost premium estimate.
	Industry interest	Stakeholder interest in hydrogen for marine mobility is emerging but tempered by practical considerations. Marine operators recognize hydrogen as a potential pathway for deep decarbonization, particularly for tug and barge services, fishing vessels, and short-route ferries. The appeal lies in its ability to deliver zero-emission propulsion through fuel-cell systems and significant emissions reductions via hydrogen co-combustion in conventional engines. However, participants noted that hydrogen adoption would require new fueling infrastructure, vessel modifications, and operational changes, introducing higher upfront costs and complexity compared to drop-in fuels.
Policy readiness	**Incentive availability**	A suite of federal mechanisms could narrow fuel and infrastructure costs for a Strait of Canso marine hub including Transport Canada's Green Shipping Corridor (Clean Ports) funding [124] for port-side clean-fuel infrastructure and safety systems; and the CIB's charging and hydrogen refueling financing for large projects. These programs may lower delivered hydrogen and port-side costs if projects are selected and if benefits are passed through under long-term offtake. They do not eliminate vessel conversion costs or guarantee merchant hydrogen availability in the near term.
	Alignment with decarbonization targets	Aggregate CO_2 reductions of up to approximately 9,300 tonnes per year were estimated[125] for the current scope and technology mix, assuming displacement of marine diesel by hydrogen via fuel cells and co-combustion. The actual abatement depends on the certified LCI of supplied hydrogen and on realized duty cycles. The pathway is consistent with national/provincial decarbonization efforts in marine transport and with green-corridor policy[126] directions.
Operational readiness	**Site readiness**	Marine refueling represents a potential opportunity. Establishing hydrogen or ammonia fueling infrastructure could attract vessels operating on nearby routes and position the site as a strategic hub for low-carbon marine energy in the future. Potential locations for a fueling station include the Mulgrave Marine Terminal or McNally Construction. A pipeline connection to McNally Construction could be advantageous if existing dolphin structures are used to install a fueling site, reducing delivery costs and improving efficiency. Mulgrave is less desirable as hydrogen would need to be transported there but a barge-based solution may be more practical. A barge could also provide flexibility by serving multiple locations within the Strait rather than being fixed to the Mulgrave Marine Terminal. It may be feasible for the EverWind Marine Terminal to dispense hydrogen or ammonia to other vessels, provided this does not interfere with its core operational requirements. Hydrogen adoption for marine mobility requires new port-side storage and bunkering systems, along with pressure control and evaporation for liquid hydrogen, gas detection, ventilation, firefighting adaptations, and hazardous-area classification. These needs go beyond a simple drop-in and increase integration complexity, particularly for sites with limited space or public access, where permitting and code compliance may pose schedule risks. In the absence of open-access hydrogen bunkering, short-term supply could rely on trucked deliveries of gaseous hydrogen via tube trailers or liquid hydrogen, supported

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[124] Transport Canada's Green Shipping Corridor (Clean Ports) funding (Accessed October 15, 2025)

[125] Deloitte detailed Excel analysis

[126] Green-Corridor Policy (Accessed October 15, 2025)

	by new port-side infrastructure. This adds cost and schedule burden compared to drop-in fuels. Fuel-cell vessels require battery hybridization, DC distribution, and high-power converters, increasing electrical integration complexity. For co-combustion, engine-specific dual-fuel kits with hydrogen metering, control systems, and safety interlocks are needed, and achievable hydrogen fractions vary by engine model and operating envelope. Asset reuse is limited. Some existing hulls and engines may be adapted with dual-fuel kits and partial reuse of diesel systems for pilot or redundancy, but new hydrogen storage, transfer systems, and safety measures are essential, creating more barriers and cost than for RD or other drop-in options.
Value chain capability	Regional hydrogen production projects near the Strait of Canso have been publicly announced but remain in early development phases and are primarily export oriented. As a result, reliable merchant volumes for local bunkering are not assured in the short term. EverWind' Point Tupper facility has announced plans to produce up to one million tonnes of green hydrogen per year,[127] with an initial phase targeting 240,000 tonnes[128] annually starting in 2027 and full capacity in 2028. Short-term operations could depend on trucked deliveries of gaseous or liquid hydrogen and new shared port storage, as no open-access hydrogen bunkering infrastructure exists today. Certainty improves only with firm multi-year offtake agreements, shared depot infrastructure, centralized safety systems, and clear operating procedures, alongside class approvals for vessel conversions. Until these conditions are met, hydrogen marine mobility should be treated as demonstration-oriented, with the scheduled ferry and a limited number of harbour craft considered the most practical early candidates. Broader rollout would depend on proven safety and reliability, improved delivered pricing, and validated engine or fuel-cell packages for the local vessel mix.

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[127] Canadian company cleared to build $6B green hydrogen facility with 2 GW wind farm (Accessed November 8, 2025)

[128] EverWind Fuels Announces Completion of FEED for its 1st Phase 240,000 Tonne per Annum Green Hydrogen-to-Green Ammonia Plant (Accessed November 8, 2025)

Opportunity #4: Hydrogen for electricity

This opportunity refers to using hydrogen as a primary or backup fuel to generate electricity typically involving fuel cells or hydrogen-compatible turbines. It focuses on replacing fuels used for electricity generation with hydrogen via two pathways: (i) 30% hydrogen co-firing (by energy) with natural gas as the primary fuel at a regional utility unit following a coal-to-gas transition, and (ii) 100% hydrogen for backup generation at public-works depots, port and marine-terminal operations, municipal and First Nations' facilities, entities, and industrial sites that currently use diesel or propane.

As standard diesel backup gensets cannot co-fire hydrogen, the backup pathway was modeled as 100% hydrogen, which in practice implies repowering/replacement with hydrogen spark-ignition engines, hydrogen-capable turbines, or fuel-cell generator sets. Technology readiness was considered consistent with these pathways in principle:

- Approximately 20–30% hydrogen co-firing has been demonstrated on modern gas turbines with combustor/controls modifications.
- 100% hydrogen turbines are available or announced for peaking/backup.
- Fuel-cell gensets and hydrogen spark-ignition engines are commercial/near-commercial but require site-specific integration.

It is important to note that assumptions reflect the theoretical technical potential under ideal conditions. The analysis considered:

- EverWind and Point Tupper Marine Services
- MOCR
- Municipality of the District of Guysborough
- Nova Scotia Community College - Strait Area Campus
- Nova Scotia Power – Point Tupper Generating Station
- Paqtnkek Mi'kmaw Nation
- Potlotek First Nation
- Mulgrave Marine Terminal
- Town of Mulgrave

Table 44: Detailed assessment of Opportunity #4: Hydrogen for electricity

Market readiness	**Potential aggregate demand**	A blended, activity-based method was used to estimate the aggregate demand. Backup consumption was anchored where fuel/electricity records existed. Municipal and community loads were scaled using population/GDP outside the provincial core; First Nations' facilities were scaled by GDP/population shares from public-works benchmarks; and port/marine-terminal stationary needs were inferred from revenue/activity data against a reference port. For the utility unit, 30% hydrogen co-firing was assumed after coal-to-gas conversion. All cases were converted to hydrogen equivalents using 100% hydrogen for backup and 30% hydrogen for the utility. Under these assumptions, approximately 59,600 tonnes of hydrogen per year was estimated[129], with the utility co-firing and several larger backup sets accounting for most of the total. Results are sensitive to standby run-hours, test schedules, and capacity factors.
	Cost-competitiveness	Although not assessed in this high-level estimation, the overall economics would be sensitive to several factors including: • The delivered price of hydrogen (dollars per kilogram), which varies based on production method, logistics, and infrastructure. • Actual run-hours of the generators, especially for low-duty standby applications where fuel consumption is intermittent, and infrastructure utilization is low.

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[129] Deloitte detailed excel analysis

		• Storage and dispensing utilization, which affects the amortization of fixed costs. • The ability to aggregate demand across multiple sites under long-term offtake agreements, which can improve pricing and reduce delivery costs. While policy incentives and producer-side support may help narrow the cost gap, they are unlikely to fully eliminate the premium in the near term. By leveraging the export market, the local producer (i.e., EverWind) may accelerate growth toward economies of scale. As a result, the local market could benefit from more competitive pricing than would be achievable through smaller-scale projects. For backup generators converted to 100% hydrogen, a significant premium over diesel is expected on a fuel-only basis in the near term due to low utilization and logistics. Hydrogen for backup generation was not factored into the estimated cost increase. Producer-side and enabling supports could help mitigate costs if benefits flow through offtake agreements. However, even with these supports, cost parity remains uncertain without high utilization, aggregation, and contracted supply. It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated into this cost premium estimate.[130]
	Industry interest	There is conceptual interest for hydrogen-blended fuels as a pathway to decarbonize existing thermal assets, particularly where natural gas conversion is already under consideration. However, uncertainty around leadership and governance remains a significant barrier. While stakeholders are aware that the NSP Point Tupper Generating Station is included in Nova Scotia Power's Integrated Resource Plan,[131] which aligns with the Nova Scotia 2030 Clean Power Plan[132] for transitioning to natural gas, the Plan emphasized that successful implementation will require strong leadership from the utility and political support to advance this initiative.
Policy readiness	**Incentive availability**	Production-side credits and capital programs could lower the delivered price of hydrogen or co-fund shared storage/logistics if projects are selected and benefits are passed on from offtake contracts. These supports do not guarantee short-term merchant supply and generally do not cover most end-user conversion costs for small, distributed backup sites. Eligibility for utility co-firing retrofits and on-site hydrogen storage would need to be confirmed under current guidance. • Clean Hydrogen ITC[114]: A refundable 15–40% federal tax credit (through 2034) on eligible clean-hydrogen production property; credit rates are dependent on the certified CI of the hydrogen produced. While this supports producers (not end-users), lower producer CAPEX can translate into better offtake pricing for co-firing or backup supply. • Canada CIB Clean Power and Project Acceleration/Front-end engineering design (FEED) support[133]: Concessional financing for clean-power infrastructure (generation, storage, transmission) and early development support for projects heading to FID. Applicable to shared hydrogen

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[130] Note on competition with electrified solutions: For short-duration resilience and power-quality events, battery storage can reduce runtime and fuel exposure.

[131] Nova Scotia Power's Path to 2030 Plan (Accessed November 8, 2025)

[132] Nova Scotia's Clean Power Plan (Accessed November 8, 2025)

[133] Clean Power (and Project Acceleration/FEED support) (Accessed November 8, 2025)

		storage/depot infrastructure or grid-side upgrades associated with a co-firing demonstration. • CGF[134]: Carbon price assurances, contracts-for-difference, and offtake contracts to de-risk project revenues; can improve bankability of clean-hydrogen supply by providing price certainty or credit offtake over long terms. Useful when anchoring multi-year offtake for utility co-firing or backup fleets. • Nova Scotia CFF [135]: Provincial capital support with recent rounds totaling approximately $6M across 2023–25 for ready-to-launch clean-fuel adoption, site infrastructure, and studies. Can help with on-site hydrogen storage, detection/ventilation, and conversion planning at distributed backup locations.
	Alignment with decarbonization targets	Reflecting displacement of natural gas in the 30% co-firing case and diesel/propane in 100% hydrogen backup case, it is equivalent to removing approximately 6,100 cars from the road each year. Actual abatement depends on the certified LCI of hydrogen and realized operating hours. The approach aligns directionally with net-zero goals by pairing coal-to-gas transition with incremental decarbonization via hydrogen blending and by reducing local pollutants where diesel backup is displaced. NO_x control for hydrogen combustion would be required through dry low NOx tuning, flue gas recirculation, water/steam injection, or selective catalytic reduction to maintain air-quality benefits.
Operational readiness	**Site readiness**	Short-term hydrogen adoption requires substantial site preparation. On-site storage for gaseous or liquid hydrogen involves installing new vessels, pressure and evaporation systems for liquid hydrogen, venting, gas detection, ventilation, hazardous-area electrical, and obtaining permits. Space constraints and safety requirements can significantly increase complexity. While some on-site hydrogen infrastructure will be required, the primary advantage of this opportunity lies in the proximity of the end-user sites to the local at scale producer (i.e., EverWind). Moreover, the opportunity to use the existing pipeline infrastructure, requiring only a minimal extension to reach the site, presents an advantage. This approach could effectively eliminate the necessity for on-site modifications, including the installation of additional storage tanks and associated equipment. Integration for co-firing leverages existing turbines and grid interconnections but requires combustor and control upgrades, hydrogen metering, flashback and Wobbe Index management[136], and NO_x mitigation strategies. Higher hydrogen blends increase technical risk and may require new combustor hardware and tighter operational controls. Backup generation with 100% hydrogen requires repowering or replacing diesel gensets with hydrogen spark-ignition engines, hydrogen-capable turbines, or fuel-cell gensets. These options demand site-specific integration, including storage siting, venting and evaporation systems for liquid hydrogen, detection and ventilation, hazardous-area electrical, interconnection, and exhaust/NO_x management for turbines. Both pathways involve significant balance-of-plant modifications and safety systems, creating a high integration burden and extended timelines.

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[134] Canada Growth Fund (CGF) (Accessed November 8, 2025)

[135] Nova Scotia Clean Fuels Fund (Accessed November 8, 2025)

[136] The Wobbe Index is key parameter used to compare the interchangeability of fuel gases. It measures the energy content of a gas relative to its flow characteristics

Value chain capability	EverWind's Point Tupper facility has announced plans to produce up to one million tonnes of green hydrogen per year,[137] with an initial phase targeting 240,000 tonnes [138] annually starting in 2027 and full capacity in 2028. While this represents significant regional supply potential, there is currently no open-access hydrogen network. The large aggregate demand of this opportunity of approximately 6,300 tonnes per year may provide a strong anchor for a potential offtake agreement. For certain sites, a pipeline connection could represent a potential economic distribution solution, significantly reducing the need for extensive on-site infrastructure. Trucked gaseous or liquid hydrogen for backup power generation could remain necessary and may benefit from economies of scale, making this an additional distribution option. These approaches could still require on-site storage and supporting systems such as vessels, pressure and evaporation equipment, venting, detection, ventilation, hazardous-area electrical, and permitting. Certainty could improve with shared depot storage and hub-and-spoke logistics, supported by firm multi-site offtake and a supplier able to certify LCI.

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[137] Canadian company cleared to build $6B green hydrogen facility with 2 GW wind farm (Accessed November 8, 2025)

[138] EverWind Fuels Announces Completion of FEED for its 1st Phase 240,000 Tonne per Annum Green Hydrogen-to-Green Ammonia Plant (Accessed November 8, 2025)

Opportunity #5: Hydrogen for blending in natural gas lines

This opportunity focuses on replacing a portion of natural gas used at the Point Tupper Industrial Park with hydrogen via blending, using an assumed 20% hydrogen share by volume. It was assumed that total delivered energy would remain unchanged (i.e., metering/billing or flow control would normalize for hydrogen's lower volumetric energy content). Blending was considered for a construction-sector process-heat user and for a segment of the regional gas-distribution system supplying local customers, assuming end-users are connected to the natural gas pipeline distribution system. The analysis considered:

- McNally Construction
- Port Hawkesbury Paper
- Maritimes & Northeast Pipeline (M&NP)

Table 45: Detailed assessment of Opportunity #5: Hydrogen for blending in natural gas lines

Market readiness	**Potential aggregate demand**	An activity-based approach was used to estimate the aggregate demand. Process-heat use in the construction sector was estimated from energy spend and end-use patterns and gas throughput for the local distribution segment was inferred from typical customer profiles and seasonal loads. A 20% hydrogen blend by volume was applied to the estimated natural gas volume, then converted to hydrogen mass with delivered energy held constant via normalization. Under these assumptions, approximately 4,756 tonnes of hydrogen per year was estimated[139] across the two applications. While blending up to 20% hydrogen by volume is technically feasible in some systems, it contributes only about 6–7% of the total energy content due to hydrogen's lower volumetric energy density compared to methane. Therefore, blending offers incremental decarbonization benefits but does not fully substitute natural gas from an energy delivery perspective. Additionally, results are sensitive to the actual blend fraction approved, seasonal demand, and whether blending is permitted system-wide or limited to selected zones. It is important to note that assumptions reflect the theoretical technical potential under ideal conditions.
	Cost-competitiveness	A like-for-like fuel-only comparison was performed, comparing 20% hydrogen by volume (energy-normalized) to baseline natural gas. End-use modifications, network upgrades, metering changes, safety systems, and installation were excluded. at current pricing, the blended supply was estimated to be approximately two times the fuel cost of natural gas.[140] Outcomes depend on delivered dollars per kilogram hydrogen, station/network utilization, and contracting structure (e.g., indexed multi-year offtake vs. spot). Producer/infrastructure-side support may help lower the cost, but parity remains unlikely without strong utilization and bankable contracts. It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated into this cost premium estimate.
	Industry interest	Interest in hydrogen blending into natural gas lines is emerging, particularly among utility and energy infrastructure operators exploring low-carbon transition pathways. The concept is viewed as technically feasible and policy-supported, with federal programs such as the CFR offering credit incentives for hydrogen integration. However, buy-in remains in early stages, with participants seeking clarity on blend limits, appliance compatibility, and pipeline integrity.
Policy readiness	**Incentive availability**	• Clean Hydrogen ITC[105]: A refundable 15%–40% federal credit (available through 2034) for eligible clean-hydrogen project property; producer-side support that can lower offtake prices for blended gas via supply contracts. • Nova Scotia CFF [135]: Competitive grants with recent rounds totaling $3M to help switch to low-carbon fuels and enable clean-fuel readiness. Relevant for

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[139] Deloitte detailed Excel analysis

[140] Deloitte detailed Excel analysis

		pilot blending infrastructure, metering/measurement upgrades, and planning. The program is currently closed as of March 2026.
	Alignment with decarbonization targets	Annual GHG reductions of up to approximately 19,000 tCO_2e were estimated[141] based on a 20% hydrogen blend by volume with energy output held constant. The actual emissions avoided depends on the certified LCI of the hydrogen used, the blend level that is implemented, and how measurements are handled.
Operational readiness	**Site readiness**	Natural gas with potential for future hydrogen blending is a viable option at the McNally Construction site given its current reliance on significant volumes of propane. There is an opportunity to extend the natural gas pipeline to serve multiple industrial users, with the NS Point Tupper Generating Station acting as an anchor tenant. The natural gas line could supply hydrogen to Point Tupper via pipeline with relative ease, given the short distances to key offtakers. There are no major public or environmental constraints between the proposed supply point and facilities such as Port Hawkesbury Paper, Nova Scotia Power, Cabot Gypsum, and McNally Construction's sites, which supports the feasibility of this approach. In many distribution systems, short-term allowable hydrogen blends are typically around 5–20% by volume without major appliance changes, provided materials compatibility, Wobbe Index and calorific value, flame speed and flashback, odorization and detection, and code compliance are verified. Transmission segments and certain industrial burners or process heaters can be more restrictive, often limited to 5–10% by volume, unless hydrogen-ready equipment and upstream compressor or material upgrades are in place. Because hydrogen's volumetric energy content is much lower than methane's, energy-normalized delivery requires higher volumetric flow for the same heat service, which can affect pressure drop, line pack, and metering range; these impacts must be engineered and approved with the utility and regulator. Integration requires injection skids at network points for mixing, flow control, analyzers, odorization, and safety, along with metering and measurement alignment for energy-basis billing and compatibility verification. The burden is moderate and concentrated at injection and utility interfaces. This approach retains the existing gas network and most end-use appliances at modest blend levels, subject to verification. New assets are focused on injection, metering, and safety rather than wholesale end-use replacement, supporting a high reuse rating. Recommended implementation is through limited pilots at 5–20% blends in selected distribution zones with utility sign-off, validated appliances, and energy-basis billing. These pilots can be executed within three years to quantify metering, pressure, and safety outcomes.
	Value chain capability	EverWind's Point Tupper facility has announced plans to produce up to one million tonnes of green hydrogen per year,[142] with an initial phase targeting 240,000 tonnes[143] annually starting in 2027 and full capacity in 2028. In the near term, hydrogen supply for blending could rely on trucked deliveries into network injection points with on-site storage. Dedicated skids for mixing, flow control, analyzers, odorization, and safety systems will support these deliveries. Broader blending zones and multi-year contracted offtake will only be possible if regional hydrogen production and certification scale up and network standards are clarified, subject to utility and

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[141] Deloitte detailed Excel analysis

[142] Canadian company cleared to build $6B green hydrogen facility with 2 GW wind farm (Accessed November 8, 2025)

[143] EverWind Fuels Announces Completion of FEED for its 1st Phase 240,000 Tonne per Annum Green Hydrogen-to-Green Ammonia Plant (Accessed November 8, 2025)

regulatory approval. Until then, blending should be treated as pilot-oriented, limited to zones where asset integrity, metering, and end-use compatibility are verified and energy-basis billing (or equivalent normalization) is implemented.

Opportunity #6: Hydrogen for heavy equipment

This opportunity focuses on replacing the fuel used in heavy equipment and machinery (e.g., wheel loaders, forklifts, dump trucks, excavators, tractors) with 100% hydrogen across community and municipal facilities, an industrial site, and a campus setting. Technology readiness was considered low to early-emerging for heavy machinery, since hydrogen is not a drop-in fuel, does not follow diesel specifications, and requires new platforms or substantial retrofits that could include HICE or fuel-cell electric drivetrains, plus storage and refueling systems. Early pilots were noted in select applications (i.e., large construction excavators, wheel loaders, mining haul trucks); however, wide commercial availability for the full range of duty cycles was not identified at this time. The analysis considered:

- Martin Marietta Materials
- MOCR Public Works
- Mulgrave Machine Works
- Port Hawkesbury Paper
- Town of Port Hawkesbury

Table 46: Detailed assessment of Opportunity #6: Hydrogen for heavy equipment

Market readiness	**Potential aggregate demand**	Reported annual diesel consumption for heavy equipment and machinery was used as the starting point with energy converted to a hydrogen equivalent based on assumed drivetrain pathways (hydrogen ICE or fuel-cell electric) and typical duty cycles. Under these assumptions, approximately 1,400 tonnes of hydrogen per year was estimated[144] for the modeled heavy equipment and machinery (i.e., dump trucks, backhoe, loaders, forklifts). It was found that approximately 90% of the modeled energy demand was linked to a single, high-load application in the aggregates/rock-crushing segment, with the remainder distributed across municipal/public-works equipment and site support machinery. Results were sensitive to load factors, operating hours, and achievable engine/fuel-cell efficiency. It is important to note that assumptions reflect the theoretical technical potential under ideal conditions.
	Cost-competitiveness	A fuel-only analysis was performed in which current diesel spend was compared with the cost of delivered hydrogen required to provide comparable work for the modeled duty cycles. Equipment procurement, retrofits, storage/dispensing, site safety systems, and installation were excluded. At current conditions and at this scale, hydrogen was estimated to be approximately 2.5 to 3 times fuel-only premium versus diesel.[145] Outcomes are most sensitive to delivered hydrogen price, utilization of on-site refueling assets, the ability to aggregate multi-site demand, and the efficiency gap between legacy diesel and hydrogen pathways. For fixed, high-utilization sites (e.g., sustained crushing campaigns), partial mitigation could be achieved through multi-year offtake and higher station utilization; for dispersed or seasonal activities, premiums are expected to remain higher. It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated into this cost premium estimate.
	Industry interest	Interest in hydrogen for heavy equipment is emerging but remains exploratory. Fabrication and construction operators expressed curiosity about hydrogen-powered machinery, particularly for applications like forklifts. Some participants indicated willingness to serve as testing grounds for hydrogen technologies.
Policy readiness	**Incentive availability**	• Clean Hydrogen ITC[105]: A refundable producer-side credit for eligible clean-hydrogen projects; indirect benefits could be reflected in offtake pricing for local users.

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[144] Deloitte detailed Excel analysis

[145] Deloitte detailed Excel analysis

	Alignment with decarbonization targets	Annual GHG reductions of approximately 15,000 tCO_2e were estimated for full fuel substitution at the modeled activity level. Actual abatement depends on the certified LCI of supplied hydrogen including electricity mix for electrolysis and on realized operating hours and duty factors. Additional local air-quality benefits that include reduced particulate matter (PM) and NO_x are pathway-dependent and influenced by combustion strategy and after-treatment.
Operational readiness	**Site readiness**	Hydrogen is not yet commercialized for heavy off-road equipment. HICE powertrains and dual-fuel conversions are at pilot or early commercial stages, with unresolved issues around NO_x control, durability, and transient performance for certain duty cycles. Fuel-cell electric machinery has been demonstrated in limited trials, offering zero tailpipe emissions and high efficiency but facing challenges related to system cost, environmental hardening, and power density for the heaviest applications. Broad, warranty-backed availability across municipal and industrial heavy equipment and machinery has not been established, while fuel-cell forklifts are a notable commercial exception with established, warranty-backed availability in material-handling markets. Legacy diesel engines, tanks, and dispensers are incompatible, meaning adoption requires new or refitted equipment and dedicated refueling and storage systems, limiting asset reuse. Refueling for heavy equipment is expected to favor 350-bar depot dispensers, tube-trailer back-to-back fills, or swap-skid logistics, each requiring hazardous-area design, ventilation, leak detection, and fire protection to meet codes and standards. Hydrogen requires new platforms or substantial retrofits (FCEV/HICE), plus storage, compression/dispensing, hazardous-area electrical, leak detection/ventilation, and fire protection. These modifications and retrofits far exceed drop-in fuels and add engineering, commissioning, and schedule risk. There is potential to develop a pipeline connection to a fueling station and to enable on-site bottle filling for distribution, which could become a viable option once EverWind's operations are fully established.
	Value chain capability	EverWind's Point Tupper facility has announced plans to produce up to one million tonnes of green hydrogen per year,[146] with an initial phase targeting 240,000 tonnes [147] annually starting in 2027 and full capacity in 2028. Short-term operations could rely on trucked gaseous or liquid hydrogen to a shared depot as no hydrogen network exists. Short-term hydrogen availability is expected to be limited but when it comes online it may rely primarily on trucked gaseous deliveries via tube trailers and, where logistics allow, liquid hydrogen.

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[146] Canadian company cleared to build $6B green hydrogen facility with 2 GW wind farm (Accessed November 8, 2025)

[147] EverWind Fuels Announces Completion of FEED for its 1st Phase 240,000 Tonne per Annum Green Hydrogen-to-Green Ammonia Plant (Accessed November 8, 2025)

Opportunity #7: Renewable diesel for mobility (on-road)

This opportunity focuses on replacing petroleum diesel with RD across on-road applications including medium- and heavy-duty regional trucks and fuel for locomotives serving the short-line railway. Technology readiness for diesel applications is high as RD is a drop-in fuel that can meet existing diesel specifications. RD100 or a 100% substitution can be used in most modern diesel engines without hardware changes, subject to OEM guidance, fuel-quality standards, and seasonal operability.

Light-duty gasoline use of approximately 430,000 L per year was noted with appropriate clean fuel alternatives identified as battery-electric vehicles and ethanol blending. One organization reported the use of propane-powered forklifts and alternatives include battery-electric systems and, where duty cycles warrant, hydrogen fuel-cells. These options fall outside the RD scope but were noted as complementary decarbonization pathways.

The analysis considered:

- Cape Breton and Central Nova Scotia Railway
- Geno Polegato Trucking
- MOCR Public Works
- Mulgrave Machine Works
- Port Hawkesbury Paper
- Potlotek First Nation
- Town of Port Hawkesbury

Table 47: Detailed assessment of Opportunity #7: Renewable diesel for on-road mobility

Market readiness	**Potential aggregate demand**	A blended top-down/bottom-up approach was used to estimate the aggregate demand. Where fuel records existed, they were used as anchors and where records did not exist, estimates were derived from sector benchmarks and duty-cycle assumptions for trucks and locomotives. Under these assumptions, a total annual requirement of approximately 740,000 litres of RD was estimated[148], led by trucking, followed by the short-line railway. It is important to note that assumptions reflect the theoretical technical potential under ideal conditions.
	Cost-competitiveness	A like-for-like, fuel-only comparison was conducted between RD and conventional diesel. Vehicle/equipment purchases, storage upgrades, and dispensing systems were excluded.[149] At the modeled demand and current supply conditions, RD was found to be approximately 25% more expensive than diesel.[150] Results were considered most sensitive to feedstock and credit markets, contract structure (multi-year vs. spot), seasonal blending/cold-flow requirements, and delivery logistics to depots and yards. For high-volume, steady operations, unit costs could be reduced through multi-year supply agreements and efficient, dedicated deliveries. It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated into this cost premium estimate.
	Industry interest	Interest in RD for on-road mobility is notably strong among participants. Industrial operators, municipal fleets, and community organizations view RD as a practical and low-barrier solution for decarbonizing existing diesel-powered vehicles and equipment. The compatibility with current infrastructure, such as storage tanks and refueling stations, was cited as a key advantage, minimizing the need for costly retrofits or operational disruptions. Participants also highlighted the importance of securing a reliable and preferably Canadian supply of RD, expressing concerns about dependence

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[148] Deloitte detailed Excel analysis

[149] Battery-electric vehicles are the most mature alternative for short, repeatable, back-to-base routes in light- and some medium-duty segments, often showing lower total energy cost but requiring site power upgrades.

[150] Deloitte detailed Excel analysis

		on U.S. imports. Overall, RD is seen as a short-term opportunity with high potential readiness, provided supply chain and policy support challenges are addressed and that it complements the business case for local hydrogen production.[151]
Policy readiness	**Incentive availability**	• CFR[152]: A federal credit market requiring lower LCI for gasoline and diesel. Supplying RD (HVO) can generate credits for primary suppliers, which may be reflected in contract pricing to fleets.
	Alignment with decarbonization targets	Annual GHG reductions of approximately 1,800 tonnes of CO_2e were estimated, based on a full displacement of diesel with RD. The actual level of emissions reduction depends on the certified LCI of the RD used, which varies by feedstock and production method. Additional local air quality benefits, such as reductions in particulate matter and aromatic compounds compared to petroleum diesel is likely, depending on the specific fuel properties and engine calibrations.
Operational readiness	**Site readiness**	Bulk RD can be delivered by truck or rail from regional terminals and stored or dispensed using infrastructure like ultra-low sulfur diesel (ULSD). Key considerations include winter performance (cold-flow properties), water management, filtration, and compatibility of older elastomers. OEM acceptance of RD has been reported across many on-road diesel engines and some rail applications, provided fuel specifications and warranty conditions are met. Operator confirmation with the relevant OEM is recommended before RD100 use. RD is a true drop-in fuel that uses existing diesel engines and most storage and dispensing infrastructure, requiring only incremental quality assurance (QA) adjustments for winter operability. Integration burden is low, maximizing reuse of current vehicles, tanks, and dispensers, a key strength compared to alternatives requiring new platforms or refueling systems. Deployment can begin immediately under supply contracts and standard QA procedures, making RD suitable for pilots at back-to-base depots and select locomotive applications, with scalability as supply contracts firm up.
	Value chain capability	EverWind could, in the future, leverage its hydrogen production to derive RD. Emerging local producers such as Nova Sustainable Fuels may also play a role in future supply through clean fuel co-processing, although RD production is not currently known to be part of their publicly announced plans. In the near term, supply may require importing volumes from other provinces to establish an initial demand signal, paving the way for a transition to larger quantities of locally produced clean fuel. Current RD production exists in Newfoundland and Labrador (e.g., Braya Renewable Fuels), British Columbia (e.g., Tidewater, Parkland), and Alberta (e.g., Imperial), as well as in the U.S., where producers offer lower price points due to generous supply-side incentives such as the 45Z Production Tax Credit.[153] Developing RD end-use would provide several benefits to the region: 1. Act as a transition fuel to advance decarbonization goals aligned with provincial targets, while enabling companies participating in an industrial carbon pricing system. Port Hawkesbury Paper participates in Nova Scotia's Output Based Pricing system to earn carbon credits[154] which can be used to

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[151] RD adoption generally does not create end-use technology lock-in, as RD is a drop-in fuel compatible with existing diesel engines and infrastructure. No major modifications are required for vehicles or equipment, allowing users to transition to other fuels later without RD use-related retrofit costs.

[152] Clean Fuel Regulations (CFR) (Accessed November 8, 2025)

[153] 45Z Production Tax Credit (Accessed November 8, 2025)

[154] Companies that earn surplus credits (by emitting less than their benchmark) can sell them to other regulated entities in Nova Scotia that need credits for compliance.

support subsequent investments towards the adoption of locally produced clean fuels such as green hydrogen.

2. Prepare the market for future uptake of hydrogen-derived RD by demonstrating opportunities for local use, initially with imported RD. This creates an early demand signal for the use of green hydrogen and supports the development of supply chains as a feedstock for hydrotreating processes to produce RD.
3. Demonstrate an early demand signal for RD, which can be co-produced with SAF, thereby encouraging local producers like Nova Sustainable Fuels to invest in and transition toward co-producing RD and SAF domestically.

Opportunity #8: Renewable diesel for marine applications

This opportunity focuses on replacing marine diesel and, where relevant, marine fuel oil with RD (HVO) for ferries, tugboats, pilot launches, barges, fishing vessels, and small cargo craft operating in or from the Strait of Canso. For vessels that run on marine distillates such as marine gas oil (MGO) and marine diesel oil (MDO), RD is a drop-in fuel that follows diesel specifications and has been used in engines where standard fuel-quality and cold-weather practices were considered sufficient. Vessels designed for residual/ HFO/low sulfur fuel oil (LSFO) are not direct drop-in candidates as moving these vessels to RD generally requires conversion to distillate operation or tailored blends, with associated cost and operational changes.

The analysis considered:

- Atlantic Pilotage Authority
- EverWind and Point Tupper Marine Services
- Marine Atlantic
- Martin Marietta Materials
- McNally Construction
- Northumberland Ferries
- Nova Scotia Community College - Strait Area Campus
- Potlotek First Nation
- Mulgrave Marine Terminal

Like Opportunity #3: Hydrogen for marine applications, the aggregate demand may be even higher since direct fuel use at marine terminals is minimal. Third-party fuel sales to commercial fishing vessels represent significant volumes which were not included in this estimate due to data availability, making them strong candidates for an offtake agreement.

Table 48: Detailed assessment of Opportunity #8: Renewable diesel for marine applications

Market readiness	**Potential aggregate demand**	Fuel use was estimated from ferry schedules and sailing hours, and from activity-based scaling for tug and harbour craft, fishing vessels, pilotage, and small cargo operations. On this basis, total renewable-diesel demand is estimated at approximately 23 million litres per year.[155] The largest volumes come from scheduled ferry service and harbour support craft with fishing vessels and small cargo uses contributing meaningful but smaller shares. It is important to note that assumptions reflect the theoretical technical potential under ideal conditions.
	Cost-competitiveness	A fuel-only comparison was conducted between RD and conventional marine fuels. Relative to marine diesel, RD may increase fuel costs by approximately 60% when compared to residual or HFOs, and potentially up to 200%[156], as incumbent fuels are currently significantly less expensive per litre. The cost of RD is most sensitive to factors such as feedstock and credit market volatility, the choice between multi-year contracting and spot purchases, cold-flow management requirements, and logistics considerations for steady-duty users like ferries and tugs versus seasonal fleets. It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated into this cost premium estimate.
	Industry interest	Stakeholder interest in RD for marine mobility has been noted, with feedback emphasizing practical considerations. Fishing operators and marine service providers have identified RD as a potential alternative to conventional marine fuels. Its drop-in compatibility with existing engines and fueling infrastructure is regarded as advantageous, as it enables emissions reductions without significant capital investment or operational disruption. Participants also indicated that RD could be distributed through existing fuel stations, including community-owned facilities, which may serve as strategic locations for initial pilot projects. Concerns were expressed regarding the

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[155] Deloitte detailed Excel analysis

[156] Deloitte detailed Excel analysis

		ability to secure a consistent and cost-competitive supply, with a preference for Canadian-sourced product to support reliability and regional energy security objectives.
Policy readiness	**Incentive availability**	Several federal programs can help improve delivered cost or enable bunkering and storage: • CFR[152]: Creates a national credit market that requires lower LCI for gasoline and diesel. RD used in Canada generates credits for primary suppliers, which can be reflected in contract pricing.
	Alignment with decarbonization targets	For the approximated demand volumes, the estimated GHG emissions reduction would be approximately 32,000 tonnes of CO_2e per year.[157] Actual outcomes would depend on the certified LCI of the RD supplied and the proportion of operations transitioned from residual fuels to distillate-range drop-in alternatives. This approach aligns with federal CFR and broader marine decarbonization initiatives aimed at reducing the CI of fuels used in Canadian waters.
Operational readiness	**Site readiness**	Site readiness varies across vessel types. For distillate-fueled vessels (using MGO or MDO), RD is a drop-in replacement requiring only standard filtration, water management, and cold-flow practices, resulting in a relatively low implementation burden. In contrast, vessels operating on residual fuels would require conversion to distillate operation or the use of tailored blends, representing a significantly higher burden. At the fleet level, the overall readiness is assessed as medium, reflecting high potential for re-use among distillate vessels and existing port storage and dispensing infrastructure, but limited re-use for residual-fuel vessels that require conversion. Weighted across the fleet including feasibility for ferries, tugs, pilot launches, fishing vessels, and other distillate-based craft using existing bunkering systems, readiness is considered medium to high. If existing land-based fuel stations are used, local delivery challenges remain, as fuel would still need to be trucked to marine locations for bunkering. There is also potential to employ barges for marine fueling and to integrate RD storage with land-based supply. Furthermore, a barge-based fueling concept may enable fueling throughout the Strait without requiring additional vessel stops at port, improving operational flexibility. An early focus on back-to-base operators, such as ferries and harbour craft, could support a dependable and scalable rollout.
	Value chain capability	The value chain capability aligns with that of Opportunity #7: Renewable diesel for on-road mobility. A key consideration is the significant distance between the Strait of Canso region and the ferry terminals, which would necessitate trucking supply to these locations and storing it on-site at their terminals. One exception is Marine Atlantic, which may benefit from RD currently produced in Newfoundland and Labrador by Braya Renewable Fuels for its NL ferry terminal.

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[157] Deloitte detailed Excel analysis

Opportunity #9: Renewable diesel for electricity

This opportunity focuses on replacing the diesel fuel used in backup electricity generators (gensets) with RD100 across port and marine-terminal operations, community and municipal facilities, Indigenous community facilities, and a campus setting in the Strait of Canso. Technology readiness was considered high for diesel generators, since RD is a drop-in that follows diesel specifications and can be used without changes in most engines, with normal attention to fuel quality and cold-weather performance. One site that uses propane was not considered, as a change to a diesel-fueled generator (or an equivalent non-propane solution) would be needed before RD could be used.

The analysis considered:

- MOCR Public Works
- Potlotek First Nation
- Municipality of the District of Guysborough
- Town of Mulgrave
- Paqtnkek Mi’kmaw Nation
- Nova Scotia Community College - Strait Area Campus
- EverWind and Point Tupper Marine Services
- Strait of Canso Superport (Mulgrave Marine Terminal)

Table 49: Detailed assessment of Opportunity #9: Renewable diesel for electricity

Market readiness	**Potential aggregate demand**	A blended, activity-based approach was used to estimate the aggregate demand. Where backup-fuel records were available, they were used as anchors; and where not available, activity-based scaling was applied from similar operations. Under these assumptions, the total requirement was estimated at approximately 22,000 litres of RD per year.[158] The majority was indicated to come from a municipal user, followed by a marine-services user, with the remainder distributed across community facilities and the campus. Results are sensitive to test-run schedules, outage frequency, and year-to-year operating hours. It is important to note that assumptions reflect the theoretical technical potential under ideal conditions.
	Cost-competitiveness	A fuel-only comparison was performed between RD and current fuels. Generator purchases, conversions, tanks, and electrical upgrades were excluded. At current conditions, RD was indicated to increase the annual fuel cost by about 25% more when compared with petroleum diesel[159], subject to contract structure and delivery logistics. Outcomes were considered most sensitive to feedstock/credit markets, multi-year versus spot contracting, seasonal cold-flow management, and delivery scale to dispersed sites. It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated into this cost premium estimate.
	Industry interest	Participant feedback indicates that interest in RD for stationary energy applications is primarily associated with backup power requirements. Industrial operators and organizations managing hospitals, municipal facilities, and energy infrastructure have identified RD as a potential substitute for conventional diesel in generators and auxiliary systems. Its compatibility with existing equipment and fuel handling processes is considered advantageous, as it enables short-term emissions reductions without significant capital investment. Overall, RD is regarded as a practical option for stationary energy applications where electrification is currently not feasible.

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[158] Deloitte detailed Excel analysis

[159] Deloitte detailed Excel analysis

Policy readiness	**Incentive availability**	Several federal programs were identified that could improve delivered cost or help with enabling infrastructure: • CFR[152]: Creates a national credit market for lower-carbon fuels. RD can generate credits for primary suppliers, which may be reflected in contract pricing.
	Alignment with decarbonization targets	An annual GHG emissions reductions of approximately 52 tCO_2e was estimated for the referenced demand volumes.[160] The actual reduction depends on the certified LCI of the RD delivered and on actual generator run hours. Local air-quality benefits, such as lower aromatics and particulate matter relative to diesel, were considered likely, subject to engine condition and fuel properties.
Operational readiness	**Site readiness**	Site readiness for RD in stationary applications is generally high. RD functions as a drop-in replacement, requiring only standard practices such as filtration, water control, stability management, and winter operability measures. No additional hazardous-fuel systems or ventilation requirements are introduced compared to ULSD. RD can be delivered by truck to existing diesel tanks and dispensers, with routine attention to cold-flow properties, filtration, water control, and fuel stability during low-hour standby operation. Most diesel-generator manufacturers recognize RD that meets established diesel specifications; however, confirmation of compliance with applicable fuel standards and warranty terms is required prior to RD100 use. Existing generators, tanks, dispensers, and operating procedures can be largely reused, with only minor incremental QA and operability practices such as cold-flow management and fuel polishing required.
	Value chain capability	The value chain capability aligns with that of Opportunity #7: Renewable diesel for on-road mobility

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[160] Deloitte detailed Excel analysis

Opportunity #10: Renewable diesel for heavy equipment

This opportunity focuses on replacing the fuel used in heavy equipment and machinery (e.g., wheel loaders, forklifts, dump trucks, excavators, tractors) with 100% RD (HVO) across community and municipal facilities, an industrial site, and a campus setting in the Strait of Canso. This opportunity targets high-diesel-consuming equipment, including rock crushers, screening plants, large wheel loaders, excavators, articulated dump trucks, graders, snowplows, forklifts, mobile cranes, diesel generators, and other heavy machinery. Technology readiness was considered high for heavy machinery, since RD is a drop-in fuel that follows diesel specifications and can be used without changes in most modern equipment, with normal attention to fuel quality and cold-weather performance. The analysis considered:

- Martin Marietta Materials
- MOCR Public Works
- Mulgrave Machine Works
- Port Hawkesbury Paper
- Town of Port Hawkesbury

Table 50: Detailed assessment of Opportunity #10: Renewable diesel for heavy equipment

Market readiness	**Potential aggregate demand**	Reported annual fuel consumption for heavy equipment and machinery was used as the primary basis for estimating demand. Where gaps existed, comparable duty cycles and activity profiles were applied for reasonableness checks. Under these assumptions, the total requirement was estimated at approximately 4.9 million litres of RD per year.[161] It was found that approximately 90% of this fuel demand was linked to a single high-load application in the aggregates/rock-crushing segment, with the remaining share distributed across municipal/public-works equipment, site support machinery, and campus operations. It is important to note that assumptions reflect the theoretical technical potential under ideal conditions.
	Cost-competitiveness	A like-for-like, fuel-only comparison was conducted between RD and conventional diesel. Equipment purchases, storage upgrades, dispensing systems, and job-site logistics were excluded. At current conditions, RD was found to be up to approximately 30% more expensive than conventional diesel on a delivered-fuel basis.[162] Results were considered most sensitive to feedstock and credit markets, contract structure (multi-year vs. spot), seasonal cold-flow management, and delivery scale to dispersed job sites and temporary yards. For high-volume users with steady operation such as crushing campaigns, costs could be moderated through multi-year supply agreements, consolidated deliveries, and coordinated storage/filtration practices. It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated into this cost premium estimate.
	Industry interest	Interest in RD for heavy equipment is strong and grounded in operational practicality. Industrial and municipal operators relying on forklifts, excavators, loaders and plows identified RD as a low-barrier solution that aligns with existing fueling infrastructure and equipment. The ability to use RD without major retrofits was seen as a key advantage, particularly for fleets with newer diesel assets that are not yet due for replacement. Several participants expressed openness to pilot deployments, especially where fuel storage and refueling systems already exist. However, concerns were raised about cost parity with diesel, securing a consistent supply, and ensuring the fuel meets performance standards.

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[161] Deloitte detailed Excel analysis

[162] Deloitte detailed Excel analysis

Policy readiness	**Incentive availability**	- CFR[152]: A federal credit market in which supplying lower-CI diesel substitutes (RD/HVO) can generate credits for primary suppliers; value can be reflected in contract pricing.
	Alignment with decarbonization targets	Annual GHG reductions of approximately 18,000 tCO_2e were estimated[163], based on full replacement of conventional diesel with RD for the modeled equipment set. This was described as roughly equivalent to the annual emissions of approximately 3,800 passenger cars. The actual level of reduction depends on the certified LCI of the RD delivered (feedstock and production pathway) and on engine condition and calibrations in the field.
Operational readiness	**Site readiness**	RD is a drop-in fuel for most off-road engines, requiring only standard fuel-quality management, winter blending and cold-flow control, and routine filtration or polishing. Existing tanks, fuel-delivery trailer day tanks, dispensers, and engines can be reused with minor procedural updates, such as cold-flow and filtration checks. Immediate pilot projects are feasible through contracted RD deliveries to existing diesel infrastructure, with priority given to one high-load industrial site (e.g., aggregates/crushing) and one municipal yard to validate winter operability and quality assurance and quality control performance.
	Value chain capability	The value chain capability aligns with that of Opportunity #6: Hydrogen for heavy equipment, Opportunity #7: Renewable diesel for on-road mobility, and Opportunity #8: Renewable diesel for marine applications.

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[163] Deloitte detailed Excel analysis

Opportunity #11: Methanol for marine applications

This opportunity focuses on replacing marine diesel or fuel oil with e-methanol for ferries, tugboats, pilotage launches, small cargo and a training vessel that operate in or from the Strait of Canso. It was assumed that approximately 95% of propulsion energy would be supplied by methanol, with approximately 5% retained for the incumbent fuel through start-up, pilot ignition, or redundancy. Technology readiness is dependent on application. Dual-fuel two-stroke methanol engines for oceangoing vessels are in commercial service and four-stroke methanol packages for ferries are commercially offered. Class/flag guidance based on the IMO's interim methanol safety guidelines (MSC.1/Circ.1621[164]) is in force. Pilots and early commercial deployments were noted for tugs and small harbour craft, but wider adoption was assessed as early-stage and dependent on OEM offerings, class approvals, and local bunkering readiness.

The analysis considered:

- Atlantic Pilotage Authority
- EverWind and Point Tupper Marine Services
- Marine Atlantic
- Martin Marietta Materials
- Northumberland Ferries
- Nova Scotia Community College - Strait Area Campus

Similarly with Opportunities #3: Hydrogen for marine applications and #7: Renewable diesel for on-road mobility, the aggregate demand may be even higher since direct fuel use at marine terminals is minimal but third-party fuel sales to commercial fishing vessels represent significant volumes which were not included in this estimate due to data availability, making them strong candidates for an offtake agreement.

Table 51: Detailed assessment of Opportunity #11: Methanol for marine applications

Market readiness	**Potential aggregate demand**	A blended, activity-based approach was used to estimate the aggregate demand. Ferry demand was anchored to published timetables and sailing hours; harbour craft (tugs, pilotage), the training vessel, and a small cargo application were scaled from activity and reference-port benchmarks. The 95% by-energy methanol share was applied and converted to litres. On this basis, approximately 47 million litres per year of e-methanol was estimated[165], with the largest shares indicated for scheduled ferry service and harbour support craft. Results are sensitive to actual service hours, load factors, and seasonal patterns. It is important to note that assumptions reflect the theoretical technical potential under ideal conditions.
	Cost-competitiveness	A fuel-only comparison was performed. At current conditions, e-methanol were estimated to be approximately two to six times more expensive than incumbent fuels on an energy-equivalent basis.[166] The lower end was associated with displacement of marine diesel, and the upper end was associated with heavy/residual fuels. Vessel conversions, tank/piping changes, safety systems, and bunkering infrastructure were not included. Cost exposure may remain material in the near term, with only partial mitigation through multi-year offtake and high utilization bunkering hubs. Policy supports may help de-risk infrastructure and pilots but may not erase the current fuel premium. It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated into this cost premium estimate.
	Industry interest	Interest in methanol as a marine fuel appears limited, with minimal direct engagement or expressed demand from local operators. While some organizations indicated openness to serving as test sites for emerging hydrogen technologies, concerns were

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[164] MSC.1/Circ.1621 INTERIM GUIDELINES FOR THE SAFETY OF SHIPS USING METHYL/ETHYL ALCOHOL AS FUEL (Accessed November 8, 2025)

[165] Deloitte detailed Excel analysis

[166] Deloitte detailed Excel analysis

		raised regarding the maturity and availability of methanol as a marine fuel for small-medium sized vessels, as well as the equipment upgrades required for its adoption.
Policy readiness	**Incentive availability**	- CFR[152]: A national compliance-credit market that rewards lower LCI. While aimed at gasoline/diesel pools, producer credits and offtake strategies can improve delivered pricing for low-carbon fuels and related infrastructure.
	Alignment with decarbonization targets	Annual GHG reductions of approximately 27,000 tCO$_2$e were estimated [167] for the modeled adoption. Realized reductions depend on the certified LCI of e-methanol (electrolyzer electricity mix and CO$_2$ source), duty cycles, and the share of activity displaced from residual fuels versus distillates.
Operational readiness	**Site readiness**	Adoption of methanol as a marine fuel requires significant infrastructure and operational changes. Vessels must undergo conversions or be constructed as methanol-capable newbuilds, incorporating alcohol-compatible tanks and piping, double-walled or segregated fuel lines, gas detection and ventilation systems, and crew training in accordance with MSC.1/Circ.1621[164] and applicable class rules. Port-side storage and bunkering would also require dedicated systems and safety cases, making the transition substantially more complex than a drop-in fuel transition. While some hull and electrical systems may be reusable, fuel storage, piping, detection and ventilation systems, and bunkering assets generally require major modifications or new installations. Reuse potential is therefore limited compared to distillate fuels. Commercial methanol engines and conversions are recognized for large vessels (two-stroke) and offered for ferries (four-stroke), with class rules and IMO guidance in place for systems, detection, and ventilation. Tugs and small craft are at as early commercial/pilot stages and adoption could progress as engine kits, safety packages, and class approvals mature. For all segments, crew training, methanol-compatible materials, double-walled/segregated piping, and gas detection/ventilation would be required.
	Value chain capability	Short-term methanol supply for marine applications in the Strait of Canso may initially rely on imports of small quantities to establish an early demand signal, supporting the transition to larger volumes of locally produced clean fuel in the future. Currently, local production remains a medium- to long-term prospect. E-methanol requires green hydrogen and renewable CO$_2$ and while early-stage hydrogen projects have been signaled, no firm e-methanol production plans are in place. Biogenic CO$_2$ from regional industry could be considered but capture and aggregation systems would need to be developed; imported CO$_2$ is technically feasible but logistically complex. Nova Sustainable Fuels has announced intentions to produce renewable methanol at its Renewable Energy Park in Goldboro, Nova Scotia, but the project is still in permitting, with no confirmed timeline.[168] In the interim, methanol may need to be sourced from out-of-province or international suppliers, either as e-methanol or bio-methanol, at premium pricing. Methanol is already a widely traded liquid and can be transported by ship or truck, but alcohol-compatible tanks, seals, transfer systems, and gas detection and ventilation would be required at depots. Truck-to-tank or depot-to-vessel bunkering is technically feasible with dedicated storage and safety systems; however, shared storage and multi-operator bunkering would require offtake certainty and port safety cases. A key consideration for ferry terminals is their significant distance from the Strait of Canso

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[167] Deloitte detailed Excel analysis

[168] Nova Sustainable Fuels Renewable Energy Park Project (Accessed November 8, 2025)

region, which would necessitate trucking supply to these locations and storing it on-site at their terminals.

Opportunity #12: Ammonia for marine applications

This opportunity focuses on replacing marine diesel or fuel oil with green ammonia for selected cargo vessels, ferries, pilotage and harbour craft, and a training vessel operating in or from the Strait of Canso. It was assumed that approximately 95% of propulsion energy would be supplied by ammonia, with approximately 5% retained for the incumbent fuel through start-up, pilot ignition, or redundancy. Technology readiness is dependent on application. Large, two-stroke propulsion, commercial ammonia-capable engines have been demonstrated at full load and are progressing toward market entry. Four-stroke ammonia solutions have undergone extensive testing and have been introduced to the commercial marine sector under class guidance and the IMO interim safety guidelines. Estimates for smaller craft were included with the caveat that they are considered further from commercial adoption as engine packages and retrofit paths mature under the new safety framework.

The analysis considered:

- Atlantic Pilotage Authority
- EverWind and Point Tupper Marine Services
- Marine Atlantic
- Martin Marietta Materials
- Northumberland Ferries
- Nova Scotia Community College - Strait Area Campus

Like Opportunities #3: Hydrogen for marine applications; #7: Renewable diesel for on-road mobility; and #9: Renewable diesel for electricity; it is important to note that the aggregate demand may be even higher since direct fuel use at marine terminals is minimal. Third-party fuel sales to commercial fishing vessels represent significant volumes which were not included in this estimate due to data availability, making them strong candidates for an offtake agreement. Assumptions reflect theoretical technical potential under ideal conditions.

Table 52: Detailed assessment of opportunity #12 (ammonia for marine applications)

Market readiness	**Potential aggregate demand**	A blended, activity-based approach was applied to estimate aggregate demand. Ferry demand was anchored to timetable-based sailing hours, while cargo use, harbour craft, pilotage, and the training vessel were scaled using activity data and reference port benchmarks. A 95% by-energy ammonia share was applied to each use case and converted to kilograms. On this basis, total green ammonia demand was estimated at approximately 7,600 tonnes per year[169], with the largest shares attributed to scheduled ferry service and harbour support craft. It is important to note that aggregate demand may be understated. While the current analysis excludes ammonia-fueled cargo vessels due to their absence in the market, there is potential for these ships to emerge as a means of exporting locally produced clean fuels to the EU. These cargo vessels could capitalize on local ammonia refueling infrastructure which in turn could also serve other cargo vessels transiting near the Strait of Canso, creating significant demand from both regional vessels responsible for exports and those passing through.
	Cost-competitiveness	A fuel-only comparison was performed. At current conditions, green ammonia was estimated to be approximately 30% to 200% the cost of incumbent fuels on an energy-equivalent basis. [170].The lower end is associated with displacement of marine diesel and the higher end with displacement of residual/HFOs. Vessel conversions, tank and piping changes, safety systems, and bunkering infrastructure were not included. A premium would likely persist in the near term, with partial mitigation only where back-to-base

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[169] Deloitte detailed Excel analysis

[170] Deloitte detailed Excel analysis

		bunkering, high utilization, and multi-year offtake are achievable. It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated into this cost premium estimate.
	Industry interest	Interest in ammonia as a marine fuel is strong given its planned production in the region, particularly with regards to out-of-province cargo operators seeking to secure low-carbon fuel supply along their routes. The Strait of Canso may be viewed as a strategic location for bunkering, given its geographic position at the intersection between major shipping corridors connecting the St. Lawrence Seaway, northern Canada, Europe, and the United States. This geographic advantage may position the region as a potential hub for ammonia supply to transiting vessels, complementing broader decarbonization efforts in international shipping.[171]
Policy readiness	**Incentive availability**	• Clean Hydrogen ITC[105]: A refundable federal tax credit for clean-hydrogen projects that also covers eligible clean-ammonia equipment integrated into a qualified hydrogen facility, with rates set by the project's certified CI and timelines.
	Alignment with decarbonization targets	Annual GHG reductions of approximately 11,000 tCO_2e were estimated[172] at the modeled adoption level. Realized reductions depend on the certified LCI of green ammonia (electrolyzer electricity mix and nitrogen/air-separation footprint), duty cycles, and the share of activity displaced from residual fuels versus distillates. Air-quality benefits are pathway-specific. Sulfur dioxide (SO_x) and PM are eliminated at the point of use, while NO_x control and potential nitrous oxide (N_2O) formation would need to be managed via combustion tuning and aftertreatment to secure net benefits.
Operational readiness	**Site readiness**	Marine refueling represents a potential opportunity; however, current demand is limited because vessels typically bypass the port, aware that fuel is not available. Operators also seek to minimize the number of stops and time spent at port. Establishing hydrogen or ammonia fueling infrastructure could attract vessels operating on nearby routes and position the site as a strategic hub for low-carbon marine energy in the future. Potential fueling options include a dedicated fueling barge or the EverWind Marine Terminal. McNally Construction could also be considered if an ammonia pipeline is placed near its site and fueling systems are installed to connect with existing dolphin structures. EverWind's Marine Terminal may be able to dispense hydrogen or ammonia to other vessels, provided this does not interfere with its core operational requirements. Adoption of ammonia as a marine fuel requires substantial infrastructure and operational changes. Vessels must incorporate ammonia-compatible tanks and piping, double-walled or segregated fuel lines, gas detection systems, forced ventilation, and crew training with emergency protocols in accordance with MSC.1/Circ.1621[164] and class rules. On-board NO_x control and ammonia slip mitigation must also be integrated. The scope of these requirements goes well beyond a conventional fuel switch. While some hull and electrical systems can be retained, fuel storage, piping, detection and ventilation systems, and bunkering equipment generally require new or significantly modified assets, limiting reuse compared to distillate drop-ins.

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[171] This perspective is also true for ammonia, methanol, and hydrogen for marine applications opportunities (Opportunities #3, #9, and #10).

[172] Deloitte detailed Excel analysis

	A single fixed-route ferry or selected harbour craft pilot could be feasible within three years, using dedicated depot storage, truck-to-tank bunkering, trained crews, and approved safety procedures. Lead-time risks include engine package availability, conversion scheduling, and safety case approvals. Although not included in the current analysis due to the absence of local commercially available ammonia-fueled dry bulk carriers, there is potential for such vessels to support exports of EverWind's product to the EU. Some vessels may be able to fuel at the EverWind Martine Terminal, while others could require a local ammonia fuel barge to support efficient refueling during port calls.
Value chain capability	Short-term ammonia availability for marine bunkering in the Strait of Canso would likely depend on imports of small quantities to establish an initial demand signal, supporting the transition to larger volumes of locally produced ammonia in the future. While export-oriented projects have been announced, firm supply for marine use is not yet confirmed. EverWind's Point Tupper facility has announced plans to produce up to one million tonnes of green hydrogen per year,[173] with an initial phase targeting 240,000 tonnes[174] annually starting in 2027 and full capacity in 2028, positioning the region as a future production hub. Transport and storage of ammonia require dedicated tanks, secondary containment, and robust safety systems. Initial bunkering could begin with truck-to-tank or ship-to-shore pilots, scaling only with commissioned port infrastructure, trained personnel, and approved safety cases. Like other opportunities, a key consideration for ferry terminals is their significant distance from the Strait of Canso region, which would necessitate trucking supply to these locations and storing it on-site at their terminals.

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[173] Canadian company cleared to build $6B green hydrogen facility with 2 GW wind farm (Accessed November 8, 2025)

[174] EverWind Fuels Announces Completion of FEED for its 1st Phase 240,000 Tonne per Annum Green Hydrogen-to-Green Ammonia Plant (Accessed November 8, 2025)

Opportunity #13: SAF for mobility (aviation)

This opportunity focuses on replacing conventional jet fuel with SAF for a regional aviation operation supporting private/business travel. For modeling, it was assumed that 100% of annual propulsion energy would be matched to SAF.[175] In practice, American Society for Testing and Materials (ASTM)-compliant SAF is used as a drop-in blend that is pathway-dependent, typically up to 50%, recertified under ASTM D1655 once blended under ASTM D7566. The use of 100% SAF without blending with conventional jet fuel remains limited to demonstrations or special approvals. Where a 100% substitution claim is desired, a book-and-claim approach was considered the practical mechanism to align fuel use with SAF production without on-airport handling of SAF.

The analysis considered the Allan J. MacEachen Airport (Celtic Air Services).

Table 53: Detailed assessment of Opportunity #13: SAF for aviation

Market readiness	**Potential aggregate demand**	The annual jet fuel demand was provided by Celtic Air Services but remains confidential. For this analysis, it is assumed that 100% of the operator's Jet-A[176] consumption is replaced with SAF on a one-to-one basis, either through physical blending or book-and-claim. The resulting opportunity equals the operator's disclosed annual Jet-A demand, though the specific value is not published in this report. Scale is constrained by SAF availability, cost, and policy signals. Within these bounds, expansion to additional operators and airframes is straightforward due to SAF's drop-in compatibility and shared airport infrastructure. It is important to note that assumptions reflect the theoretical technical potential under ideal conditions.
	Cost-competitiveness	A fuel-only comparison was performed. At current conditions, SAF was indicated to be around approximately two times the cost of conventional jet fuel for the modeled operation.[177] This comparison excluded storage/segregation, QA updates, and dual-product handling. Results are most sensitive to production pathway/feedstock (see Section 5.4 for additional information on SAF production), contract structure (multi-year vs. spot), credit realization (e.g., CFR credit pass-through for domestic use), and logistics (pre-blended deliveries vs. book-and-claim). It is important to note that the potential impact of policy measures and incentives on reducing the cost differential was not incorporated into this cost premium estimate.
	Industry interest	Interest is active but constrained by regulatory and economic barriers. Luxury travel and business aviation sectors have shown strong enthusiasm, viewing SAF as a branding differentiator and a pathway to sustainability leadership. Based on community and industry feedback, regulatory timelines have been identified as a challenge that could affect operational feasibility. Participants also emphasized the importance of targeted subsidies to help close the cost gap between SAF and conventional jet fuels. Despite these considerations, SAF is viewed as a potential low to medium-term solution for aviation decarbonization, provided there is continued regulatory progress and tailored financial support.
Policy readiness	**Incentive availability**	• CFR[152]: A federal credit market under which eligible low-CI fuels including SAF can create credits for registered creators/producers/importers. Value can be reflected in pricing for domestic SAF use. Guidance and credit-tracking systems were noted to be in place. There is no federal SAF blending mandate in force as of Oct 27, 2025.

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[175] Deloitte detailed Excel analysis

[176] Jet-A is the baseline fuel that SAF is designed to replace on a drop-in basis.

[177] Deloitte detailed Excel analysis

		• Clean Economy ITCs (select assets)[178]: Refundable ITCs are available for certain clean-technology equipment (e.g., hydrogen, clean electricity, manufacturing) that may apply to components of SAF projects, depending on project design and eligibility rulings.[179]
	Alignment with decarbonization targets	Annual GHG reductions of approximately 1,700 tCO_2e were estimated at the modeled adoption level. Realized reductions depend on the certified LCI of the SAF pathway/feedstock and on actual blend levels realized via physical vs. book-and-claim. This is directionally aligned with Canada's Aviation Climate Action Plan[180] with its net-zero vision, aspirational 2030 SAF uptake, and international practice.
Operational readiness	**Site readiness**	For ASTM-certified blends (D1655), SAF is a true drop-in fuel as existing aircraft, engines, airport tanks, hydrant systems, and dispensing equipment remain fully usable with standard QA/QC and documentation updates. No additional infrastructure is required unless handling neat SAF or performing on-site blending. Aircraft, storage tanks, filtration systems, hydrant networks, bowsers, and fueling procedures are expected to be reused with only minor procedural adjustments, a key advantage compared to non-drop-in alternatives.
	Value chain capability	Nova Sustainable Fuels has signaled plans to produce up to 150,000 tonnes of SAF annually, but the project is still in early permitting and environmental assessment review with potential timeline of construction in 2028 and operation in 2031.[181] Although the project is primarily designed for export markets, there may be an opportunity to allocate a portion of production to supply local aviation demand, supporting regional decarbonization objectives. Short-term SAF availability at the Strait of Canso may depend on importing small quantities to establish an initial demand signal, supporting the transition to larger volumes of locally produced clean fuel in the future. This approach reflects Canada's current import-based SAF usage. Global production remains limited and priced at a premium, making multi-year contracting and credit monetization under the CFR[152] essential for cost management and supply continuity.

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[178] Clean Economy Investment Tax Credits (select assets) (Accessed November 8, 2025)

[179] Canada does not have a SAF-specific production tax credit; industry continues to advocate for one.

[180] Canada's Aviation Climate Action Plan (Accessed November 8, 2025)

[181] Simply Blue Group chooses Nova Scotia for Sustainable Aviation Fuel Project (Accessed November 8, 2025)

4.4 Summary of results and short list of opportunities

Table 54: Ranked and shortlisted clean fuel opportunities by end-use application

Criteria	Opportunities	Hydrogen						RD				Methanol	Ammonia	SAF
		1	2	3	4	5	6	7	8	9	10	11	12	13
		Process heat	Mobility (on-road)	Marine	Electricity	Blending with natural gas	Heavy equipment	Mobility (on-road)	Marine	Electricity	Heavy equipment	Marine	Marine	Mobility (air)
Market readiness	**Potential aggregate demand** What is the potential aggregate fuel volume of pursuing the strategic option?	1	2	1.5	3	2	1.5	1.5	3	1	2	2.5	2.5	1.5
	Cost-competitiveness Considering commodity costs; what is the required end-user fuel switching cost?	1	2	2.5	2	2	2	3	3	3	3	1	2.5	2
	Industry interest What is the level of interest and engagement from potential end-users?	3	3	3	3	3	3	2	2	2	2	1	2	1
Policy readiness	**Incentive availability** Are support mechanisms available to potentially reach cost parity or align with willingness-to-pay model?	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	1.5	2	1.5
	Alignment with decarbonization targets What is the level of CO_2 abatement associated with the option?	1	2	1.5	2	2	1.5	1	3	1	2	3	1.5	1
Operational readiness	**Site readiness** How much change is required in terms of storage/infrastructure, logistics and distribution, and equipment?	1	1.5	1	2	1.5	1	3	3	3	3	1	1	3
	Value chain capability To what extent does the option align with local clean fuel supply (current, planned, not planned)?	3	3	3	3	3	3	2	2	2	2	1	3	2
	Total	12.5	16	15	17.5	16	14.5	14.5	18	14	16	11	15.5	12
	Overall opportunity level	**Medium**	**High**	**Medium-High**	**High**		**Medium-High**	**High**				**Low-Medium**	**High**	**Medium**
	Rank	7	**2**	5	**1**		6	**4**				9	**3**	8

Scoring legend	1 Low	1.5 Low-Medium	2 Medium	2.5 Medium-High	3 High

The four highest-ranked opportunities which form the short list for further consideration are summarized as follows:

1. **Hydrogen for electricity and blending with natural gas**
   Opportunities #4 and #5 were grouped due to their similarity in requiring utilities to lead the transition. *Illustrative future state:* Hydrogen is blended in Point Tupper's gas lines, supplying the local paper mill and paving the way for a broader transition to hydrogen-based energy generation at the Nova Scotia Power Point Tupper Generating Station[182], supporting their planned shift from coal to natural gas.
2. **Hydrogen for mobility (on-road)**
   Illustrative future state: A new hydrogen refueling station would enable local trucking and railway companies to begin transitioning their fleets to locally produced clean hydrogen. The adoption of dual fuel diesel-hydrogen retrofit kits for Class 8 trucks and/or new heavy-duty FCEV would need to be supported by dedicated hydrogen supply and refueling infrastructure.
3. **Ammonia for marine applications**
   Illustrative future state: A local heavy industry company introduces a dual-fuel ammonia cargo ship powered by locally produced ammonia. The availability of ammonia has also attracted other dual-fuel cargo operators to incorporate refueling in the Strait of Canso region as part of their routes, reinforcing the jurisdiction as an emerging hub for clean marine fuels.
4. **RD across all end-use applications**
   RD opportunities (#7-10) were grouped due to their similarity, as RD functions as a drop-in fuel requiring no modifications to existing equipment. *Illustrative future state:* The Strait of Canso community will begin by importing small volumes of RD to establish an initial demand signal, laying the foundation for a future transition to larger quantities of locally produced clean fuel. This fuel will power ferries, tugboats, railways, and municipal operations, while local fleets and backup generators operate on decarbonized energy, marking a significant milestone in Nova Scotia's green transition.

These four shortlisted opportunities will serve as the foundation for identifying potential pilot projects for infrastructure development and community-scale planning in Section 6.

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[182] Nova Scotia Power was consulted as part of industry engagement. NSP has considered blending hydrogen into a future state; however, plans are in very early stages, and no firm commitments have been made around leveraging hydrogen for this plant.

5. Investment attraction opportunities

While the previous chapter focused on opportunities to use clean fuels in the region's existing economy, this section explores a more transformative opportunity: how the local availability of green hydrogen, ammonia, and other clean fuels can enable new industrial activity and attract co-located anchor tenants. By leveraging these fuels as feedstocks, the Strait of Canso has the potential to reshape its economic trajectory for decades to come. The aim is of this chapter is to identify industries most likely to commit major capital investment alongside early clean fuel production, based on global evidence and the region's unique locational advantages.

5.1 How hydrogen is being used today

While hydrogen has long been discussed as a key fuel for decarbonization, progress toward *green* hydrogen has been slower and more economically challenging than early expectations. According to IEA, global demand for hydrogen remains dominated by established industrial sectors such as refining, ammonia, and methanol production, at roughly 100 million tonnes[183] (Mt) per year. Low-emissions hydrogen still accounts for less than 1% of total production due in large part to high costs and limited policy support.[184]

While emerging applications such as power generation or mobility have been explored, they currently represent a very small share of overall demand and face cost competition from incumbent fuels and alternative technologies. This economic gap, combined with regulatory and infrastructure uncertainty, has tempered investment momentum in some regions and slowed project pipelines, even as low-emissions hydrogen production capacity is projected to grow through 2030 with supportive measures.

Table 55: Overview of global hydrogen use by industry/sector

Industry / sector	How hydrogen is used	Share of global demand [185]
Oil refining	Hydrotreating and hydrocracking to remove sulphur and improve fuel quality	40%
Ammonia production	Haber–Bosch synthesis of ammonia, primarily for fertilizer	35%
Methanol production	Hydrogen-rich syngas used to produce methanol	10–15%
Iron and steel (direct reduced iron)	Hydrogen used as a reducing agent instead of coal or natural gas	<5% today (rapidly growing)
Other chemicals	Hydrogenation and synthesis processes (e.g., aniline, cyclohexane, polymers)	<10%

Low-carbon hydrogen production in Canada

Canada is among the world's top ten hydrogen-producing countries, with approximately four million tonnes of hydrogen produced each year. Canada's low-carbon hydrogen activity is currently clustered in three primary regions. Alberta has emerged as the focal point for large-scale blue hydrogen development, leveraging natural gas and carbon capture to serve industrial demand. Notable projects under construction include Air Products' Net-Zero Hydrogen Energy Complex in Edmonton and Linde's facility in Fort Saskatchewan. In British Columbia, efforts are centred on establishing a coastal hydrogen network to support transportation and port applications, led by HTEC and anchored by production in Burnaby, a liquefaction facility under development in North Vancouver, and proposed hubs in Nanaimo and Prince George. In central Canada, Québec and Ontario are advancing green hydrogen production, supported by operating assets such as Air Liquide's 20 MW PEM electrolyzer in

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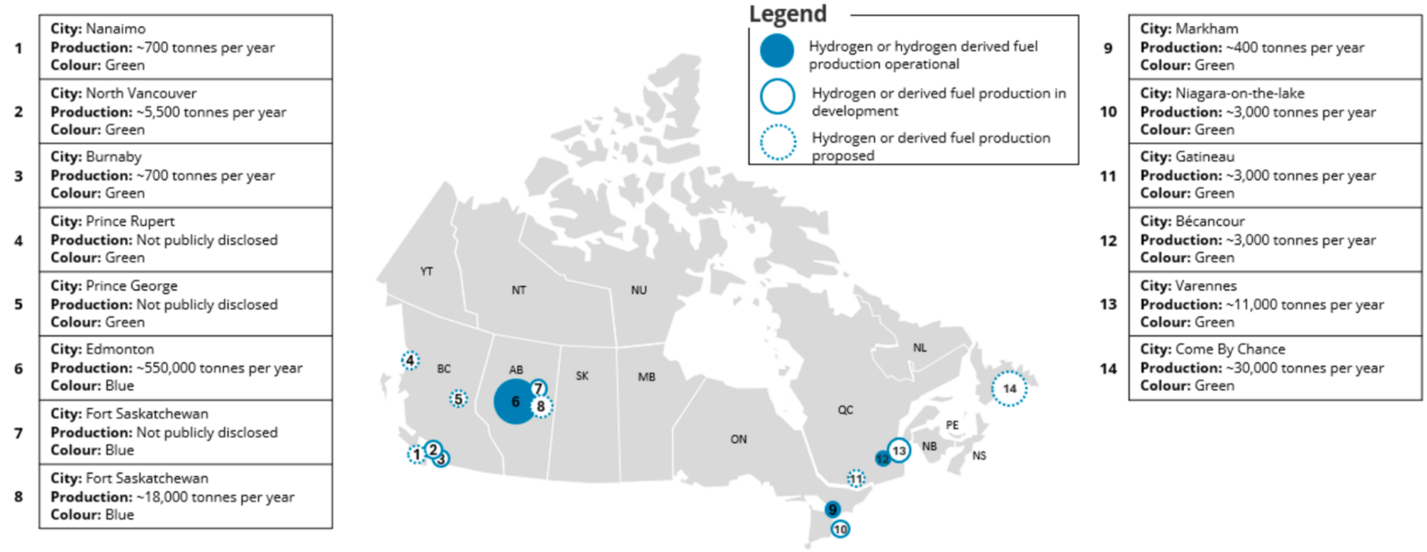
[183] IEA 2025 Global Hydrogen Review (Accessed October 2025)

[184] Canada Energy Regulator: Market snapshot: Hydrogen update (Accessed September 2025)

[185] IEA 2025 Global Hydrogen Review (Accessed December 2025)

Bécancour and the Enbridge/Cummins 2.5 MW power-to-gas facility in Markham. This corridor is expanding further with new projects, including Hydro-Québec's 88 MW Varennes electrolyzer and Atura Power's 20 MW Niagara Hydrogen Centre.[186]



	City	Production	Colour
1	Nanaimo	~700 tonnes per year	Green
2	North Vancouver	~5,500 tonnes per year	Green
3	Burnaby	~700 tonnes per year	Green
4	Prince Rupert	Not publicly disclosed	Green
5	Prince George	Not publicly disclosed	Green
6	Edmonton	~550,000 tonnes per year	Blue
7	Fort Saskatchewan	Not publicly disclosed	Blue
8	Fort Saskatchewan	~18,000 tonnes per year	Blue
9	Markham	~400 tonnes per year	Green
10	Niagara-on-the-lake	~3,000 tonnes per year	Green
11	Gatineau	~3,000 tonnes per year	Green
12	Bécancour	~3,000 tonnes per year	Green
13	Varennes	~11,000 tonnes per year	Green
14	Come By Chance	~30,000 tonnes per year	Green

Figure 7: Low-carbon hydrogen production facilities across Canada[187]

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[186] Deloitte Future Fuels in Transportation: Path Forward for Rail, Marine, and Aviation (Accessed December 2025)

[187] Ibid

5.2 Green hydrogen projects in operation or at FID and their industrial offtake

To move from theoretical demand to observed investment behaviour, the following section examines green hydrogen projects that have reached operation or FID. As shown in Table 56, both operating facilities and FID-backed projects are overwhelmingly anchored by established industrial offtakers, particularly oil refining, ammonia production, and steelmaking. In these cases, green hydrogen is primarily deployed as a direct replacement for fossil-based hydrogen in existing feedstock applications, rather than for speculative or emerging end uses. This pattern underscores the importance of aligning hydrogen production with known, large-scale industrial demand when seeking to attract investment and enable bankable projects.

Table 56: Sample green hydrogen projects in operation or at FID and their industrial offtake (not exhaustive)

Industry	Offtaker	Project	Location	Developer / owner	Status	Electrolyzer capacity	Estimated volume (kt H_2/year)
Oil refining	Shell (Rhineland refinery)	REFHYNE I[188]	Germany	Shell	Operating	10 MW	1.5
	Shell (Pernis refinery)	Holland Hydrogen I[189]	Netherlands	Shell	Construction	200 MW	30–35
	Shell (Rhineland refinery)	REFHYNE II[190]	Germany	Shell	FID	100 MW	15
	OMV (Schwechat refinery)	Schwechat green hydrogen plant[191]	Austria	OMV	FID	140 MW	20–25
	TotalEnergies (Leuna refinery)	Lingen green hydrogen[192]	Germany	RWE	FID	300 MW	45
Ammonia and fertilizer	Fertiberia	Puertollano green hydrogen[193]	Spain	Iberdrola	Operating	20 MW	3
	Air Products	NEOM Green Hydrogen Project[194]	Saudi Arabia	NEOM Green Hydrogen Company	Construction (financial close reached)	2.2 GW	220
	Galp	Sines green hydrogen[195]	Portugal	Galp	FID	100 MW	15
Iron and steel	SSAB	HYBRIT (early commercial phase)[196]	Sweden	SSAB, LKAB, Vattenfall	Operating / early commercial	100 MW	15

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[188] REFHYNE Project 10 MW Electrolyzer Rhineland Refinery General Overview (Accessed December 2025)

[189] First large-scale hydrogen plant on the high-voltage grid (Accessed December 2025)

[190] Shell to build 100-megawatt renewable hydrogen electrolyzer in Germany (Accessed December 2025)

[191] OMV announces new investment in large 140 MW green hydrogen plant (Accessed December 2025)

[192] Germany: TotalEnergies and RWE join forces on green hydrogen to decarbonize the Leuna refinery (Accessed December 2025)

[193] Iberdrola commissions its largest green hydrogen plant for industrial use in Europe (Accessed December 2025)

[194] Construction of giant 2.2GW Neom green hydrogen and ammonia plant is now 80% complete: Air Products (Accessed December 2025)

[195] Galp's Sines Refinery Receives Reactors for Advanced Biofuels Production (Accessed December 2025)

[196] Vattenfall orders the world's first fossil-free steel dam gate from SSAB (Accessed December 2025)

Taken together, the global and Canadian evidence shows that green hydrogen projects reaching operation or FID are overwhelmingly anchored by existing industrial demand and co-located with suitable infrastructure. These projects tend to cluster in locations that combine access to large-scale renewable electricity, industrial land, port or pipeline connectivity, and demand certainty. This pattern suggests that the success of future hydrogen-enabled industrial development depends as much on place-based characteristics as on the availability of hydrogen itself, underscoring the importance of local site readiness in attracting investment.

5.3 Strait of Canso locational advantages

The success of attracting new hydrogen-enabled industries depends not only on the availability of clean fuels, but on the broader set of place-based characteristics that influence industrial investment decisions. Experience from operating and FID-backed green hydrogen projects shows that industrial co-location occurs where fuel supply is paired with suitable sites, export-ready infrastructure, regulatory certainty, and workforce capacity. In this context, the Strait of Canso presents a unique combination of physical, economic, and policy assets that have the potential to reduce risk for energy-intensive anchor tenants.

These assets position the region to support industries that require continuous energy input, large material throughputs, and access to global markets. Deepwater port access, pre-zoned industrial land, proximity to proposed large-scale renewable generation, and established heavy-industrial capabilities together create conditions like those observed in successful hydrogen and clean fuels hubs in Europe and elsewhere. Importantly, many of these advantages already exist or are well advanced, reducing reliance on speculative infrastructure development.

However, these advantages do not apply uniformly across all potential hydrogen end uses. Some industries derive significant economic value from co-location near production and ports, while others are less sensitive to location or require conditions that are not yet in place. To translate site readiness into targeted and credible investment attraction, potential industries must be screened based on how strongly they benefit from the Strait of Canso's specific asset base and how closely their demand profiles align with early clean fuel supply. Table 57 summarizes the region's key locational advantages and the strategic benefits they offer to priority target industries.

Table 57: Key locational advantages supporting clean fuel–based industrial investment

Advantage	Strategic benefit for target industries
Port strength	Canada's deepest, ice-free port, offering direct transatlantic access—non-negotiable for high-volume export of ammonia, green steel, and e-fuels.
Industrial land	Existing heavy industrial zoning at Point Tupper and Melford Atlantic Gateway reduces permitting risk and provides critical access to existing utility connections and adjacent industrial expertise.
Energy potential	Pipeline of proposed renewable electricity (onshore and offshore wind) in the Strait area supports the scale and long-term price stability required for continuous, energy-intensive processes.
Policy support	Strong policy certainty via provincial net-zero targets and federal incentives (e.g., CFF, Hydrogen Investment Tax Credits) de-risks capital investment.
Workforce	An experienced regional workforce and local training pipelines, in collaboration with the Nova Scotia Community College, familiar with heavy industry, energy, and fabrication processes.

However, these advantages do not apply uniformly across all potential hydrogen end uses. To translate site readiness into targeted investment attraction, industries must be screened based on how strongly they benefit from these assets.

5.4 Strategic priorities: targeting investment attraction opportunities

The availability of clean hydrogen and its derivatives in the Strait of Canso presents a significant opportunity to attract new industrial investment. However, not all potential hydrogen end uses are equally likely to co-locate near early production. To translate future clean hydrogen demand into actionable investment attraction priorities, this section applies a structured screening approach to identify industries most likely to commit capital alongside early clean fuel supply, considering both short-term feasibility and longer-term market direction.

Screening framework

Potential co-located industries were evaluated against a consistent set of criteria focused on bankability, scalability, and alignment with regional strengths:

- **Scale and continuity of hydrogen demand**, favouring industries with large, steady feedstock requirements capable of anchoring early hydrogen production. This could also include the byproducts of electrolysis including oxygen or waste heat.
- **Commercial maturity of hydrogen use**, prioritizing applications that are already operating at scale globally or advancing through FID.
- **Sensitivity to location and logistics**, including the degree to which co-location near hydrogen production and port infrastructure materially improves project economics.
- **Alignment with regional assets**, including port access, industrial land availability, renewable electricity potential, and workforce capabilities.

Industries that perform strongly across these criteria represent the most credible targets for near- to medium-term investment attraction in the Strait of Canso. Based on the screening framework above, potential co-located industries were grouped into three priority tiers reflecting their relative readiness to attract near-term investment alongside early clean fuel production. Priority 1 industries perform strongly across all criteria and represent the most bankable near-term anchors, while Priority 2 and Priority 3 industries reflect progressively longer development timelines driven by technology maturity, infrastructure requirements, and market conditions.

Short-term anchors (Priority 1)

These represent the most credible co-location targets, offering the large, steady demand needed to underpin early hydrogen production and ensure project bankability.

#1	**Ammonia and fertilizer production**
Description	Ammonia production combines hydrogen with nitrogen (separated from air) to make NH_3, which is then sold as ammonia or upgraded into fertilizers such as urea or ammonium nitrate. Plants are typically large, continuous operations built around an ammonia synthesis loop (Haber–Bosch) with significant utilities and round-the-clock operating requirements.
Rationale	This is one of the strongest “anchor tenant” candidates because hydrogen is the core feedstock and demand is high and steady. The underlying chemistry and plant design are commercially mature at global scale, and the output product is highly exportable as ammonia is widely traded and more practical to ship than hydrogen. Co-location avoids having to move large volumes of hydrogen offsite which would otherwise require high-capacity compression and distribution systems or new pipeline networks by converting hydrogen into an exportable molecule at the source. It can also allow shared infrastructure for storage, utilities, and port handling that improves economics for both the hydrogen producer and the ammonia plant.
Candidate companies	Nutrien, Yara International, CF Industries, OCI Global, Fertiberia, Mosaic

#2	**Energy and industrial gases**
Description	Industrial gas companies function as “molecule utilities”. They finance, build, and operate gas production assets and deliver products to customers through a mix of on-site/tonnage supply for large users, pipeline networks in industrial clusters, and merchant/bulk and packaged delivery for mid-scale and smaller users, often bundling oxygen, nitrogen, hydrogen and related services into long-term supply contracts.
Rationale	This sector is a strategic hub enabler because it can aggregate demand across multiple users, help standardize product specifications, and build the distribution “spine” of on-site supply, bulk logistics, and eventually pipelines that allows a hydrogen cluster to scale beyond a single anchor. Co-location avoids the need for every smaller user to individually solve hydrogen logistics and reliability across compression, storage, deliveries, safety case, and permitting. It is especially relevant for oxygen monetization, since industrial gas firms already operate oxygen production and distribution networks and can integrate electrolyzer oxygen into existing merchant models where purity, handling, and proximity make it economic.
Candidate companies	Air Liquide, Linde, Air Products, Messer, Itochu

Medium-term diversification (Priority 2)

The next cluster comprises sectors gaining momentum due to tightening climate regulations and policy mandates, which will become highly competitive as the local hydrogen supply scales.

#3	**E-methanol production**
Description	E-methanol facilities synthesize methanol by reacting captured CO_2 with green hydrogen (typically via CO_2 hydrogenation), producing a liquid fuel/chemical feedstock that is easy to store and ship using conventional liquid logistics and can serve marine fuels markets and chemical value chains.
Rationale	E-methanol is compelling as a priority growth industry because hydrogen demand can be large and steady at plant scale, policy and customer pull especially in shipping and chemicals is strengthening, and the product is highly exportable as a liquid using established port infrastructure. Co-location avoids paying the premium to transport hydrogen to distant synthesis sites often requiring compression, trucking, or new pipelines. It can also reduce the complexity of CO_2 logistics by enabling either local CO_2 sourcing or more efficient port-enabled CO_2 handling strategies. In addition, some configurations can take advantage of waste heat integration opportunities when suitable heat sinks exist nearby.
Candidate companies	Methanex, BASF, Dow, A.P. Moller – Maersk, European Energy, Liquid Wind, Proman

#4	**SAF production**
Description	SAF is a renewable or waste-derived jet fuel that meets all technical specifications for aviation and is produced from sustainable feedstocks such as waste oils and fats, municipal solid waste, agricultural and forestry residues/biomass, non-food crops, or via power-to-liquids using captured CO_2 with low-carbon hydrogen; it is considered “sustainable” when it avoids competition with food/water and does not drive deforestation or ecological degradation. SAF is engineered as a drop-in fuel, it can be blended with Jet A/Jet A-1 and used in existing aircraft and fueling infrastructure without modification, and depending on pathway and feedstock, can reduce lifecycle CO_2 emissions by up to approximately80% relative to conventional jet fuel. Green hydrogen CO_2-to-jet (Power to Liquid or PtL) is one pathway among others (e.g., HEFA, ATJ).

Rationale	SAF is a strong medium-term diversification target because it is hydrogen-intensive, exportable as a liquid, and driven by tightening aviation decarbonization mandates and offtake frameworks. It is also more complex than ammonia or methanol and carries higher execution risk, which supports second priority positioning. Co-location avoids transporting very large quantities of hydrogen and/or other feedstocks to remote fuel synthesis plants and can simplify project logistics by centralizing the major energy input near port export infrastructure. It also has the potential to reduce the overall “two-way” logistics burden (moving CO_2 in and products out) when the hub is designed around shared port and utility systems.
Candidate companies	*Neste, TotalEnergies, SkyNRG, Gevo*

#5	**Aquaculture**
Description	Intensive aquaculture systems often require reliable oxygenation to maintain fish health and growth, and many operations use high-purity oxygen supply (frequently delivered and stored as liquid oxygen or generated onsite) as part of their standard operating approach for high-density production.
Rationale	Aquaculture is less a “hydrogen anchor” and more a byproduct anchor: it can provide a stable local sink for electrolyzer oxygen, improving the economics and story of an integrated clean-fuels cluster, particularly if there is meaningful year-round oxygen demand. Co-location avoids the need to truck oxygen long distances in liquid form (and the boil-off/handling challenges that grow with distance and storage time), replacing it with nearby oxygen supply from electrolysis where purity, compression/liquefaction needs, and delivery mode pencil out. It also creates a local circularity narrative where hydrogen production co-products directly support a regional industry.
Candidate companies	*Cooke Aquaculture, Mowi ASA, Cermaq, Grieg Seafood*

Longer-term transformation (Priority 3)

This category identifies capital-intensive, frontier industries that offer the highest potential for regional economic reshaping but require longer development timelines and significant infrastructure scaling.

#6	**Green steel (H_2-DRI direct reduced iron)**
Description	Hydrogen-based DRI replaces fossil reductants with hydrogen to remove oxygen from iron ore in a shaft furnace, producing direct reduced iron (“sponge iron”) that is then typically melted in an electric arc furnace. This enables a pathway to very low-carbon primary steel when powered by low-carbon electricity and supplied with green hydrogen.
Rationale	This is a classic “transformational” tenant because the hydrogen demand can be significant and continuous, potentially anchoring large electrolyzer build-outs, while the port can support ore import and steel export logistics at scale. Capital requirements and infrastructure needs are significant, and global deployment is still emerging, which supports third priority framing. Co-location avoids the prohibitive cost and complexity of delivering very large volumes of hydrogen to an inland DRI facility (which would otherwise require substantial pipeline infrastructure and storage), and it supports shared export/import logistics that are difficult to replicate away from deepwater port and industrial land advantages.
Candidate companies	*ArcelorMittal, SSAB, H2 Green Steel (Stegra), RioTinto, Salzgitter, thyssenkrupp, Nucor*

#7	**Green cement**
Description	Hydrogen-fired kilns are not yet commercial at scale but are gaining momentum. The offshore wind industry, combined with a long list of infrastructure projects in Nova Scotia, will require large volumes of concrete, creating potential demand for locally produced low-carbon cement. Recent studies have

	examined the feasibility of developing a cement plant in the region, reflecting its access to raw materials, port infrastructure, and export markets. However, timing remains uncertain, as viability depends on technology maturity, carbon pricing, and access to low-cost clean electricity and hydrogen. Within the Strait of Canso strategy, green cement should therefore be viewed as a future growth option rather than a short-term anchor tenant, with the potential to complement the region's clean fuels and renewable energy platform over time.
Rationale	Co-location allows for the integration of hydrogen as a high-temperature thermal energy source to replace fossil fuels in kilns. Furthermore, the Strait's port infrastructure is ideal for the "circular" movement of bulky raw materials and finished low-carbon cement to global markets.
Candidate companies	*Holcim, Heidelberg Materials, Vicat, CEMEX, CRH*

Conclusion

Realizing this vision requires careful due diligence, outreach, and sequencing. Investment attraction must begin immediately with targeted outreach, but most anchor tenants will require firm confidence in local supply.

Attraction efforts are most likely to succeed once an early-mover hydrogen production project has reached FID and established a clear timeline for production. Pre-FID engagement, however, is essential for aligning public infrastructure planning, such as pipeline corridors, water access, and port upgrades, with the specific needs of future industrial tenants.

The ability of the Strait of Canso to attract these anchor tenants will be the ultimate measure of turning its geographic and renewable energy advantages into a lasting competitive edge.

6. Infrastructure and community-scale planning

The four highest-ranking opportunities of the thirteen different fuels and scenarios analyzed have been selected for further exploration. For each of these opportunities, potential pilot projects and illustrative future states have been proposed. These projects were designed with the current context of the Strait of Canso region in mind, considering industrial and municipal fuel users, the anticipated trajectory of green fuel production in the area, and the scalability of pilots into long-term industrial operations. Each pilot project includes an estimated timeline, required infrastructure, and a CAPEX breakdown to demonstrate the feasibility of growth for the Strait of Canso in renewable fuel demand. Table 58 summarizes the proposed pilot projects and illustrates a possible future state for each of the four short-listed clean fuel opportunities.

Table 58: Summary of proposed pilot projects and illustrative future state for each short-listed opportunity

Opportunity	Timeframe[197]	Proposed projects	Purpose	Description	Infrastructure	Estimated CAPEX[198]
Hydrogen for on-road mobility	**15-18 months (Q2 2027)**	**Pilot project:** **Hydrogen truck fleet and mobile refueling station**	Build confidence, collect operational data, demonstrate feasibility	• Partner with a trucking company or Port Hawkesbury Paper to operate or lease/retrofit 1-3 diesel trucks with hydrogen dual-fuel kits on predictable local routes. • Install a temporary mobile refueling unit. • Truck in hydrogen in small amounts from New Brunswick or Quebec.[199]	• Truck fleet retrofitted to use hydrogen-diesel dual-fuel kit. • Hydrogen tank (approx. 15m^3). • Distribution system includes a mobile dispenser, storage tank, tube trailer supply.	• $50,000 per truck conversion kit. • $6,000 - $10,000 per month for hydrogen transportation unit. • $3,000 - $5,000 per month for freight truck rental.
	2.5 years+ (Q2 2028+)	**Illustrative future state:** **Permanent hydrogen refueling station**	Establish long-term fueling network for regional fleets	• Dedicated hydrogen refueling station, like a standard petrol station, in partnership with an existing fuel distributor. • If large scale production is not yet available, install a smaller production unit (1 to 1.5MW) with connected refueling station.	• Distribution system (may be able to use existing infrastructure at petrol station). • Containerized hydrogen production unit(s), requiring 2x 40ft containers. • Hydrogen tank(s) (approx. 15m^3 each).	n/a
Hydrogen for electricity and blending	**5 years+ (Q2 2030+)**	**Pilot project: Small scale hydrogen blending**	Build operational and regulatory experience	• Hydrogen blended directly into natural gas pipeline near Point Tupper Generating Station at low concentrations (approx. 2 to 5%).	• Hydrogen blending unit. • Hydrogen pipeline.	• $1-2 million for H2-Natural Gas blending unit. • $100,000 - $200,000 Hydrogen pipeline.
	7 years+ (Q2 2032+)	**Illustrative future state: Hydrogen distribution system**	Build long-term pathway to higher blend fractions and/or pipeline extension	• As production scales, explore higher blends of natural gas/hydrogen (up to 20% by volume) and/or extending the pipeline into the broader Point Tupper industrial park and eventually the Strait of Canso region.	• Hydrogen pipeline (approx. 5km). • Hydrogen blending unit.	n/a

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[197] The proposed timeline reflects the current large-scale production schedule and may need adjustment if those timelines change.

[198] This estimate excludes the cost of purchasing clean fuel as well as other operating expenses (OPEX) and all CAPEX associated with the illustrative future-state scenario (marked as 'n/a'), which are outside the scope of this analysis.

[199] This pilot project could use small volumes of trucked in hydrogen to signal early demand until local large-scale production is available.

Ammonia for marine mobility	**2.5 years (Q2 2028)**	**Pilot project: Fuel barge ammonia refueling**	Establish the Strait of Canso as an early ammonia-refueling waypoint	• Engage companies operating ammonia-fueled cargo vessels near the Strait. • Establish a fuel barge in the Strait, supplied by local large-scale production of ammonia, to refuel these vessels as they transit.	• Fuel barge (rental).	>$20,000 per day for full operation of barge and jetty.
	5 years+ (Q2 2030+)	**Illustrative future state: Ammonia-fueled cargo vessels**	Demonstrate low-emission marine logistics and establish local leadership	• Ammonia-fueled local cargo ship exporting regional products (e.g., aggregate, ammonia).	• Ammonia dual-fuel cargo vessel (engine conversion).	n/a
Renewable diesel aggregation	**15-18 months (Q2 2027)**	**Pilot project: Mobile/temporary renewable diesel fueling station**	Provide immediate GHG reductions with no engine changes	• Aggregate local demand. • Mobile or temporary fueling station using a tanker truck or install tank at a properly zoned location. • Truck in RD in small amounts from NL.[200]	• Fuel truck. • Fuel tank (10,000 gal) and pump.	• $70,000+ for fuel tank. • $15,000 for refueling unit.
	5 years+ (Q2 2030+)	**Illustrative future state: Permanent refueling station**	Establish durable, drop-in clean fuel access	• Dedicated RD refueling in a standard petrol station, in partnership with an existing fuel distributor.	• Buried tank. • Fuel pump (may be able to use existing infrastructure at petrol station).	n/a

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[200] This pilot project could use small volumes of trucked in renewable diesel to signal early demand until local large-scale production is available.

6.1 Proposed pilot project: Hydrogen truck fleet and mobile refueling station

High-level infrastructure/community plans for storage, distribution, and equipment

Alberta has pioneered the operation of pilots to demonstrate the technical feasibility of hydrogen for heavy-duty vehicles including the Alberta Zero Emission Truck Electrification Collaboration (AZETEC) and Transport Canada's Zero Emission Truck Testbed (ZETT). These are in addition to the Alberta Zero Emission Hydrogen Transit (AZEHT) project for municipal transit in Edmonton and Strathcona County, the Alberta Zero Emission Fleet Fueling (AZEFF) project for two mobile fueling stations, and Canadian Pacific Kansas City's (CPKC) Hydrogen Locomotive Program, the first of its kind in North America.

The equipment required for the hydrogen truck fleet and mobile refueling station is as follows:

Dual fuel trucks: 1-3 operating in the Strait region. These trucks would be retrofitted from typical diesel-powered trucks owned by freight operators or PHP to accept a hydrogen-diesel dual fuel system. Dual fuel retrofit kits are commercially available from Canadian suppliers with systems that integrate hydrogen storage tanks, injector hardware, and control systems into the existing engine. Diesel Tech Industries' Guardian Hydrogen Diesel System is depicted in Figure 8.

Hydrogen is injected alongside diesel, enabling the vehicle to displace a portion of fossil fuel use while maintaining diesel-based ignition. Retrofitted vehicles preserve the majority of their original engine components and physical layout, making them attractive for fleets looking to reduce emissions without fully replacing assets. However, they are not considered zero-emission and still produce greenhouse gases and criteria air pollutants. The effectiveness of dual fuel operation varies depending on engine load, retrofit technology, and the ratio of hydrogen substitution achieved. A typical dual fuel heavy transport truck requires 20-30 kg/day of hydrogen in addition to diesel and can have a fuel range from 500-800 km depending on load and route.

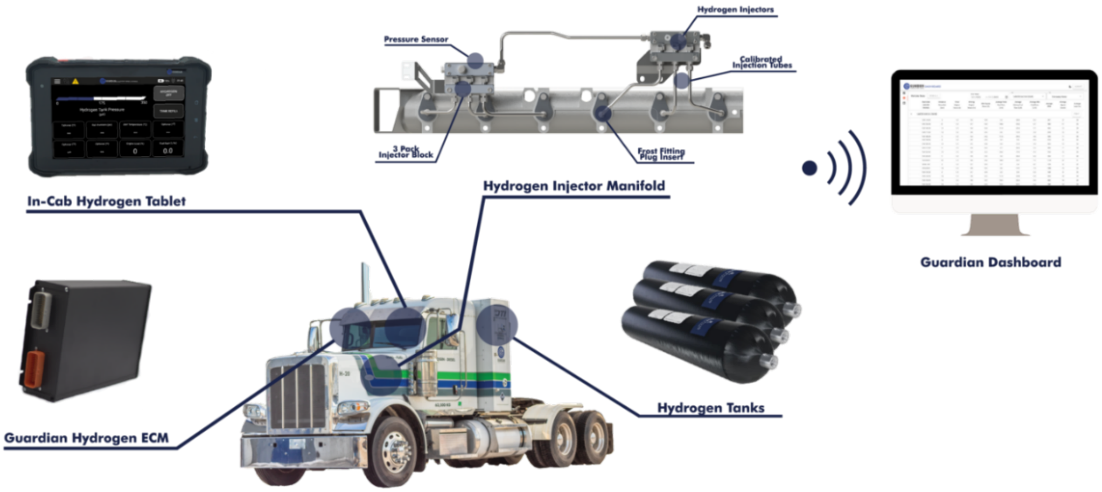

Figure 8: Dual fuel retrofit kit configuration on a heavy-duty Class 8 truck

Hydrogen tank trailer: A hydrogen tank trailer module, specially designed for the storage and transportation of compressed or liquified hydrogen can act as a mobile storage/supply unit and be rented and situated as required. They are highly engineered and regulated assets built to ensure extreme safety, high energy density, and regulatory compliance during transportation. Alberta's Hydrogen Guidebook provides developers and authorities with instructions for establishing hydrogen refuelling stations in the province, outlining the necessary steps, regulatory requirements and best practices to ensure safe and efficient station development.[201]

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[201] Alberta hydrogen refuelling station guidebook 2025 (Accessed January 27, 2026)

Hydrogen distribution system: A temporary, portable unit consisting of hoses and metering equipment for refueling hydrogen-powered vehicles. This system can typically be supplied with the hydrogen tank trailer. Hydrogen truck pilots across Canada have used portable fueling units with self-contained dispensing capabilities requiring no utility hook-ups as shown in Figure 8. Such units hold up to 150 kg of hydrogen and offer an opportunity to test the feasibility of the pilot without the high, up-front capital cost of a permanent refueling facility.

Real estate and property access needs will be driven by permitting and regulatory requirements. The footprint of a standard cargo trailer is approximately 2.5 x 12 metres, and space is needed to accommodate the fueling of trucks participating in the pilot and the truck refueling the temporary station. Alberta's Hydrogen Guidebook provides a comprehensive overview of the international and national regulations, codes, and standards guiding the build, installation, and operation of hydrogen refuelling infrastructure that may serve as a helpful starting point.[202]

Figure 9: Portable hydrogen refueling station

A permanent fueling station constructed on an optimal location for trucking in the region would require pressurized tanks (typically at 350 bar for heavy-duty trucks) with high storage and dispensing capacity. Modular stations are prefabricated and scalable stations with a greater potential for quick deployment and flexibility. As the market moves beyond pilots and expected demand grows, these types of fixed stations intended for long-term use and with the potential to serve both light-and heavy-duty vehicles could be explored.

Regulations around hydrogen fueling may be used as a starting point in understanding the international and national regulatory requirements for hydrogen storage and distribution. An identification of the Authorities Having Jurisdiction (AHJ) for Nova Scotia is critical.
Currently Nova Scotia has the Gas Distribution Act and Pipeline Act to oversee natural gas systems both of which have been amended to include hydrogen. Other areas such as storage, environmental assessment (EA), and the electricity grid have also undergone amendments to include hydrogen.

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[202] Alberta hydrogen refuelling station guidebook 2025 (Accessed January 27, 2026)

High-level CAPEX estimates

Numbers quoted for this study are based on current (2025) pricing and are subject to changes based on market conditions and other factors. Revised estimates should be completed at the time of implementation.

Table 59: High-level CAPEX estimates for a hydrogen truck fleet and mobile refueling station pilot project

Item/Service	No. Of Units	Description	Price per Unit	Reference(s)
Retrofit of a Class 8 Diesel Truck	1–3	Conversion of a class 8 diesel truck to a dual fuel hydrogen-diesel truck.	$50,000 CAD	Communication with supplier
Hydrogen Transportation Module and Distribution	1	D.O.T. 3T 2,600 psi / UN ISO 11120 Specifications 2,900 psi 8 tube trailer (see image below). Different model or supplier could be selected if needed. Distribution equipment is included with this module.	$6,000 – 10,000 CAD per month	Communication with supplier
Truck Rental	1	Standard Class8 freight truck for transporting the hydrogen fuel module.	$3,000 - $5,000 CAD per month	Communication with supplier

Figure 10: Example of hydrogen tank trailer for transportation and distribution

Implementation pathways

The greater use of hydrogen for on-road is benefitting from supportive policy and regulatory requirements. For large fleet operators there is some hesitancy with adopting hydrogen, due in part to the large upfront investment for retrofitted or new trucks and the price of hydrogen.

Pilot project phase

A small-scale pilot which helps prove technology and address issues specific to the region would include a trucking company or PHP to lease or retrofit one to three (1-3), diesel trucks to dual fuel on planned routes. In the initial months, participating fleet operators are identified, suitable trucks for retrofit are selected, and routes are planned to support return-to-base fueling while avoiding unsuitable terrain. This trial could start around Q2 of 2027 once equipment is in place but would not be dependent upon local production, rather the supply of hydrogen would be shipped in from a Quebec or New Brunswick supplier. The Q2 2027 start aligns with steering committee discussions indicating a minimum one-year preparation window for procurement, retrofit, training, and local approvals. Future projects with a greater capacity are anticipated to begin once EverWind production is underway, around 2028.

Planned and predictable routes would have to be selected to allow the vehicle to return to the mobile refueling station. Significant work to configure refueling and determine best path is needed alongside operator training and safety reviews with input from AHJ, municipalities, and local first responders. At this stage, there would be a need to select between refueling station options.

Future state/scale up phase

To support the increased use of hydrogen for on-road transport beyond the pilot project, a permanent refueling station could be built. The expectation is that larger volumes of local hydrogen would be available once EverWind begins production.

If EverWind is delayed and local demand has grown, there is potential for small scale local production. A hydrogen electrolyzer production unit of 1-1.5 MW size unit could produce approximately 500 kg of hydrogen per day, which could fuel approximately 20 dual-fuel trucks or a combination of trucking and other use cases. The capital costs for this unit are not included here, and this option would need further evaluation. The purpose of the unit would be to support larger offtake and provide additional local knowledge around hydrogen production and storage. This would be a pathway to the more permanent fueling station with product supplied by EverWind and could help understand future demand volumes.

The refueling station would have hydrogen shipped or piped to its storage tanks for distribution. Where space is available, this hydrogen distribution center could potentially be co-located on site of a typical fuel station. Planning for a permanent station may only proceed once multiyear offtake commitments are in place. EverWind's confirmation of the availability of commercial scale hydrogen at unit costs that either achieve cost parity with incumbent fuels or align with local users demonstrated willingness to pay may provide confidence in the stability of demand, supply, and long-term economics. Additionally, pilot data on substitution rates, reliability, safety, and user experience will inform the investment case for permanent infrastructure.

Both dual fuel and hydrogen fuel cells are commercially available, but vehicle choice remains limited. The Hyundai XCient is performing trials in Alberta and British Columbia in demanding operational environments. Current ranges are 400 km for dual fuel and upwards of 1,000 km for FCEV and vary by manufacturer, terrain covered, and load being hauled.

6.2 Proposed pilot project: Small scale hydrogen blending

High-level infrastructure/community plans for storage, distribution, and equipment

For a small-scale hydrogen blending pilot project, it is assumed that locally produced hydrogen is available for use in the region, meaning that supply and large-scale storage are not a consideration. A small volume blend of hydrogen into the natural gas line for use by PHP and NSP for this pilot project would require the following equipment:

- **Hydrogen-Natural Gas Blending Unit**: The footprint for the blending unit would be about 2.5 x 2.5 m and would be located near the natural gas distribution line on EverWind's site. This unit would blend hydrogen from EverWind into the natural gas line at a small percentage prior to the fuel use in PHP or NSP units (if NSP conversion to natural gas has been completed).

- **Hydrogen Pipeline:** A pipeline would need to be installed from the EverWind's hydrogen source/storage to the blending unit. The pipeline from source to blending point is approximately 1 km and the path would be determined after the site selection is complete.

Current usage of natural gas at PHP is intermittent but is used for over 10% of their total steam production. NSP does not currently use natural gas at the Point Tupper generating station; if/when NSP converts from coal to natural gas, larger-scale hydrogen blending could be enabled. Early-stage hydrogen-natural gas blending could be accomplished with few changes required by end users. Typical natural gas burners and boilers are compatible with low levels of hydrogen in the combined fuel stream. Site assessment should be performed to determine any areas of potential risk or where procedural or operational changes may need to be implemented. Compatibility checks and site-specific risk assessments would need to be completed before commissioning the blending system.

High-level CAPEX estimates

Numbers quoted for this study are based on current (2025) pricing and are subject to changes based on market conditions and other factors. Revised estimates should be completed at the time of implementation.

Table 60: High-level CAPEX estimates for a small-scale hydrogen blending pilot project

Item/Service	No. Of Units	Description	Price per Unit	Reference(s)
Hydrogen-Natural Gas Blending Unit	1	Valving, meters, piping and controls arrangement to mix desired	$1,000,000 – 2,000,000 CAD	Communication with supplier
Hydrogen Pipeline	Approx. 1km	Small approx. 2-inch line to carry hydrogen from production plant to edge of site to tie into natural gas distribution line.	$200,000 – 500,000 CAD	Communication with supplier

Figure 11: Hydrogen storage example

Implementation pathway

Pilot project phase

Current usage of natural gas at NSP at PHP's generating unit is intermittent but is used for over 10% of their total steam production. The proposed pilot project for hydrogen used in blending and electricity production would benefit from NSP using hydrogen at a more consistent rate but could still provide an initial trial for blending hydrogen. Another opportunity would be if NSP begins to use natural gas for electricity production at their Point Tupper generating facility. The modified operation would have potential for large volumes of hydrogen to be blended in the 150 MW facility.

To accelerate the timeline for a hydrogen blending pilot, hydrogen would need to be shipped into the region from out of province, stored onsite, and periodically blended into the natural gas line serving NSP's Point Tupper Generating Station site. However, the cost of installing the required blending equipment and purchasing out of province hydrogen for a short-term pilot would not be economically justified. For this reason, the pilot is assumed to occur on an extended timeline of approximately five years, when local, large-scale hydrogen production from EverWind is expected to be available. The timing is also dependent on when the NSP Point Tupper generating station could become a viable end user, which is anticipated around 2030 to coincide with planned coal phase-out. Once these conditions are in place, initial blending would begin at low concentrations (approximately 2-5%) to demonstrate operability, generate operational experience, and build familiarity with the regulatory environment.

Early-stage hydrogen-natural gas blending should be accomplished with few changes required by end users. Typical natural gas burners and boilers are compatible with low levels of hydrogen in the combined fuel stream. Site assessment should be performed to determine any areas of potential risk or where procedural or operational changes may need to be implemented.

Future state/scale up phase

Before moving to a larger project, two or more years of blending experience in the region is recommended. Once EverWind produces hydrogen, and blending at small concentrations occurs into the natural gas pipeline from their site, the pathway exists for greater hydrogen blending adoption in the region. Further reduction of carbon emissions can be realized by increasing the percentage of hydrogen in the distribution system and increasing the number of users. Based on previous studies such as the UK HyDeploy and the SoCalGas H2 Innovation Experience, concentration of hydrogen could be increased from the initial pilot project up to 20%, if downstream equipment can accept this fuel and customers agree. All users on the system would need to perform risk assessments to ensure appropriate controls to accept the input fuel mixture. Some physical upgrades may be warranted depending on the infrastructure at each site as well as a thorough review of safety and regulatory requirements. Limiting factors to the larger adoption of hydrogen blending include:

- Individual users' equipment specifications (need to meet standards).
- Available natural gas supply to the area which could limit the use case for hydrogen.
- Cost competitive to natural gas.

With an extension to the natural gas pipeline and an upgraded blending unit (if needed) the greater industrial area of the Strait of Canso could be supplied with hydrogen-blended natural gas.

6.3 Proposed pilot project: Fuel barge ammonia refueling

High-level infrastructure/community plans for storage, distribution, and equipment

The potential pilot project for ammonia fuel in the Strait of Canso region is an ammonia fuel barge. This would be a fully operational, fuel barge which can be filled with ammonia produced by EverWind. As this project assumes that local production and exporting of ammonia fuel is concurrent, a means of production and shipment of fuel to portside is not included in this study. No land would be required for this pilot project, but the barge would need a place to berth when not in use or when needing resupply or maintenance. There would likely be additional regulatory mechanisms required by Transport Canada and DFO to operate safely and ensure limited impact environmentally. An available tug would also be needed to facilitate barge movements. The barge size could vary but an estimate would be in the range of 50,000 to 80,000 gallons. Berthing arrangements and resupply procedures would need to be defined to minimize operational downtime and integrate with port schedules.

High-level CAPEX estimates

Numbers quoted for this study are based on current (2025) pricing and are subject to changes based on market conditions and other factors. Revised estimates should be completed at the time of implementation.

Table 61: High-level CAPEX estimates for a fuel barge ammonia refueling pilot project

Item/Service	No. Of Units	Description	Price per Unit	Reference(s)
Ammonia Fuel Barge	1	50,000 – -gallon, pressurized tank barge	>$20,000 CAD per day *	IMO **

*This cost includes upgrading and operating the jetty for refueling the barge.
**The market for ammonia fuel barge rental and purchase is not yet developed, so pricing information is not available. To provide an estimate for the proposed pilot project, a comparison can be made to LNG bunkering barges due to the similar nature of storage, even though ammonia is a more volatile substance. Based upon a cost model from a research paper from the IMO for operating an LNG fueling jetty and barge, the price for a similar operation using ammonia will likely be more expensive, but more precise figures are unknown at this time.

Figure 12: Ammonia fuel barge example

Implementation pathway

The proposed pilot project focuses on establishing an ammonia bunkering capability in the Strait of Canso to support the emerging market for ammonia fueled marine vessels. The pilot would rely on locally produced ammonia from EverWind, meaning it cannot begin until commercial scale production is operational. Although EverWind's initial output is expected to be exported to the European Union, a portion of this supply could be made available for local bunkering once production volumes and operational reliability have been established.

A second key prerequisite is the availability of compatible vessels. The pilot is intended to serve dual-fuel or dedicated ammonia powered ships, including both smaller regional vessels, such as tugs that could be converted to dual-fuel operation, and larger oceangoing ammonia capable vessels currently under development and expected to enter commercial service between 2026 and 2027. Because of the need for both local production and end-user readiness, and given the high capital, regulatory, and safety requirements associated with ammonia bunkering, project initiation is expected to occur no sooner than approximately 2.5 years from initial production.

Pilot project phase

Once ammonia production is underway, the pilot project would focus on vessel recruitment and operational setup. Vessels already calling on regional industries may present strong early opportunities for conversion or adoption. The bunkering operation would be delivered via a dedicated ammonia fuel barge, enabling alongside refueling during cargo loading or unloading. This approach minimizes operational disruption for vessels by eliminating a separate fueling berth or additional port time. For larger carrier vessels operating regional or transatlantic routes, the availability of a reliable, low-carbon fuel supply in the Strait could provide a competitive advantage and attract new marine traffic. Where feasible, these vessels can berth at EverWind facility for fueling, with the bunkering barge providing flexibility when berth availability is constrained.

As global adoption of ammonia fueled vessels grows, the Strait of Canso could serve a broader range of users, including vessels operating along the eastern seaboard and transatlantic corridors. Ammonia carriers are the most common ammonia-ready ships designed today, making it likely that some export vessels loading at EverWind would also use ammonia as a propulsion fuel. This strengthens the case for a local bunkering operation and enhances the region's strategic positioning as an early mover in clean marine fuel infrastructure.

Future state/scale up phase

As technology advances for smaller vessels, local vessels such as fishing fleets may also look to convert to ammonia or dual-fuel propulsion systems. Potlotek First Nation, Clearwater, and local tug operators that regularly call on the Strait could become early adopters, as they would benefit from having a reliable and locally available fuel source. This evolution may occur in the 2030+ timeframe as vessel designs mature and supporting infrastructure becomes well established. In parallel, an ammonia-fueled local cargo ship exporting regional products (such as aggregate exported to U.S. markets by regional producers in a cargo vessel or EverWind produced ammonia anticipated for export by future cargo vessel to Europe), represents another potential scale-up opportunity, demonstrating low-emission marine logistics within the region.

In all cases, ammonia-related marine activity will be governed by regulations covering both fuel handling and marine transport. Because these elements will be part of EverWind's routine operations, it is expected that a defined regional regulatory framework will emerge that can be consistently applied across the Strait. The IMO is currently developing guidelines for ammonia as a marine fuel, which will support jurisdictions in establishing appropriate local regulations.

This leading-edge technology in the Strait provides an opportunity for those involved in local ammonia production to participate in establishing best practices for storage and bunkering in line with IMO guidelines. This collaborative effort would involve First Nations, first responders, Transport Canada, and Class societies, working with industry to define a clear regulatory/permitting pathway, and performing foundational risk studies such as HAZOP (Hazard and Operability Study), HAZID (Hazard Identification Study), and dispersion modelling.

6.4 Proposed pilot project: Mobile/temporary renewable diesel fueling station

High-level infrastructure/community plans for storage, distribution, and equipment

With no local production of RD occurring in the short term, the fuel would need to be shipped to the region for this pilot project. The equipment required for the proposed pilot is as follows:

- **Fuel truck with tank:** A standard fuel truck with atmospheric tank could be used for storage and transportation of RD in the region. If the trailer is easily removable, the tank can be parked in a desired location for filling, distribution, or storage. An appropriate tank size for this pilot would be approximately 10,000 gallons (38,000 L).
- **Fuel pump:** A motorized fuel pump, much the same as those used at petrol station, would be attached to the tank for distribution and metering.

Real estate requirements for this pilot are minimal, as only a designated space to park and operate the fuel tank trailer as a temporary refueling point for heavy machinery is needed. The simplest option may be to locate the unit at a site that already permits fuel dispensing, such as an existing diesel refueling area, thereby reducing additional permitting or preparation work. Otherwise, prior to commissioning, the site would undergo standard safety assessments, including spill containment planning and operator training. While the mobile configuration may lessen the infrastructure needs compared to a permanent installation, all relevant regulatory requirements would still apply and are expected to be broadly similar to those governing diesel refueling operations.

High-level CAPEX estimates

Numbers quoted for this study are based on current (2025) pricing and are subject to changes based on market conditions and other factors. Revised estimates should be completed at the time of implementation.

Table 62: High-level CAPEX estimates for a mobile/temporary renewable diesel fueling pilot project

Item/Service	No. Of Units	Description	Price per Unit	Reference(s)
Fuel Tank	1	10,000-gallon double-walled fuel tank	$70,000 CAD	Quote
Fuel Pump	1	Filling cabinet, dispensing unit, hose, nozzle and accessories.	$15,000 CAD	Quote

Figure 13: RD refueling example

Implementation pathway

Pilot project phase

Due to the lack of availability of RD and the likely lack of local production, pilot projects for RD do not include a local production element like the other clean fuel types. It is presumed in the cases presented below that RD is trucked/shipped into the region from a reliable source, and it is available at a competitive price. Preparation for implementation would include securing supply, selecting a host site, and completing safety and operator readiness before installation.

A relatively inexpensive pilot project would be for the region to access a fuel tank to store trucked in RD. Equipment including distribution system (pump, hose, and nozzle) is needed as well as all required safety and spill containment equipment. A potential trial user would be local industry and municipal bodies to refuel their diesel-powered heavy machinery. The tank could be located at a municipally owned lot, on the land of an industrial partner/off-taker, or a third party. If desired, the tank could be moved where refueling is required, as it could be kept on a trailer base for ease of mobility. Operational procedures for receipt, storage, metering, and dispensing will be finalized before first fueling.

The parties who participate in the trial would perform their own assessments to evaluate the performance and value of RD versus standard fuel. As RD is a true drop-in solution, a longer lead-time before offtake is not required. This could mean that project kick-off could be as soon as 15-18 months (Q2 2027), with early users including municipal fleets, industrial machinery operators, and First Nations partners, to provide various user operating experiences for evaluation.

Future state/scale up phase

Building upon the short-term pilot project, more fuel tanks could be established across the region to ensure municipal bodies, First Nations, and industrial offtakers have easy access to RD. For instance, a tank could be installed at the Potlotekewey Expedition Gas station owned by Potlotek First Nation, the Town of Port Hawkesbury vehicle bay, Mulgrave Machine Works, or Breton Fuels.

With a consistent supply of RD and its use becoming more common, dedicated refueling could be established permanently in the region at existing diesel stations. Partnering with stations like Breton Fuels and Potlotekewey Expedition Gas for the refueling locations would make this larger-scale project more feasible. If dedicated RD refueling is introduced in existing petrol station infrastructure, it would facilitate implementation and reduce initial costs. The assumption is that widespread RD uptake would occur after several years of use in the Strait and with greater production across Canada, likely beyond 2030. Pilot data on performance, reliability, cost, and user acceptance will be used to justify deployment of additional tanks and the transition to permanent stations.

7. Recommendations and implementation roadmap

This chapter outlines a practical set of implementation actions to advance clean fuel adoption. It translates the findings of the assessment into short-term pilots, medium-term infrastructure pathways, and long-term opportunities that reinforce the region's potential as a clean fuel hub.

The recommendations focus on the four priority opportunities identified through research and engagement: hydrogen for on-road mobility, hydrogen for electricity and blending, ammonia for marine mobility, and RD across on-road mobility, marine, and other end-use applications; that will provide a roadmap to guide decision-makers, partners, and local industry.

The following principles provide a framework for decision-making as the region advances clean fuel adoption. These principles anchor the recommendations and help ensure that early steps support long-term regional outcomes.

- **Start with early wins**. Prioritize actions that are immediately feasible, such as establishing a governance framework to sustain regional momentum and selecting pilot projects that require minimal technology or infrastructure modifications, with lower CAPEX requirements.

- **Build toward scalable clean fuels pathways with a focus on hydrogen and ammonia**. Early pilots should be designed to collect operational data, validate technologies, and prepare users for the transition to larger-scale clean fuel systems as local production expands. For instance, local fleets could start with the installation of a hydrogen diesel dual-fuel kit to retrofit an existing truck rather than invest in a new heavy-duty fuel cell truck like the Hyundai Xcient.

- **Facilitate regional coordination and assume a leadership role**. Municipal and community capacity is constrained, while clean fuel pathways require sustained effort over long timeframes and depend on interconnected decisions across land use, ports, utilities, and project development. A coordinated, regional approach helps prioritize the highest-value actions, avoid fragmented pilots and duplicative infrastructure; and align timelines and assumptions across multiple actors. Municipal and provincial governments, industrial operators, and utilities must work collaboratively, alongside First Nations, to plan infrastructure, share learnings, and align regulatory requirements.

- **Pursue cost-effective infrastructure sequencing**. Infrastructure investments should be staged, beginning with temporary or modular assets before transitioning to permanent systems as demand matures.

The principles are grouped into foundational themes which are required to support successful implementation:

- **Regional coordination and governance**. Establish a working group or steering committee structure to oversee implementation, monitor progress, and facilitate collaboration across municipalities, First Nations, industry, and utilities.

- **Funding pathways**. Identify and pursue federal and provincial funding streams, including clean fuels programs, innovation funds, and municipal infrastructure grants, to accelerate pilot deployment and reduce early capital barriers.

- **Shared infrastructure and planning**. Coordinate siting for storage tanks, bunkering systems, and refueling stations to provide early signals of local demand, reduce duplication of effort, and enable shared use where appropriate.

Cost remains a determining factor for clean fuel adoption. Globally, early adopters of hydrogen, ammonia, and renewable fuels often face price premiums compared to fossil fuels due to technology maturity, infrastructure requirements, and limited supply. In the Strait of Canso region, the willingness to pay will evolve as supply stabilizes, production scales, and policy incentives strengthen. Although policy support mechanisms are dynamic and subject to change over time, there are currently several incentives available to support closing the cost parity gap for each of the assessed opportunities.

Organizations with strong environmental, social, and governance commitments or regulatory drivers may be prepared to pay a premium for early adoption. Over time, coordinated demand aggregation, increased local supply, and maturing technologies are expected to reduce costs and narrow the price gap between incumbent and clean fuels. The recommended pilots will help generate real-world cost data to inform future decisions about long-term adoption.

To maintain momentum, the region should establish a fit-for-purpose governance structure to monitor progress, adjust priorities, and coordinate partners. Annual reviews, anchored by simple metrics such as pilot participation, fuel volumes used, training completed, and infrastructure deployed, will help track progress and keep implementation aligned with evolving technologies, market conditions, and community priorities.

Ongoing engagement with First Nations, community members, industry, and regulators will help to ensure that clean fuel adoption proceeds safely, transparently, and with inclusive support.

The Strait of Canso is well positioned to lead Atlantic Canada and North America in clean fuel adoption. By taking coordinated early actions, advancing targeted pilot projects, and planning for scalable long-term infrastructure, the region can strengthen energy resilience, reduce emissions, and attract new industrial activity. The recommendations presented here provide a practical roadmap for turning this potential into tangible economic and environmental benefits for the region.

7.1 Recommendations

The analysis of sector readiness, community and industry input, and global case studies shows that the Strait of Canso is well-positioned to pursue domestic clean fuel adoption but requires coordinated action to translate opportunity into implementation. While large-scale hydrogen and ammonia projects are progressing towards export markets, developing a local demand base will help reduce adoption risks, strengthen regional energy resilience, generate local support, reduce carbon emissions and expand economic benefits. The recommendations that follow are designed to sequence actions (see the corresponding implementation roadmap in Section 7.2) in a way that reflects commercial readiness, technical feasibility, infrastructure constraints and the timelines of emerging clean fuel production.

These recommendations balance short-term pilot activity with longer-term infrastructure and market development. Early demonstrations can provide valuable operational data and build familiarity among end-users, while medium-term planning will support future investment decisions and position the region for strategic industry attraction. Together, these actions form a practical pathway for municipal partners, First Nations, industry, and provincial agencies to advance domestic clean fuel use in a coordinated and evidence-based manner.

Table 63: List of themes, observations and recommendations to advance the adoption of clean fuels

Theme	#	Observation	Recommendation	Description
Regional coordination and governance	**1**	The Strait of Canso's clean fuels opportunity is not confined to a single municipality, site, or sector. The priority pathways identified span multiple end-use segments and depend on coordinated decisions across municipal governments, First Nations, industrial operators, utilities, provincial agencies, and producers. At the same time, clean fuel adoption is characterized by long lead times, evolving regulations, and uncertain economics. Without a structured forum to coordinate planning and sustain momentum, there is a material risk that efforts remain fragmented, pilots compete for the same limited resources, and infrastructure decisions are made in isolation rather than designed for shared use and scale. Successful clean fuels hubs are built through deliberate co-location, demand aggregation, and sequenced infrastructure investment. The region's strongest short-term prospects rely on shared assets and clear decision gates tied to offtake confidence. A fit-for-purpose standing working group with defined accountability is foundational. It enables common assumptions, shared planning for siting and permitting, coordinated engagement with utilities and regulators, and a consistent method for tracking readiness and determining when pilots should scale into permanent infrastructure.	**Establish a regional clean fuel working group to build shared purpose and momentum**	**Establish a permanent governance structure that brings together core partners, including the Government of Nova Scotia, Municipality of the County of Richmond, the Town of Port Hawkesbury, Mulgrave, MODG, Potlotek First Nation, Port Hawkesbury Paper, the Cape Breton Partnership, EverWind, relevant utilities, to coordinate planning, share data/learnings, and align infrastructure decisions.** This framework should identify representatives from each organization and designate additional lead partners responsible for executing selected pilot projects. Roles and responsibilities should be clearly defined using a RACI model (Responsible, Accountable, Consulted, Informed) to ensure accountability and streamlined decision-making. **Responsibilities could include providing strategic oversight for pilot projects and future scale-up, monitoring technoeconomic performance, supporting funding proposals, tracking regulatory developments, and guiding both pilot implementation and long-term infrastructure planning to enable clean fuel growth and scalability.** The governance structure should include an analytics and reporting cadence, with monthly updates on ongoing local learnings and policy matrix changes, with quarterly updated technoeconomic analyses dashboards featuring key financial metrics and decision gates that inform future go/no-go decisions. Adoption Readiness Level scorecards should be incorporated to support scale-up planning and future project prioritization. To enable collaboration, launch monthly coordination meetings and create a shared data room/dashboard with a standardized repository for technoeconomic templates, policy matrices, and end-user feedback logs.

	2	Clean fuel adoption introduces new operational requirements that extend beyond technology and economics. Hydrogen refueling, blending into gas networks, and ammonia bunkering each require new competencies in safety management, procedures, emergency response planning, and ongoing compliance with applicable standards and codes. Early success depends on engaging local permitting authorities and first responders, completing risk assessments, and ensuring operators have the training and confidence to work with new fuels. Community and industry interest across several opportunities is described as “emerging” or “early-stage,” which signals that readiness is as much about comfort, familiarity, and perceived risk as it is about the technical solution itself. In addition, the strategy’s success hinges on widespread local support and visible local benefits, particularly given the long timeframes required for major hydrogen and ammonia pathways. The domestic offtake strategy is explicitly positioned to expand economic benefits and community value beyond export-oriented projects. Building workforce capacity through partners such as NSCC, and supporting inclusive access for First Nations communities, strengthens both implementation feasibility and legitimacy. Community engagement and education also reduce schedule risk by addressing concerns early, setting realistic expectations about pilots (learning-oriented and staged), and ensuring clean fuel adoption proceeds transparently and with broad support as the region transitions from analysis to real-world deployment.	**Support community and workforce readiness through ecosystem convening and coordination**	**Map local workforce needs and gaps through the identification of specific skills demanded by clean fuel projects in the region.** There is an opportunity to lead this assessment using employer surveys, labour market data, local trades/union input, and utility and infrastructure operator interviews. **Partner with educational institutions to develop workforce training programs for clean fuel handling, safety, and maintenance, ensuring access for First Nations.** This could include sharing workforce needs with local academic institutions, encouraging the development of clean fuel micro-credentials, supporting partner institutions to design training modules specific to the selected pilot projects/fuel types, and promoting apprenticeships tailored to clean fuels and maintenance, prioritizing accessibility and inclusivity for First Nations **Initiate community engagement and education campaigns to build public support.** Create outreach materials, host information sessions, leverage local media and social platforms, and track community feedback to inform project planning and implementation. **Embed Indigenous participation frameworks into governance and project planning.** Leverage formal consultation processes, integrating Indigenous Knowledge into decision-making, ensuring representation in governance structures, and monitoring adherence to reconciliation and equity commitments.
Funding pathways	**3**	Early adoption carries significant fuel-cost premiums versus incumbent fuels, and for several uses it also requires new enabling infrastructure and operational changes. For a drop-in fuel like RD, the assessment identifies a consistent delivered cost premium at current conditions and a need to secure reliable supply and logistics for early deployments. The recommended short-term pilots are intentionally designed to be modest in scale and reversible, but still require upfront capital (equipment retrofits, modular refueling and storage, blending units, or mobile dispensing systems) and dedicated project capacity to execute safely. Given these realities, early-stage implementation is unlikely to proceed at the needed pace without coordinated access to federal and provincial programs	**Secure funding for pilot projects and enabling infrastructure**	**Identify, monitor, and pursue provincial and federal funding programs** through a centralized funding tracker accessible to working group members. Use systematic program monitoring across relevant Departments and agencies, track early signals and pre-announcements as most major funding programs are telegraphed months in advance through budget documents, mandate letters, provincial budget previews, regulatory consultations, and government requests for information seeking input on new program design. **Establish a coordinated funding strategy through a regional clean fuel working group** to maximize competitiveness and avoid duplication of effort. At this stage, the working group’s priority is to align federal, provincial, and industry funding streams around shared

	that can offset first-mover costs and de-risk demonstration activity. Importantly, the report frames pilots as vehicles to generate operational data, validate performance, and build user confidence, with economic viability treated as a secondary consideration. Funding, therefore, becomes the bridge between "promising opportunity" and "real implementation", allowing the region to prove performance, establish local baselines for cost and operations, and build the evidence base needed for future go/no-go decisions on permanent assets. At the same time, the strategy emphasizes the need to avoid indefinite reliance on subsidies by tracking economics, utilization, and carbon credit mechanisms over time and scaling only when the long-term business case is credible.		objectives and ensure that early investments support pilot projects with long-term scaling potential. **Leverage available funding to run pilot projects that validate technical performance, operational fit, and user acceptance.** At this stage, economic viability is deliberately a secondary consideration, the priority is to demonstrate that the technology performs reliably under real-world conditions and that end users experience clear operational benefits. Although early adoption may come with higher end-user costs, these pilots generate the performance data, operational insights, and user feedback required to support a future scaleup decision. **Establish a clear pathway toward eliminating long-term funding reliance by monitoring fuel economics improvements as the industry scales and carbon credits are leveraged.**[203] There is a longer-term expectation that fuel purchase economics will strengthen as local producers reach largescale production, including through exports to markets such as Europe, which would bring local fuel pricing closer to cost parity or established willingness to pay thresholds and reduce the need for continued funding. Additional cost reduction mechanisms (such as carbon credit incentives) could further enhance the financial case. This improved outlook must be sufficiently demonstrated before moving from pilot deployment to commercial scaleup, ensuring that long-term reliance on funding is no longer required.
4	The dominant driver of global green hydrogen projects reaching operation or FID is not speculative demand, but the replacement of fossil-based hydrogen in large, continuous industrial processes, often through co-location with established offtakers. This evidence strongly supports an investment attraction strategy focused on industries with bankable, steady demand and high sensitivity to logistics, where proximity to hydrogen production and port infrastructure materially improves economics. The Strait of Canso's locational advantages align with the characteristics observed in successful clean fuels hubs elsewhere, but the report also notes that these advantages do not apply uniformly across all potential end uses. Targeted outreach is required to focus on industries that best match the	**Support strategic industry investment attraction through active collaboration and a shared project pipeline**	**Collaborate with Cape Breton Partnership, Invest Nova Scotia, and Invest in Canada as core strategic partners** to target industries aligned with clean fuel availability. **Share market intelligence and technical insights with economic development agencies** including infrastructure and permitting needs, carbon intensity calculations, supply chain requirements, workforce needs, project timelines and risk factors. **Support investment attraction through** the identification of priority fuel pathways and shovel-ready sites with infrastructure potential, provide prospective investors with clear information on timelines, infrastructure plans, local workforce capacity, and clean fuel pricing trajectories. **Leverage the networks and skills of economic development agencies to engage local leadership and community stakeholders.** This could be achieved through public

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[203] See Section 4.3 - Opportunity #7 for additional context on carbon credits.

		region's asset base and are most likely to co-locate alongside early clean fuel supply. Domestic offtake and early pilots serve a second strategic purpose beyond emissions reduction: they demonstrate real demand signals, build enabling infrastructure, and reduce perceived risk for prospective anchor tenants. Potential investors will need credible visibility into production timelines, infrastructure planning, permitting pathways, workforce development, and realistic clean fuel pricing trajectories. Pre-FID engagement is particularly important so that public infrastructure planning aligns with the specific needs of future tenants and avoids stranded or mis-sized investments. Coordinating investment attraction with the pilot program and infrastructure sequencing therefore strengthens the region's ability to translate clean fuel potential into durable industrial development.		information sessions, the facilitation of Indigenous economic development partnerships, and the communication of clean fuels benefits to local industry.
Shared infrastructure and planning	**5**	The opportunity assessment and shortlisting exercise indicates that the most actionable near- to medium-term pathways cluster around four themes: hydrogen for on-road mobility, hydrogen for blending and electricity (utility-led), ammonia for marine mobility, and renewable diesel as a drop-in decarbonization option across multiple end-uses. These pathways combine meaningful emissions potential with the highest relative feasibility in the local context and the ability to anchor shared infrastructure. These priorities are further translated into implementable pilots with defined timelines, infrastructure requirements, and indicative CAPEX, deliberately emphasizing modular or mobile approaches to avoid overcommitting before demand and supply conditions are proven. A consistent success factor is that pilots must be designed to generate the evidence required for scale. Stakeholders show strong interest in low-barrier options like RD, and cautious, emerging interest in hydrogen and ammonia where safety, logistics, and reliability are the central concerns. The recommended pilots directly address those barriers by focusing on controlled duty cycles (return-to-base routes for hydrogen mobility), low initial blend fractions for hydrogen blending (to build regulatory and operational experience, and early feasibility and safety groundwork for ammonia bunkering to position the Strait as a waypoint as vessels emerge.	**Prioritize and advance early pilot projects**	Focus on 2-3 pilot projects in the short-term. These early initiatives will help to signal early demand for the respective clean fuels and build confidence in the technologies, generate technoeconomic insights, user feedback, and support future scale up projects and funding applications. Potential pilot projects include: • **Hydrogen for on-road mobility:** Deploy a retrofitted truck fleet to use hydrogen-diesel dual fuel kit along with a mobile hydrogen refueling unit to evaluate performance, fueling logistics, and cost profiles on local routes. • **Hydrogen for blending with natural gas:** Deliver hydrogen by truck to blend into natural gas pipeline near Point Tupper Generating Station at low concentrations. • **Renewable diesel aggregation:** Establish a mobile or temporary RD fueling point to deliver immediate emissions reductions with minimal technical barriers, while bridging to potential future locally produced hydrogen-derived RD. • **Ammonia marine refueling:** Begin technical feasibility, including safety and risk assessment, and partner engagement for a fuel barge–based ammonia bunkering pilot project. **For each selected pilot project, develop a set of technical, financial/economic, environmental, operational/safety, community, workforce, and market adoption metrics to inform go/no-go decisions**, This could include measures specific to system uptime, reliability, energy efficiency, carbon intensity reduction, operational stability, capital cost and operating cost variance, cost per unit of fuel produced, additional investment

	Embedding tracking, structured end-user feedback, and policy/permitting monitoring within each pilot is therefore essential to produce decision-quality data and to ensure early projects remain aligned with long-term infrastructure pathways.		attracted, value of public funding leveraged, GHG emission reductions, air quality improvements, water usage, safety incidents, training completed, community acceptance/sentiment, Indigenous partnerships, fuel demand generated, number of follow-on projects initiated or planned, among others. **Define and monitor financial metrics to support future go-no go decision-making on selection and sequencing of additional pilot projects** (e.g., finance the pilot project when the IRR exceeds WACC under a conservative scenario). Track sensitivity to fuel prices, duty cycles, incentives, and utilization. Run a technoeconomic analysis before (and during) each selected pilot project with a clear scope (components/product/infrastructure), a process flow diagram, documented internal/external assumptions, key financial metrics (e.g., IRR, Minimum Selling Price, Total Cost of Ownership), using base/upside/downside scenarios to support go-no go decision-making. **Develop and embed continuous end-user primary market research insights** to gather user profiles/persona/feedback/acceptance, safety learnings, and operational KPIs for inclusion into the technoeconomic analysis assumption updates and to support future go-no go decision making. **Develop and continuously update a policy matrix** for each pilot project to identify potential permit/regulatory timelines, incentives/rebates, customer cashflow impacts, and potential near term policy changes.
6	Section 6 makes clear that permanent infrastructure should not precede evidence of dependable supply and bankable offtake commitments. The analysis also identifies clear dependencies that will govern timing: local production availability, utility transition schedules (including the Point Tupper generating station's trajectory), end-user equipment turnover cycles, and the maturation of technologies and safety frameworks. Without a structured approach to translating pilot learnings into infrastructure decisions, there is a risk of stranded assets, underutilized facilities, or misaligned siting that fails to enable aggregation across users. The analysis therefore supports a disciplined "pilot-to-scale" approach that uses defined metrics and readiness tracking to determine when to move from modular pilots to permanent stations, pipeline extensions, and bunkering	**Prepare for future state infrastructure pathways**	Use insights and metrics from the pilot projects (see summary in Table 56, Section 6) to inform go/no-go decisions about selection and sequencing of scaleup/permanent infrastructure (i.e., technoeconomic analysis insights should feed infrastructure siting and CAPEX prioritization), including: • **Hydrogen refueling:** Plan for a permanent hydrogen refueling station as demand grows and production becomes locally available. • **Hydrogen distribution system:** Build long-term pathway to higher blend fractions and/or pipeline extension. • **Renewable diesel access:** Transition from mobile dispensing to a permanent RD refueling site, with the potential to evolve from trucked in supply into locally produced hydrogen-derived RD.

	systems. Aggregation and high utilization are the levers that improve cost competitiveness and make infrastructure investable. Pilot results should inform where demand concentrates, what service models users accept, what pricing and contracting structures are viable, and what permitting and safety requirements create schedule risk. Aligning infrastructure sequencing with production timelines, confirmed willingness-to-pay thresholds, and measurable adoption readiness will allow the region to grow clean fuel access without locking into premature capital commitments.		• **Ammonia dual-fuel cargo vessel:** Evaluate siting, regulatory requirements, and vessel partnerships to enable engine conversion for a local cargo ship exporting regional products (e.g., aggregate, ammonia). **Test customer willingness under different service and pricing models, while using technoeconomic analysis to identify additional cost-reduction levers such as carbon credit mechanisms.** Track the minimum selling price relative to market benchmarks and adjust pricing strategies in real time. This evidence base is essential for determining whether clean fuels can compete with incumbent fuels or justify a premium through operational savings or environmental value. Additionally, sequencing should align with production timelines and expected end-user equipment turnover cycles (e.g., fleet). Implement an **Adoption Readiness Level tracking system** that considers factors such as producer FID status, supply chain readiness, workforce availability, and regulatory progress to determine when pilot projects are ready for permanent assets in line with future-state infrastructure pathways (i.e., go/no-go decision). Review and report on this system quarterly to ensure timely adjustments and informed decision-making.
7	While the strategy prioritizes four high-ranking pathways, the broader opportunity set assessed in Section 4 confirms that clean fuels adoption is dynamic and will evolve with policy, technology maturity, and supply chain development. Some pathways were deprioritized due to current cost premiums, equipment availability, and infrastructure complexity, not because they lack long-term relevance. SAF, for example, is treated as a valuable pathway with strong alignment to aviation decarbonization but constrained by availability, cost, and practical implementation mechanisms. This supports the logic of maintaining a rolling watchlist and revisiting assumptions as market tailwinds strengthen. As regional projects mature, there is an opportunity to position local assets as early adopters, building demand signals and reinforcing the region's clean fuels leadership narrative. A structured approach to reassessment—using policy monitoring, primary market research, and updated readiness scoring—ensures that future decisions remain evidence-based and that emerging	**Advance broader set of clean fuels adoption opportunities**	**As SAF production matures regionally[204], begin discussions with Allan J. MacEachen Regional Airport on trialing SAF for local carriers and ground operations.** This positions the airport as an early adopter and may attract additional aviation activity. **Regularly revisit and update non-shortlisted opportunity ratings and prioritization** using insights from policy monitoring (such as the policy matrix) and ongoing primary market research. Maintain a rolling watchlist and reassess when policy or market tailwinds strengthen, ensuring no major decisions are made without refreshed data.

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[204] As mentioned in earlier sections of this report, Nova Sustainable Fuels is preparing for FID and is exploring opportunities to supply or move a portion of its product within domestic and regional markets.

opportunities are activated at the right time, rather than being missed due to outdated assumptions or lack of active stewardship.

7.2 Implementation roadmap

The following roadmap is informed by insights from the opportunity readiness analysis, community and industry engagement, review of global case studies, and regional infrastructure considerations. It reflects input from municipal partners, First Nations, industry stakeholders, and provincial agencies, as well as lessons learned from early clean fuel adoption efforts in comparable jurisdictions. This roadmap is designed to translate opportunity into action by sequencing steps that align with technical feasibility, infrastructure constraints, and emerging production timelines.

The implementation plan focuses on short-, medium-, and long-term horizons validated through industry and community discussions and industry benchmarks.

Together, these actions provide a practical pathway for municipal partners, First Nations, industry, and provincial agencies to advance domestic clean fuel use in a coordinated and evidence-based manner.

Table 64: Implementation roadmap with short-, medium-, and long-term actions

	Recommendation	Proposed actions	2026	2027	2028	2029	2030	2031	2032
1	**Establish a regional clean fuel working group**	Identify representatives from all core partners (using a RACI model) —including the Municipality of the County of Richmond, the Town of Port Hawkesbury, Potlotek First Nation, Port Hawkesbury Paper, the Cape Breton Partnership, EverWind, and the Government of Nova Scotia—and designate additional lead partners responsible for executing selected pilot projects (e.g., industry, utility). Incorporate a governance analytics remit to deliver quarterly summary of learnings and policy matrix updates, as well as technoeconomic analysis dashboards and Adoption Readiness Level scorecards to guide future scale-up decisions.	■						
		Develop and approve a formal Terms of Reference that defines the governance mandate, roles and responsibilities for executing roadmap actions, meeting and reporting cadence, and decision rights. Explicitly outline financial metrics and decision gates (e.g., IRR vs. WACC), policy matrix components, and technoeconomic analysis workflow requirements (pre-, mid-, and post-project stages), along with standardized reporting artifacts to ensure transparency and consistency.	■						
		Initiate monthly coordination meetings and establish a secure shared data room/dashboard to enable collaboration across partners. Stand up a standardized repository for technoeconomic analysis templates, policy matrices, and end-user feedback logs to ensure consistent data management and streamlined access for all stakeholders.	■						
2	**Support community and workforce readiness**	Develop and launch workforce training and community engagement specific to the selected pilot projects/fuel types, embedding First Nations participation; expand training to include cross fuel safety certifications, emergency response, and competency tracking in partnership with educational institutions.	■	■					
		Integrate structured community feedback loops (user acceptance, operational/safety learnings) into pilot project planning and technoeconomic analysis assumption updates.	■	■					
3	**Secure funding for pilot projects and enabling structure**	Prepare coordinated funding strategy and application calendar; link funding decisions to pilot project finance gates and technoeconomic analysis outputs, referencing policy matrix incentives and carbon credit eligibility.	■						
		Develop draft proposals with partners (i.e., costing, business case, emissions reduction impact); include minimal selling price vs. market price analysis, willingness to pay insights, and sensitivity.	■			■			
		Submit applications and manage follow-up with funders; maintain a pricing tracker and update proposals as minimum selling price-market deltas or policy tailwinds change.	■	■		■	■		
4	**Support strategic industry investment attraction**	Align with Invest Nova Scotia, the Cape Breton Partnership, and Invest in Canada on target sectors and messaging; embed quantified clean fuel pricing trajectories, infrastructure timelines, and workforce capacity.		■					
		Build investor information package (i.e., timelines, infrastructure maps, workforce profiles) in green steel/cement/logistics industries; add policy/incentive summaries and Adoption Readiness Level based readiness indicators.		■					
		Conduct outreach to priority prospects in the above-mentioned industries and schedule briefings; implement an investor feedback tracker to refine the value proposition and materials quarterly.		■	■	■			
		Track investor feedback by industry and refine value proposition; publish a quarterly synthesis and update the investor pack accordingly.		■	■	■	■	■	■
5	**Prioritize and advance early pilot projects**	Select 2-3 priority pilot projects and confirm lead partners responsible for executing; apply conservative finance gates to approve sequencing.	■						
		Conduct technical and regulatory prefeasibility assessments, including safety and risk assessments for the ammonia related pilot project (if selected); standardize cross fuel safety framework, training certifications, and emergency response plans.		■					
		Develop implementation plans for the select pilot projects (i.e., logistics, equipment sourcing, safety protocols), including training (e.g., for operators, community, and First Nations); embed technoeconomic analysis templates, policy matrix creation, and data collection plans for operational KPIs.		■					
		Launch pilot projects and collect operational/performance data; run technoeconomic analysis cycles pre/mid/post, update assumptions with continuous end-user primary market research (user acceptance, feedback) and produce sensitivity analyses.		■	■	■			
6	**Prepare for future state infrastructure pathways**	Conduct structured go/no-go decisions on scaling up opportunities by using insights from pilot projects to refine infrastructure scenarios, incorporating selected key financial metrics, technoeconomic analysis, changes in fuel pricing, and Adoption Readiness Level scores to guide the sequencing of next steps, including CAPEX planning and site selection.				■	■		
		Conduct siting and feasibility work for scaling up; prioritize sites based on Adoption Readiness Level thresholds (e.g., producer FID confirmation, supply chain, workforce, regulatory progress, demand signals).					■		
		Develop staged infrastructure roadmap aligned with production timelines; publish readiness-based sequencing recommendations and update technoeconomic assumptions quarterly.					■		
7	**Advance broader clean fuels adoption opportunities**	Monitor SAF developments and assess regional supply availability; maintain a rolling watchlist of non-shortlisted opportunities and re-prioritize quarterly using policy matrix changes and market signals.	■	■	■	■	■	■	■

8. Appendix

8.1 Literature review of case studies

Manufacturing

Table 65: Manufacturing – Processing plants, light-medium industry, logistics & maintenance

Use case	Project	End use application	Overview	End use technology	Incumbent fuel	New fuel	Deployment stage	Location & Year
Iron & steelmaking	Salzgitter SALCOS[205]	Process heat	Program converting blast-furnace operations to hydrogen-based DRI	Hydrogen DRI	Fossil fuel	Green hydrogen	Execute	Germany, 2023
Iron & steelmaking	Ovako Hofors[206]	Process heat	Operational 20 MW electrolyzer producing hydrogen to heat steel before rolling.	Steeling heating + rolling	Coal, natural gas	Green hydrogen	Execute	Sweden, 2023
Iron & steelmaking	HYBRIT (Hydrogen Breakthrough Ironmaking Technology)[207]	Process heat	World's first pilot plant using green hydrogen for iron ore reduction to make fossil-free steel.	Alkaline electrolyzer for green HYDROGEN; Direct reduced iron (DRI)	Petcoke	Green hydrogen	Pilot	Sweden, 2020
Iron & steelmaking	ArcelorMittal Contrecoeur[208]	Process heat	Pilot replacing 6.8% of natural gas with hydrogen in iron ore reduction for DRI-based steel production	Hydrogen DRI	Coal / petcoke	Low-carbon hydrogen (potentially green)	Pilot	Canada, 2022
Pulp & paper	Smurfit Kappa / HYFLEXPOWER[209]	Electricity	Paper packaging company using hydrogen to power gas turbine	Power for turbine used in drying process	Natural gas	Green hydrogen	Execute	France, 2023

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[205] The concept for a sustainable future - Our program Salcos (Accessed August 4, 2025)
[206] World's first fossil-free hydrogen plant revolutionizes steel (Accessed August 4, 2025).
[207] Decarbonising end-use sectors: Practical insights on green hydrogen (Accessed August 4, 2025)
[208] Hydrogen strategy for Canada: Progress report (Accessed August 4, 2025)
[209] HYFLEXPOWER consortium successfully operates a gas turbine with 100 percent renewable hydrogen, a world first (Accessed August 4, 2025)

Cement & lime	Limak Çimento (Anka Plant)[210]	Process heat	Pilot injected 50% hydrogen blended carbon-neutral fuel into cement calciner	Hydrogen + AF (alternative fuel) directly in calciner feed	Coal	Hydrogen-enhanced fuel blend	Pilot	Turkey, 2024
Cement & lime	TITAN Group – HYDROGENCEM Project[211]	Process heat	IPCEI project deploying 3.5 MW electrolyzer units and pilot kilns running on hydrogen	Electrolysis to power green hydrogen-fired rotary kiln	N/A	Green hydrogen	Pilot	Greece, 2025
Cement & lime	Mitsubishi Ube Cement Corporation[212]	Process heat	Started commercial testing of ammonia co-firing in the cement manufacturing process	Replace 30% of the calorific value of coal with ammonia in the cement kiln	N/A	Ammonia (30%)	Pilot	Japan, 2025
Light / medium industry	Project WhiskHy[213]	Process heat	Distillery using green hydrogen for process heat in whisky distillation.	Hydrogen combustion boiler	Coal	Green hydrogen	Pilot	Scotland, 2024
Light / medium industry	Arbikie Distillery[11]	Process heat	Green hydrogen powered distillery. Uses on-site wind power to generate hydrogen for direct use in production heat.	Hydrogen combustion boiler	N/A	Green hydrogen	Pilot	Scotland, 2024
Light / medium industry	Deutz Machining & Assembly Centre[214]	Electricity	Pilot hydrogen energy centre on-site at Deutz engine component workshop: HYDROGEN combustion generator	Hydrogen combustion engine	N/A	Green hydrogen	Pilot	Spain, 2025

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[210] Update on hydrogen use at cement plants, July 2024 (Accessed August 4, 2025)
[211] TITAN - Pioneering Green Hydrogen for Industrial Cement Production in Greece (HYDROGENCEM) (EL11) (Accessed August 4, 2025)
[212] Commercial-scale testing of ammonia heat for cement manufacturing in Japan (Accessed August 4, 2025)
[213] Green whisky: The distilleries turning to hydrogen for net zero in Scotland (Accessed August 7, 2025)
[214] Deutz inaugurates first green hydrogen pilot plant in Spain (Accessed August 4, 2025)

Workshops and fabrication	Port of Antwerp-Bruges - Hydrogen boiler for workshop[215]	Process heat	First-of-its-kind 100% green hydrogen boiler heating a 1,430 m^3 workshop	Hydrogen boiler	Natural gas	Green hydrogen	Execute	Belgium, 2024
Industrial support services	Oncore Energy Hydrogen Generators[216]	Electricity	Modular containerized systems replacing diesel gensets at job sites, marine barge operations, manufacturing backups. Pre-filled hydrogen tanks used for power.	Hydrogen fueled generator sets (4 kW–32kW)	Diesel	Green hydrogen	Execute	US, 2025
Industrial support services	Stratbag – Wheel loader[217]	Electricity	STRABAG and Liebherr will be testing the wheel loader in daily operation over a trial period lasting several years.	Hydrogen engine	Diesel	Green hydrogen	Pilot	Austria, 2024
Maintenance & logistics	Hydrogen Crane Deployment at The Port of Los Angeles[218]	Mobility fuel	Hydrogen-powered RTG crane in container terminal	Fuel cell power pack (60 kW) on RTG replacing genset	Diesel	Green hydrogen	Execute	US, 2024
Maintenance & logistics	DP World RTG Crane Pilot[219]	Mobility fuel	DP World Pilots Hydrogen Fuel Cell Crane at Port of Vancouver	HEG (fuel cell + battery + regenerative braking) on rubber-tired gantry (RTG) crane	Diesel	Green hydrogen	Pilot	Canada, 2024

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[215] Belgian first with green hydrogen boiler in workshop (Accessed August 1, 2025)
[216] The future of reliable, clean energy in America (Accessed August 1, 2025)
[217] Sustainability in the construction sector: STRABAG and Liebherr test hydrogen-powered wheel loader in Gratkorn quarry (Accessed August 1, 2025)
[218] Hydrogen Crane Deployment At The Port Of Los Angeles (Accessed August 1, 2025)
[219] DP World Pilots Hydrogen Fuel Cell Crane At Port of Vancouver (Accessed August 1, 2025)

Maintenance & logistics	Port of Montreal – Gaussin Hydrogen Machinery[220]	Mobility fuel	Hydrogen-powered terminal tractors and yard machinery	Hydrogen fuel cell	Diesel	Green hydrogen	Pilot	Canada, 2024
Processing plant	TotalEnergies Leuna Refinery[221]	Chemical feedstock	Plan to use 300,000 metric tons of green hydrogen annually ~~to reduce emissions~~	Reduced CO_2 emissions	Natural gas	Green hydrogen	Plan	Germany, 2025
Processing plant	Irving Oil[222]	Chemical feedstock	Using hydrogen to reduce sulphur in petroleum products	Lowering sulphur content in petrol products	Natural gas	Blue / green hydrogen	Plan	Canada, 2022

Marine

Table 66: Marine vessels - Fishing fleet, commercial shipping, support vessels and bunkering services

Use case	Project	End use application	Overview	End use technology	Incumbent fuel	New fuel	Deployment stage	Location & Year
Fishing vessel	MS Skulebas [223]	Mobility fuel	Hydrogen-electric hybrid fishing & training vessel. Majority of its operations fully electric and will be supplemented by clean hydrogen.	340 kW PEM fuel cells & batteries	N/A	Green hydrogen & battery	Execute	Norway, 2023
Fishing vessel	Alba[224]	Mobility fuel	Hydrogen-electric fishing training vessel	Dual fuel-cell (RexHYDROGEN) & battery propulsion setup	N/A	Green hydrogen & battery	Execute	France, 2024

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[220] New hydrogen-powered equipment prototypes received by QSL at the Port of Montreal (Accessed August 1, 2025)
[221] RWE and TotalEnergies agree groundbreaking long-term offtake agreement for green hydrogen (Accessed August 7, 2025)
[222] Irving Oil to introduce hydrogen for the regional market – a first-of-its-kind investment from a Canadian refiner | Irving Oil (Accessed August 7, 2025)
[223] Fishing and aquaculture vessels with alternative power sources (Accessed August 11, 2025)
[224] France's First Hydrogen-Electric Powered Fishing Training Vessel Ready to Set Sail (Accessed August 11, 2025)

Container shipping	Laura Mærsk (Maersk)[225]	Mobility fuel	World's first methanol-enabled container ship (dual-fuel diesel/methanol)	MAN engine capable of burning methanol or HFO	HFO / marine diesel	Green methanol	Execute	Denmark, 2023
Container shipping	Yara Eyde [226]	Mobility fuel	Planned world's first pure ammonia-fueled container ship	Ammonia fueled engine	N/A	Green ammonia	Plan	Norway, 2023
Barge	HYDROGEN Barge 1 & 2[227]	Electricity	Hydrogen powered inland barges. Converted from traditional diesel to PEM fuel cells and batteries.	Hydrogen fuel cells	Diesel	Green hydrogen	Execute	Netherlands, 2024
Tugboat	Hydrotug 1[228]	Mobility fuel	World's first hydrogen powered tugboat; dual fuel engines	Two BeHydro V12 dual-fuel engines that can run either on hydrogen or on traditional fuel	N/A	Green hydrogen	Execute	Belgium, 2024
Tugboat	Prince Rupert Port Authority transition to RD[229]	Mobility fuel	Began using 100% RD across its port operations in 2023, including heavy-duty equipment and tugboats, using drop-in fuel with no infrastructure upgrades required.	Drop in fuel compatible with existing engines	Diesel	RD	Pilot	Canada, 2024
Ferry	MF Hydra[230]	Mobility fuel	First liquid hydrogen ferry; hybrid fuel cell + genset system	Hydrogen fuel cells	N/A	Green hydrogen	Execute	Norway, 2023

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[225] Maersk says ocean shipping's zero-emissions push needs government support (Accessed August 6, 2025)
[226] The world's first clean ammonia-powered container ship (Accessed August 6, 2025)
[227] Delivery of Hydrogen-Powered Vessel "HYDROGEN Barge 2" (Accessed August 6, 2025)
[228] Hydrotug 1: the very first hydrogen-powered tug (Accessed August 6, 2025)
[229] 2024 Annual Report Summary - Prince Ruport Port Authority (Accessed August 6, 2025)
[230] World's first liquid-powered hydrogen ship, MF Hydra, is powered by Ballard's fuel cells (Accessed August 6, 2025)

Ferry	MV Sea Change[231]	Mobility fuel	Commercial hydrogen fuel-cell ferry operation	Hydrogen fuel cells	Diesel	Green hydrogen	Pilot	US, 2024
Offshore wind service boats	Windcat Workboat –	Mobility fuel	CTV & CSOV fleets are heavily experienced in various offshore windfarms in the EU	Dual fuel hydrogen combustion engine; hydrogen & diesel	N/A	Green hydrogen	Execute	Various EU markets, 2024

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[231] Sea Change Hydrogen Ferry Demonstration Project (Accessed August 6, 2025)

	Hydrocat 60[232]

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[232] Windcat delivers Hydrocat 60, the first hydrogen powered CTV in the MK5 series (Accessed August 6, 2025)

Offshore wind service boats	Anchor-handling vessel (Blåvinge)[233]	Mobility fuel	Pilot to use green ammonia fuel for offshore wind support vessel	Vessel using green ammonia as power source	N/A	Green ammonia	Pilot	Norway, 2024
Bunkering infrastructure support	STS Ammonia Bunkering[234]	Mobility fuel	First ship-to-ship ammonia bunkering pilot off Australia	800 m^3 liquid ammonia transfer between vessels	N/A	Green ammonia	Pilot	Australia, 2025
Coast guard, public service vessels	Canadian Coast Guard[235]	Mobility fuel	Use and optimization of RD/biodiesel blends in government marine fleets	Bio/RD blends, engine adaptation, emissions validation	Diesel	RD, biodiesel	Pilot	Canada, 2024

Transportation

Table 67: Transportation - Public transportation, trucking and freight, aviation, ferries

Use case	Project	End use application	Overview	End use technology	Incumbent fuel	New fuel	Deployment stage	Location & Year
Aviation	Airbus Canada rolls out SAF[236]	Mobility fuel	Airbus Canada's A220 site, enabling the Mirabel teams to use SAF for production, customer acceptance and test flights.	SAF blending	Jet fuel	Jet-A1 blended with 30% SAF	Pilot	Canada, 2025
Aviation	Universal Hydrogen[237]	Mobility fuel	Hydrogen-electric De Havilland Canada Dash 8, containing the world's largest hydrogen fuel cell ever to power an aircraft	Hydrogen fuel cell	Jet fuel	Green hydrogen	Pilot	US, 2023

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[233] Zero-emission solutions for the installation and operation of floating offshore wind turbines (Accessed August 6, 2025)
[234] Yara Clean Ammonia supports groundbreaking ammonia bunkering pilot in Pilbara (Accessed August 6, 2025)
[235] Testing and analysis of renewable/bio/conventional diesel blends for marine vessel applications: task 2 report (Accessed August 6, 2025)
[236] Airbus Canada rolls out sustainable aviation fuel, unlocking 100% SAF capacity across all delivery centres worldwide (Accessed August 7, 2025)
[237] Universal Hydrogen: The Dash 8 With An Electric Engine (Accessed August 12, 2025)

Aviation	Avmax aircraft[238]	Mobility fuel	Retrofitting 20 regional turboprop aircraft with green hydrogen fuel cell technology to enable zero-emission flights.	Hydrogen fuel cell	Jet fuel	Green hydrogen	Execute	Canada, 2022
City transit	Solaris fuel cell bus fleet[239]	Mobility fuel	Deployments of Solaris Urbino-12 hydrogen buses.	Hydrogen fuel cell	Diesel	Green hydrogen	Execute	Germany, 2025
City transit	MiWay[240]	Mobility fuel	Pilot of 10 hydrogen fuel-cell electric buses & depot infrastructure	FCEB	Diesel	Green hydrogen	Pilot	Canada, 2025
City transit	Halifax Transit: Dual fuel hydrogen buses[241]	Mobility fuel	Four Halifax transit busses powered by hydrogen and diesel. No modifications required to engine.	Dual fuel system (hydrogen & diesel)	Diesel	Hydrogen blended with diesel	Pilot	Canada, 2024
School bus	Twin Rivers school board[242]	Mobility fuel	Switched 75 diesel-powered school buses to RD. No engine modifications required	Diesel engine	Diesel	RD	Execute	US, 2020
Trucking	4 Gen Logistics[243]	Mobility fuel	Growing fleet which includes 75 zero emission vehicles (ZEVs). Of which there are 15 Nikola hydrogen fuel cell trucks	Hydrogen fuel cell	N/A	Green hydrogen	Execute	US, 2024

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[238] Universal Hydrogen and Avmax Announce Firm Order for Hydrogen Conversion and Fuel Services for 20 Re (Accessed August 12, 2025)

[239] First-phase fuel cell bus fleet enters operation in Duisburg, Germany - powered by Ballard (Accessed August 7, 2025)

[240] Zero-emission transit: Mississauga launches innovative hydrogen-powered bus initiative (Accessed August 7, 2025)

[241] Halifax launching dual-fuel hydrogen bus project this year (Accessed August 11, 2025)

[242] Twin Rivers is proud of making a real difference by running a completely sustainable and alternative fuel operation (Accessed August 5, 2025)

[243] 4 Gen Logistics Launches First Phase of Electrification at Port of Long Beach with 30 New Hyper-Fast Chargers (Accessed August 5, 2025)

Trucking	Walmart introduces hydrogen fuel cell electric semi-truck[244]	Mobility fuel	Walmart Canada deployed hydrogen fuel cell electric semi-truck to its fleet (Nikola Hydrogen Fuel Cell EV Class 8)	Hydrogen fuel cell	N/A	Green hydrogen	Execute	Canada, 2024

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[244] Walmart Canada becomes the first major retailer in Canada to introduce a hydrogen fuel cell electric semi-truck (Accessed August 4, 2025)

Government operations

Table 68: Government operations – Municipal and first nations fleet, public works, healthcare facilities

Use case	Project name	End use application	Overview	End use technology	Incumbent fuel	New fuel	Deployment stage	Location & Year
Fleets	Haíłzaqv Nation R99 Pilot[245]	Mobility fuel	RD fuel pilot for community vehicle fleets and service barge	Drop-in RD at local fuel dock	Diesel	RD	Pilot	Canada, 2019
Fleets	New York city fleet completes transition to RD[246]	Mobility fuel	Fully transitioned its 12,500 heavy-duty and off-road vehicles to RD, cutting 162 million pounds of annual CO_2 emissions.	Drop-in RD	Diesel	RD	Execute	US, 2024
Waste management	Solo Resource Recovery - Hydrogen fuel cell garbage trucks[247]	Electricity	Australia's first hydrogen fuel cell rear loader garbage truck delivered to Solo Resource Recovery, marking a significant milestone in the clean energy transition	Hydrogen fuel cell	N/A	Green hydrogen	Execute	Australia, 2025
Public works	Calistoga Resiliency Center[248]	Electricity	Hybrid facility with onsite hydrogen fuel cell + battery storage to power a local resilience center	Hydrogen fuel cell	N/A	Green hydrogen	Execute	US, 2025

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[245] Haíłzaqv Renewable Diesel Pilot Overview (Accessed August 5, 2025)
[246] Mayor Adams Announces Full City Fleet has Completed Transition to Renewable Diesel (Accessed August 12, 2025)
[247] Pure Hydrogen Delivers Hydrogen Fuel Cell Truck to Waste Management Company (Accessed August 5, 2025)
[248] Calistoga Resiliency Center (Accessed August 5, 2025)

Health care	Klickitat Valley Health – HYDROGEN fuel cell for	Electricity	The fuel cell power system, which combines Kohler's power generation control platform and system integration expertise with a fuel cell module from Toyota, can be used as a prime or back-up power source or as part of a distributed network.	Hydrogen fuel cell	N/A	Green hydrogen	Execute	US, 2024

	power hospital generation[249]							
Health care	Viamed San José Hospital – Heat & O2[250]	Electricity	Hydrogen boiler used to generate heat and oxygen for medical needs.	Hydrogen boiler	N/A	Green hydrogen	Execute	Spain, 2024
Emergency services	ULEMCo – Hydrogen Powered Ambulance[251]	Mobility fuel	Hydrogen-fuelled ambulance delivers zero-emission, rapid response for NHS deployment.	Hydrogen fuel cell	N/A	Green hydrogen	Pilot	UK, 2021

Utilities

Table 69: Utilities – Natural gas blending, combustion for power

Use case	**Project name**	**End use application**	**Project overview**	**End use technology**	**Incumbent fuel**	**New fuel**	**Deployment stage**	**Location & Year**
Natural gas blending	Enbridge Gas – Markham[252]	Blending in natural gas lines	Delivering blended gas—that is, clean hydrogen injected into the natural gas distribution network to reduce the fuel's carbon footprint.	Hydrogen blended into natural gas distribution line	Natural gas	Blended gas (Green hydrogen + natural gas)	Execute	Ontario, 2022
Natural gas blending	ThermHYDROGEN Project[253]	Blending in natural gas lines	Blended 5% hydrogen in a test gas distribution system to confirm copious amounts of industry research on the efficacy and safety	5% hydrogen blended into natural gas grid	Natural gas	Blended gas (Green hydrogen + natural gas)	Execute	Utah, 2023

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[249] Kohler and Toyota partner on hydrogen fuel cell for U.S. hospital (Accessed August 5, 2025)
[250] Spain: green hydrogen to heat a hospital and generate oxygen (Accessed August 5, 2025)
[251] ULEMCo Shows World's First Hydrogen Powered Ambulance Prototype at COP26 (Accessed August 5, 2025)
[252] Hydrogen blending project now operational, reducing carbon footprint of natural gas delivered by Enbridge Gas (Accessed August 6, 2025)
[253] ThermHYDROGEN - Hydrogen Blending Project (Accessed August 6, 2025)

			of blending hydrogen with natural gas.					
Natural gas blending	ATCO/AltaGas – Fort Saskatchewan[254]	Blending in natural gas lines	Using 5% hydrogen into homes' gas supply; Canada's first residential hydrogen blend project in Alberta	5% hydrogen blended into natural gas grid	Natural gas	Blended gas (Green hydrogen + natural gas)	Execute	Alberta, 2022
Energy generation	JERA Hekinan Boiler Pilot[255]	Electricity	Coal boiler co-fired with 20% ammonia	Modified burners & ammonia feed system	Coal	Green ammonia (20%)	Execute	Japan, 2024
Energy generation	Amazon Web Services[256]	Electricity	Amazon Web Services started transitioning to HVO, also called RD, to power backup generators at its data-center sites in Europe, with sites in Ireland and Sweden among the first to make the switch.	Drop-in RD compatible with existing gensets	Diesel	RD (HVO)	Execute	Ireland, Sweden, 2023
Natural gas blending	20HyGrid project[257]	Blending in natural gas lines	The firm tested the technical feasibility of supplying homes with a mixture of natural gas (80%) and hydrogen (20%) through the existing natural gas infrastructure	30 – 35% hydrogen blended into natural gas lines	Natural gas	Blended gas (Green hydrogen + natural gas)	Plan	Romania, 2024
Energy generation	Mitsubishi Power[258]	Blending in natural gas lines	The demonstration verified the achievement of the same low nitrogen oxide (NOx) emissions and stable combustion during hydrogen co-firing, and that switching fuels from natural gas to hydrogen fuel blending is possible during partial-load and full-load	J-series JAC gas turbine with hydrogen blend capability	Natural gas	Green hydrogen (30%)	Plan	Japan, 2023

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[254] fort Saskatchewan hydrogen blending project (Accessed August 6, 2025)
[255] Successful Demonstration Test of Ammonia Firing Conducted at Commercial Power Station (Accessed August 6, 2025)
[256] Amazon Web Services transitions to renewable diesel for backup generators at data centers in Europe (Accessed August 6, 2025)
[257] Romania successfully tests blending hydrogen in natural gas distribution grid, households (Accessed August 6, 2025)
[258] Mitsubishi Power completes 30% hydrogen co-firing demo using grid-connected gas turbine (Accessed August 6, 2025)

Energy generation	IHI / PLN Gresik Pilot[259]	Mobility fuel	Southeast Asia's first ammonia co-firing trial at a gas-fired steam boiler	Burner retrofits for ammonia injection	Natural gas	Green ammonia blend	Pilot	Indonesia, 2022

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[259] IHI Initiates Southeast Asia's First Ammonia Co-Firing Pilot Facility at Operational Power Plant with View to Swift Commercialization Across Region (Accessed August 6, 2025)

8.2 Literature review of policy levers

Federal level policy levers: Canada

Table 70: Federal level policy levers in Canada[260]

Mechanism	Title	Description and requirements
Investment tax credits	**ITC for CCUS**	37.5% to 60% credit on carbon capture, transport, and storage equipment.
Investment tax credits	**Clean Technology Manufacturing ITC**	Up to 30% credit for machinery manufacturing technologies, including electrolyzers.
Investment tax credits	**Clean Technology ITC**	Up to 30% credit of the cost of clean technology property that is acquired and becomes available for use from March 28,2023 to December 31, 2034. May be up to 15% for property acquired and becomes available for use in 2034.
Investment tax credits	**Clean Hydrogen ITC**	A refundable tax credit for hydrogen production projects using electrolysis, natural gas with reduced emissions through CCUS, and conversion of clean hydrogen into ammonia. Available to businesses that invest in properties that produce hydrogen, particularly those using eligible pathways like water electrolysis and natural gas reforming with carbon capture. The oxygen production equipment used to produce hydrogen will also be eligible where the resulting CO_2 is captured by a CCUS method.
Regulatory framework	**Federal Fuels Charge Rate**	Charge rates for fuel types and combustible waste based on global warming and emission factors by Environment and Climate Change Canada.
Regulatory framework	**CFR**	Incentives for clean fuel development requiring liquid fossil fuel suppliers to reduce CI. The government announced in September 2025 the launch of a new $370 million biofuel production incentive and additional support measures for Canada's canola and agriculture producers. This includes amending CFR, temporarily raising the interest-free Advance Payments Program limit for canola to $500,000 and increasing AgriMarketing Program funding to help diversify into new markets.
Regulatory framework	**Large Emitter Pricing Systems (LETS)**	LETS focuses on emissions-intensive and trade-exposed sectors, pricing emissions associated with a firm's output rather than its inputs. Firms exceeding emissions intensity thresholds must buy credits, while those below can sell credits. Stricter thresholds are crucial to maintaining the effectiveness of LETS.
Regulatory framework	**Carbon Pollution Pricing**	All jurisdictions have had a price on carbon since 2019. The federal benchmark has an increasing price on carbon pollution of up to $170 per tonne of CO2-equivalent by 2030.
Strategic finance	**CGF**	Accelerates commercialization of energy transition technologies. The CGF's mandate directs the Fund to align with Canada's economic plan and prioritize transactions in clean technology sectors, including blue and green hydrogen.
Strategic finance	**CHRI**	Funding for public charging and hydrogen refueling infrastructure delivered by the private sector, with eligible project costs of at least $20 million (CAD). Funding includes infrastructure operation and maintenance support.
Strategic finance	**National Research Council Canada Innovation Corporation**	Supports Canadian companies in developing and deploying sustainable technologies through funding for development and demonstration, fostering collaboration across sectors, and promoting the adoption of new technologies in Canada's key economic sectors.

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[260] Alberta Hydrogen Analysis 2025 (Accessed August 13, 2025); Active as of December 2024.

		Eligible applicants are Canadian companies with a defined project with a strong end-user value proposition, potential to attract consortia partners for market validation, and demonstrate environmental and economic benefits for Canadians.
Strategic finance	**Carbon Contracts for Difference**	A first of its kind carbon credit offtake agreement with Entropy Inc, a Calgary based carbon capture and sequestration company. The support depends on the market price of carbon: • If it is lower, the entity offering the carbon contract for difference pays the difference to the company. If it is higher, the company could provide the difference of the sale of its credits back to the entity offering the carbon contract for difference allowing profits to be shared between both parties.
Strategic finance	**Output-Based Pricing System Proceeds Fund: Decarbonization Incentive Fund (DIF)**	A merit-based program which aims to incentivize decarbonization in industrial sectors and support GHG emissions reduction goals. Eligible provinces include Manitoba, Ontario, and New Brunswick. Applicants must be incorporated or registered in Canada, operate eligible facilities covered under the OBPS in the eligible provinces, and demonstrate authority over the facility. The program supports single or multi-year projects and provides financial assistance to accelerate the deployment of commercially available and proven low-carbon technologies.
Strategic finance	**FEED Capital Initiative; Project Finance**	$500 million committed to Project Acceleration Funding (FEED capital draws from this pool); $5 billion allocated to Green Infrastructure (SAF project finance draws from this pool; inclusive is the $500MM announced for biofuels support as part of the 2024 budget). Available to all energy transition sectors (including low carbon fuels) FEED Capital Initiative - Minimum Project Eligibility Conditions: Must be physically located in Canada; Have completed Pre-FEED / Feasibility Study (FEL 2 and Class 4 estimate) and ready to enter FEED; Entering the commercial development stage with Technology Readiness Level (TRL) of 8 or above; Clear financing strategy through FID with equity funding already in place for FEED. Project Finance: Project capex of $200+ million. Minimum CIB investment size of $100 million (net of other government funding) Private capital / equity investment already in place.
Strategic finance	**Low Carbon Fuel Procurement Program (LCFPP)**	Financial support for federal air and marine operations. The primary objectives of the LCFPP are to i) reduce GHG emissions from the federal air and marine fleets by providing funding to help offset the extra costs of purchasing low-CI liquid fuels (e.g. SAF, RD, biodiesel) and ii) stimulate market demand and development for low carbon aviation and marine fuels in Canada through federal leadership and procurement. In Budget 2024, the government expanded the mandate of the LCFPP include the procurement of carbon dioxide removal (CDR) services.
Targeted programming	**Federal CFF**	Funding for new or expanded clean fuel production facilities that demonstrate technical and financial feasibility, GHG reduction potential, market contribution, and alignment with national climate goals. Eligible applicants include legal entities incorporated or registered in Canada, such as not-for-profit and for-profit organizations, utilities, and private sector companies. The fund also supports the development and adoption of codes and standards across the clean fuels value chain, ensuring regulatory compliance, market access, and safety.
Targeted programming	**Green Freight Program**	Program to reduce fuel consumption and GHG emissions in MHDV fleets through energy assessments, retrofits, engine repowers, best practices, and low-carbon vehicle purchases.
Targeted programming	**ZEV Infrastructure Program**	Funding for electric vehicle chargers and hydrogen refueling stations across Canada, covering production, storage, transportation, operation, and maintenance, as well as their end-use in vehicles.

Targeted programming	**Incentives for Medium- and Heavy- Duty Zero-Emission Vehicles Program (iMHZEV)**	Point-of-sale incentives for Canadian organizations and businesses buying or leasing eligible medium-and heavy-duty zero-emission vehicles.
Targeted programming	**SIF**	Supports projects (at least $20 million CAD) that promote decarbonization of large emitters, clean technology and Industrial transformation and development of a Canadian battery ecosystem. Projects should have a large and positive environmental impact and address GHG abatement in Canada.
Targeted programming	**Net-Zero Accelerator**	Supports projects that contribute to the achievement of GHG reduction targets across three main investment pillars: Decarbonization of large emitters, industrial transformation and clean technology and battery ecosystem development.
Targeted programming	**EIP - Clean Fuels and Industrial Fuel Switching**	Industrial fuel switching, clean fuels production, and hydrogen codes and standards to support Canada's commitment to a low-carbon economy.
Targeted programming	**Low Carbon Economy Challenge (LCEC)**	Provides funding to a wide range of applicants to support the deployment of proven, low-carbon technologies that will result in material GHG emissions across sectors. Eligible applicants include federal, provincial, territorial, municipal governments, Indigenous communities, and the private sector.
Targeted programming	**Various Support for Feedstocks**	Agriculture and Agri-Food Canada supports the Canadian agriculture and agri-food sector through initiatives that promote innovation and competitiveness. The following are some of the programs that may indirectly support feedstocks that could be used for SAF: AgriInnovate Program AgriScience Program – Projects Canadian Agricultural Strategic Priorities Program Agricultural Climate Solutions Program (closed to applications).

Federal level policy levers: EU

Table 71: Federal level policy levers in the EU[261]

Mechanism	Title	Description and requirements
Regulatory framework	**Renewable Energy Directive (RED) III**	• RED III is the EU's framework designed to promote renewable energy across its member states. It establishes binding targets to increase the share of renewable energy in the EU's energy mix, with a particular focus on RFNBO. • Mandated volume of clean H2 use in industry, starting at 42.5% in 2030, and increasing to 60% by 2035, accompanied by penalties for Non-Compliance
Regulatory framework	**EU Emissions Trading Scheme (ETS) and Carbon Border Adjustment Mechanism (CBAM)**	• The EU Emissions Trading System (EU ETS) is a cap-and-trade system to reduce GHG emissions, while the Carbon Border Adjustment Mechanism (CBAM) imposes a carbon price on imports to prevent carbon leakage and ensure fair competition. • Carbon prices expected to reach approx. 100 to 135 €/tonne CO2 by 2030 as free allowances phase out (from a 2024 range of ~55-75 €/tCO2)
Regulatory framework	**REFuelEU (Aviation, Maritime)**	• Sets mandatory minimum shares for SAF • **2%** share of SAF in EU airports from 2025 • **70%** share of SAF in all EU airports from 2050 • **1.2%** share of synthetic aviation fuels in all EU airports from 2030 • **35%** share of synthetic aviation fuels in all EU airports form 2050 • RFNBO target starting in 2034 if the RFNBO share in 2030 is below 1%.
Regulatory framework	**Global Solidarity Levies Task Force (GSLTF)**	• In July 2025, new initiative under the **Global Solidarity Levies Task Force (GSLTF)** to impose levies on premium airline tickets and private jet travel. The proposed levies aim to raise approximately **€78 billion** annually to fund global climate resilience and just transition efforts. The measure will be further advanced at COP30, with implementation expected to begin in 2026.
Regulatory framework	**Duurzame Luchtvaarttafel (DLT)**	• Formulate the Akkoord Duurzame Luchtvaart. This agreement included, among other commitments, targets for emission reduction within commercial aviation: reducing CO2 emissions by 2030 to the levels of 2005, cutting emissions by 50% by 2050, and achieving zero CO2 emissions by 2070. The DLT also established the working group Duurzame Brandstoffen (WDB), which initially set the direction for the development of SAF in the Netherlands through its WDB Action Programme

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[261] Alberta Hydrogen Analysis 2025 (Accessed August 13, 2025); Active as of December 2024.

Strategic finance	**Important Projects of Common European Interest (IPCEI)**	• In February 2024, the EU Commission approved €4.6bn in funding for 23 hydrogen projects as part of the IPCEI. This funding supports key elements of the hydrogen value chain, including production, storage, transport infrastructure, and its use in industries such as steel and chemicals.
Strategic finance	**ETS Zero Rating, FEETS, and the EU Innovation Fund**	• To support airlines grappling with higher costs for SAF, two measures have been introduced under the EU Emission Trading System (ETS). Firstly, a "zero rating" has been established within the ETS for SAF, meaning airlines are exempt from purchasing emission allowances for emissions from SAF, irrespective of the emission reductions achieved. • Additionally, under Fuels Eligible for ETS (FEETS), 20 million EU-ETS allowances are allocated to airlines for purchasing SAF, providing €1.6 billion1 in support between 2024 and 2030. Airlines can apply for financial assistance based on SAF acquired from 1 January 2024 for flights within the EU and refuelled at European airports from which they operate. Only SAF meeting specific criteria qualifies for support under the EU-ETS SAF allowance programme • European Innovation Fund allows EU-ETS funds to be requested for establishing large-scale energy projects. The aviation sector is eligible for funding from the EU-ETS. In the past year, only one grant was awarded to the Aura Aero initiative for electric aviation. Moving forward, it is expected that SAF refining will have a higher likelihood of receiving support.
Targeted programming	**EHB**	• The EHB, managed by the European Commission, is a financing mechanism that uses an auction-based system to provide fixed-price premiums across the clean hydrogen supply chain, **including infrastructure for ammonia/hydrogen import terminals.**
Targeted programming	**REPowerEU**	• A strategy developed in response to the energy crisis exacerbated by geopolitical tensions (like the Russia-Ukraine conflict), with the goal of reducing the EU's reliance on Russian fossil fuels.
Targeted programming	**Clean Hydrogen Partnership**	• Joint public-private partnership supported by the EU Commission.
Targeted programming	**European Clean Hydrogen Alliance**	• Alliance to deploy hydrogen technologies by bringing together renewable and low-carbon hydrogen production, demand in industry, transport and other sectors, and hydrogen transmission and distribution.
Targeted programming	**Hydrogen Public Funding Compass**	• Online guide for stakeholders to identify public funding sources for hydrogen projects. • Provides information on all relevant EU programs and funds for 2021-2027.
Targeted programming	**The Hydrogen Acceleration Act (2023)**	• In Germany, this program focuses on streamlining permitting and approval processes to accelerate the development of hydrogen infrastructure projects, including production plants, import terminals, storage facilities, and transport networks.

Federal level policy levers: US

Table 72: Federal level policy levers in the US[262]

Mechanism	Title	Description and requirements
Investment tax credits	**IRC Section 45V Clean Hydrogen Production Credit**	A program that aims to promote clean hydrogen production by providing financial support to eligible projects. The tax credit is based on the CI of the hydrogen production pathway, with a maximum limit of four kilograms of CO_2-equivalent per kilogram of hydrogen and is provided in four tiers based on CI and compliance with prevailing wage and apprenticeship requirements.
	IRC Section 45Q	Allows taxpayers to claim a federal income tax credit for capturing and disposing of qualified carbon oxides emitted from a qualified facility over a 12-year period. The captured CO_2 must be securely stored underground or used for specific purposes such as Enhanced Oil Recovery, Enhanced Gas Recovery, or certain chemical processes. Construction of the qualified facility must have started prior to January 1, 2024, and carbon capture equipment must be in place to capture and separate CO_2 from emissions.
	IRC Section 45Z	Allows taxpayers to claim a federal income tax credit for producing and selling transportation fuel from a qualified facility. The credit amount is determined based on the applicable amount per gallon and the emissions factor of the fuel. The requirements include producing the fuel at a qualified facility, selling it in a specified manner, and meeting emissions rate criteria.
	Alternative Fuel Excise Tax Credit	A tax incentive available for alternative fuels used as a motor vehicle fuel. Entities eligible for the credit must be liable for reporting and paying federal excise tax on the fuel, and tax-exempt entities dispensing qualified fuel from on-site stations also qualify. The credit is first applied to the entity's alternative fuel tax liability, with any excess potentially claimed as a direct payment from the IRS.
	Alternative Fuel Tax Exemption	Alternative fuels used in a manner deemed non-taxable by the IRS are exempt from federal fuel taxes. Common non-taxable uses include farming purposes, intercity and local buses, school buses, non-profit educational organizations, and state or political subdivision use. Tax-exempt entities not liable for excise taxes on transportation fuel are not eligible for this exemption.
	Commercial EV and FCEV Tax Credit	A tax credit available to businesses and tax-exempt organizations for the purchase of new EVs and FCEVs. Vehicles with a gross vehicle weight rating (GVWR) below 14,000 pounds (lbs.) must have a battery capacity of at least seven kilowatt-hours (kWh) and vehicles with a GVWR above 14,000 lbs. must have a battery capacity of at least 15 kWh.
	EV FCEV Tax Credit	Taxpayers who purchase an eligible vehicle may qualify for a tax credit of up to $7,500 (USD). Additional requirements available depending on when the vehicle is purchased or placed in service.
Strategic finance	**Regional Clean Hydrogen Hubs Program (H2Hubs)**	A program that aims to establish networks of hydrogen producers, consumers, and infrastructure. Projects seeking funding must demonstrate the production, processing, delivery, storage, and end-use of clean hydrogen.

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[262] Alberta Hydrogen Analysis 2025 (Accessed August 13, 2025); Active as of December 2024.

	Environmental Justice Community Technical Assistance Program	An assistance opportunity that provides customized, high quality technical assistance to selected communities to develop clean energy related economic development pathways. Specifically open to low-income, energy-burdened communities that are also experiencing either direct environmental justice impacts, or direct economic impacts from a shift away from historical reliance on fossil fuels.
	Innovative Research and Development Competitive Prizes	A series of prize competitions designed to incentivize innovation and reestablish American leadership in the energy marketplace. These challenges aim to lower barriers for US-based innovators by accelerating learning cycles and fostering partnerships with the private sector and DOE's National Laboratories. The challenges bring together top research institutions, fabrication facilities, energy incubators, and national laboratories to support entrepreneurs in developing innovative solutions and products.
	Energy Efficiency and Conservation Block Grant Program	A grant program designed to assist states, local governments, and First Nations. in implementing strategies to reduce energy use, to reduce fossil fuel emissions, and to improve energy efficiency. Eligible uses of funds include the development and implementation of energy efficiency and conservation strategies, promoting energy-efficient transportation measures, adopting energy distribution technologies, promoting material conservation programs, implementing onsite renewable energy technologies, and financing energy efficiency, renewable energy, and zero-emission transportation projects and more.
Targeted programing	**reight Efficiency and Zero-Emission Vehicle Infrastructure Grants**	Provides financial assistance to eligible transportation infrastructure projects that address climate change and environmental justice impacts. Eligible projects may include developing zero-emission vehicle infrastructure, using one or more demand management strategies to reduce congestion and GHG emissions, and supporting the installation of electric vehicle charging stations along the National Highways System. Eligible applicants include states, metropolitan planning organizations that serve urbanized areas with a population of more than 200,000 individuals, local governments, political subdivisions, port authorities, and First Nations governments
	Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT)	Discretionary grant program to provide funding for projects that improve resilience of the surface transportation system through support of planning activities, resilience improvements, community resilience and evacuation routes, and at-risk costal infrastructure. Eligible projects include those that demonstrate GHG reductions in transportation sector through transition to clean vehicles and fuels, including electrification.
	AFV Research and Development Grants	Funds available for the R&D of commercial innovations related to electric vehicle charging infrastructure, including hydrogen and fuel cell vehicle technologies.
	Carbon Reduction Program (CRP)	Provides funds for projects aimed at reducing transportation emissions, specifically CO_2 emissions from on-road highway sources. Eligible projects include various initiatives such as traffic management systems, public transportation projects, deployment, port electrification, and more. States are required to develop a carbon reduction strategy and update it every four years to support emission reduction efforts.
	Clean School Bus Program	Offers funding for the replacement of existing school buses with clean, alternative fuel school buses or zero-emission school buses. The program covers up to 100% of the cost of the replacement bus, charging equipment, or fueling infrastructure. Alternative fuels such as electricity, natural gas, hydrogen, or propane are eligible. Priority for funding is given to high-need local education agencies, low-income, rural, and First Nations schools, and applications that involve cost sharing through public-private partnerships, grants, or school bonds.

Title 17 Clean Energy Financing – Innovative Energy and Innovative Supply Chain	Loan Program Office can finance projects that deploy new or significantly improved high-impact clean energy technology (Innovative Energy) or that employ new or significantly improved technology in the manufacturing process for a qualifying clean energy technology or manufacture innovative products with an eligible technology end-use (Innovative Supply Chain).
Title 17 Clean Energy Financing – Energy Infrastructure Reinvestment	Offers financing for projects that retool, repower, repurpose, or replace energy infrastructure that has ceased operations or to reduce GHG emissions. Eligible projects include upgrading, replacing, or building energy infrastructure for clean energy purposes and addressing environmental damage from legacy infrastructure.
The Energy Improvements in Rural or Remote Areas (ERA) program	Offers funding to community-driven energy projects that demonstrate new energy systems, deliver measurable benefits, and build clean energy knowledge and capacity in rural America. Eligible uses include improving energy generation, transmission, and distribution systems, reducing GHG emissions, modernizing electric generation facilities, developing microgrids, and increasing energy efficiency.
Powering Affordable Clean Energy (PACE)	PACE provides financial support to renewable energy projects in rural America that use technologies such as wind, solar, hydropower, geothermal, biomass, and energy storage. Eligible applicants include corporations, municipalities, cooperatives, nonprofits, First Nations, and more. Projects must be financially and technically feasible, reliable, affordable, and completed within the allotted timeframe.
Smart Grid Grants	Provides financing for projects focused on enhancing the electric power system's flexibility, efficiency, and reliability by increasing transmission capacity, preventing faults, integrating renewable energy, and facilitating the integration of electrified vehicles and buildings. It is open to domestic entities, including educational institutions, for-profit and non-profit entities, and state/local governmental entities.
Charging and Fueling Infrastructure Discretionary Grant Program (CFI Program)	This program aims to provide accessible and sustainable infrastructure for electric, hydrogen, propane, and natural gas vehicles. It offers two funding categories: Community Charging and Alternative Fueling Grants (Community Program) and Charging and Alternative Fuel Corridor Grants (Corridor Program). Eligible applicants include states, local governments, First Nations, and other organizations. The program prioritizes deploying infrastructure in underserved and disadvantaged communities.
Advanced Technology Vehicles Manufacturing (ATVM) Loan Program	This program provides loans to support the manufacture of eligible vehicles and qualifying components. It aims to finance auto manufacturing projects that contribute to the production of advanced technology vehicles. To be eligible for an ATVM loan, projects must manufacture eligible vehicles or components, be in the United States and provide a reasonable prospect of repayment. Formal application steps include application intake, preliminary due diligence, advanced due diligence and term sheet negotiation, credit approval, loan closing, and execution of the loan guarantee agreement.
Community Waste-to-Biofuel Development Grants	Grants available for the development of strategies for communities to sustainably manage and recover clean energy sources from waste streams for transportation end-uses. Eligible projects include feasibility studies, design work, and experimental validation for renewable natural gas, hydrogen, or other waste-derived fuel. Eligible prime applicants include non-profit organizations; transit authorities; and state, local, and First Nations governments.
Congestion Mitigation and Air Quality (CMAQ) Improvement Program	Funding to state departments of transportation (DOTs), local governments, and transit agencies for projects and programs that help reduce mobile source emissions and regional congestion on transportation networks. Eligible activities include alternative fuel vehicles and infrastructure, and medium- or heavy-duty zero emission vehicles and related charging equipment. Projects must demonstrate emissions reductions, be in, or benefit a US EPA-designated nonattainment or maintenance area and be a transportation project.

EV and FCEV Manufacturing Loans	Funding for the domestic production of hybrid, plug-in electric hybrid, plug-in electric drive, and hydrogen fuel cell electric vehicles and components. A minimum 50% non-federal cost share is required. Funding will prioritize projects that address the conversion of manufacturing facilities that have recently ceased operation or will cease operation in near future.
Hydrogen Shot – Part of the Energy Earthshots initiative	This program aims to reduce the cost of clean hydrogen by 80% to $1 (USD) per kilogram within a decade. It funds hydrogen demonstration projects that can help lower the cost of hydrogen, reduce carbon emissions and local air pollution, create good-paying jobs, and provide benefits to disadvantaged communities. Hydrogen Shot focuses on various projects that bridge technical gaps in hydrogen production, storage, and distribution and utilization technologies, including fuel cells
Hydrogen FCEV and Equipment Infrastructure Research and Deployment Grants	Grants for research, development, and demonstration of clean-hydrogen technologies. Eligible projects can focus on components for and standardization of hydrogen fueling stations and port equipment. Applicants must include community benefits plan that addresses diversity, equity, inclusion, and accessibility. Eligible applicants include higher education institutions, for-profit and non-profit organizations, and state, local, and First Nations governments.
Low or Zero Emission Ferry Program	Provides competitive funding for projects that aim to support the purchase of electric or low-emitting ferries and the electrification or emission reduction of existing ferries. Eligible recipients include designated or direct recipients of FTA's Urbanized Area Formula Program or Formula Grants for Rural Areas. Capital projects that involve the purchase of electric or low-emitting ferry vessels and related charging infrastructure, which reduce emissions or produce zero onboard emissions, are eligible. The use of alternative fuels such as methanol, ethanol, natural gas, hydrogen, electricity, and other non-petroleum fuels is also allowed.
National Multimodal Cooperative Freight Research Program	A national cooperative freight transportation research program, administered in collaboration with the National Academy of Sciences (NAS). NAS established an advisory committee to recommend a national research agenda on improvements in the efficiency and resiliency of freight movement, including adapting to future trends such as zero emissions transportation. NAS may award research contracts or grants under the Program.
Clean Ports Program	Aims to support the deployment of zero-emission port equipment and infrastructure, as well as climate and air quality planning at US ports. The program seeks to reduce diesel pollution in near-port communities, promote community engagement and emissions reduction planning as standard practices in the port industry, and transition ports to fully zero-emissions operations over time. The program includes two separate funding opportunities - the Zero-Emission Technology Deployment Competition and the Climate and Air Quality Planning Competition.
Port Infrastructure Development Program (PIDP)	Provides discretionary funding to projects that enhance the safety, efficiency, and reliability of goods movement within ports. Supports port and freight infrastructure improvements to meet nation's transportation needs and accommodate anticipated growth in freight volumes. Offers funding for planning and capital projects in both urban and rural areas, with a specific set-aside for small ports to enhance capacity for efficient freight movement and support local and regional economies.
First Nations and Territory Grants: Diesel Emissions Reduction Act	Provides funding for eligible diesel emissions reduction solutions for federally recognized First Nations governments, Alaska Native Villages, and territory government agencies with jurisdiction over transportation or air quality. Eligible uses of funding include retrofit technologies, aerodynamic technologies, engine replacements and conversions, and vehicle or equipment replacements for various diesel vehicles, engines, and equipment.

Other international policy levers

Table 73: Other international policy levers[263]

Mechanism	Title	Description and requirements
Regulatory framework	**ICAO Long-Term Aspirational Goal Net-Zero 2050**	• In 2022, ICAO adopted the Long-Term Aspirational Goal (LTAG), a long-term objective aimed at supporting the Paris Agreement (UNFCCC) to achieve "net-zero" emissions by 2050. Additionally, during the ICAO Conference on Aviation Alternative Fuels (CAAF)/32 in 2023, an ambition was declared to reduce CO_2 emissions in international aviation by 5% by 2030. The focus is on increasing the use and production of SAF and low-carbon aviation fuels (LCAF). Even though the LTAG and CAAF/3 are non-binding, they serve as guidelines for states to implement national policy measures
Regulatory framework	**IMO Net-Zero Framework**	• A landmark global carbon pricing mechanism expected to start in 2028, placing a US $100 per tonne CO_2e levy on ships above 5,000 gross tonnage, with revenues funding climate resilience initiatives in developing nations • Supporting mechanisms: In parallel, the IMO is exploring complementary strategies, including fuel standards and carbon pricing tools designed to favor cleaner fuels like ammonia and hydrogen
Regulatory framework	**The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)**	• Offers a financial incentive for airlines

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[263] Alberta Hydrogen Analysis 2025 (Accessed August 13, 2025); Active as of December 2024.

Provincial and municipal policy levers in Canada

Table 74: Provincial and municipal policy levers in Canada[264]

Mechanism	Title	Description and requirements
Targeted Program	**BC LCFS**	• Supply side market transformation policy incentivizing the supply of low carbon and/or renewable transportation fuels into BC and disincentivizing the supply of fossil derived fuel. • Volumetric renewable content requirements for jet fuel supplied to BC (starting at 1% in 2028, and increasing 1% annually to 3% in 2030) • Low carbon requirements for jet fuel. Sets target CIs for jet fuels, suppliers of fuel greater than the target will incur debits, those supplying fuel below the target CI will generate credits. • Initiative agreements: competitive, performance based, program to award credits for initiatives that will increase the supply of low carbon fuel or renewable fuel to BC. Not limited to infrastructure or capital expenditures.
Urban planning and permitting	**Prince George**	• Prince George completed a permitting case study that outlines the development and approval process for hydrogen or ammonia production facilities. While focused on production, the same exercise could be applied to end-use infrastructure (e.g., hydrogen fueling stations).
Urban planning and permitting	**Edmonton**	• The city is adopting hydrogen-powered vehicles in its fleet, which in turn has spurred the rollout of hydrogen fueling infrastructure that can benefit other potential users.
Urban planning and permitting	**Mississauga**	• The city has introduced hydrogen buses as part of its zero-emission transit program, supporting the development of a hydrogen hub.

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[264] Alberta Hydrogen Analysis 2025 (Accessed August 13, 2025); Active as of December 2024.

8.3 Reference data used in detailed excel analysis

Table 75: Reference data used in the detailed excel analysis

Fuel	Category	Unit type	Unit	Energy density (MJ/unit)	LCI (gCO2e/MJ)	Commodity cost (CAD/unit)
Renewable Diesel	Clean fuel	Liquid	Liter	34.4[265]	33[266]	1.80[267]
Gasoline	Incumbent fuel	Liquid	Liter	34.7[268]	101[266]	1.60 [269]
Jet-A	Incumbent fuel	Liquid	Liter	34.7[270]	89[271]	2.99[272]
Kerosene	Incumbent fuel	Liquid	Liter	35.8[273]	73.5[266]	1.51[269]
Diesel	Incumbent fuel	Liquid	Liter	35.8[274]	105[266]	1.50[275]
Natural gas	Incumbent fuel	Gas	Liter	0.0403[276]	56[266]	0.00044[277]
Hydrogen	Clean fuel	Gas	Kg	120[276]	17[278]	14.70[279]
Ammonia	Clean fuel	Gas	Kg	20.0[280]	2.5[281]	1.16[282]
Coal	Incumbent fuel	Solid	Kg	28.0[283]	100[284]	0.19[285]
Heating Oil	Incumbent fuel	Liquid	Liter	35.8[286]	80[284]	1.16[287]

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[265] U.S. DOE Fuel Properties Comparison (Accessed November 8, 2025)

[266] U.S. Energy Information Administration Carbon Dioxide Emissions Coefficients (Accessed November 8, 2025)

[267] Estimated as the price of diesel plus $0.39/L, based on 2021 biofuels report commissioned by the Government of the Northwest Territories. (Accessed November 8, 2025)

[268] Government of Canada Clean Fuel Regulations (Accessed November 8, 2025)

[269] Petro-Canada West Nova Fuels The Federal Fuel Charge (Accessed November 8, 2025)

[270] DOE Bioenergy Technologies Office (BETO) 2021 Project Peer Review Novel Method for Biomass Conversion to Renewable Jet Fuel Blend (Accessed November 8, 2025)

[271] Corsia Handbook January 2024 (Accessed November 8, 2025)

[272] Celtic Air Services Fuel Prices (Accessed November 8, 2025)

[273] Neutrium Specific Energy and Energy Density of Fuels (Accessed November 8, 2025)

[274] Thermal Engineering Diesel Fuel | Energy Density, Uses in Transportation (Accessed November 8, 205)

[275] Nova Scotia average price, captured on September 18, 2025.

[276] The Engineering ToolBox Fossil vs. Alternative Fuels (Accessed November 8, 2025)

[277] Eastward Energy Rates for Business (Accessed November 8, 2025)

[278] Carbon Intensity of Hydrogen Production Methods March 2023 (Accessed November 8, 2025)

[279] HTEC FAQs – How much does hydrogen cost? (Accessed November 8, 2025)

[280] An average density was calculated, considering the range of 18-22 MJ/kg; The Maritime Executive Fuel Comparisons Must Consider Energy Density (Accessed November 8, 2025)

[281] An average coefficient was calculated, considering the coefficient was 0 gCO2e/MJ for green ammonia, and 5 gCO2e/MJ for blue ammonia.

[282] Used the Q2 2025 cost of green ammonia (USD 858/MT) and converted to CAD/kg; Green Ammonia Prices Hold Firm Amid Decarbonization Push – Q2 2025 Insights (Accessed November 8, 2025)

[283] An average density was calculated, considering the range of 23 – 33MJ/unit for bituminous coal (most commonly used in thermal applications); Energy Education Coal Types (Accessed November 8, 2025)

[284] Government of Canada Clean Fuel Regulations Default Carbon Intensity (Accessed November 8, 2025)

[285] An average price per unit was calculated, converted from $160CAD/tonne and $220CAD/tonne; Government of Canada Canadian Centre for Energy Information Coal (Accessed November 8, 2025)

[286] Comparison of Properties of Liquid Fuels from Different Sources (Accessed November 8, 2025)

[287] Discount Fuels (Accessed November 8, 2025)

Heavy Fuel Oil	Incumbent fuel	Liquid	Liter	38.5[286]	92.5[288]	0.20[289]
Liquified Petroleum Gas	Incumbent fuel	Liquid	Liter	46.0[265]	60.6[290]	1.50[291]
Marine Diesel Oil	Incumbent fuel	Liquid	Liter	36.3[286]	74[292]	1.18[293]
Marine Gas Oil	Incumbent fuel	Liquid	Liter	39.0[294]	88.9[295]	0.72[296]
e-Methanol	Clean fuel	Liquid	Liter	15.6[297]	37.5[298]	2.22[299]

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[288] Well-to-Tank Carbon Intensity Variability of Fossil Marine Fuels: A Country-Level Assessment ("Well to Wake" only) (Accessed November 8, 2025)

[289] Based on recent Statistics Canada information, the price per kL is $42.50, translating to approximately $0.04 CAD, but Nova Scotia has a provincial carbon levy of $0.154, which results in the final price of $0.1975; Statistics Canada Report on Energy Supply and Demand in Canada (Accessed November 8, 2025); Fuel Government of Canada Consumption Levies in Canada (Accessed November8, 2025)

[290] Government of Canada Greenhouse Gas Emissions Trend 2012 (Accessed November 8, 2025)

[291] National Joint Council Reimbursement for Business Use for Personal Vehicles (Accessed November 8, 2025)

[292] International Maritime Organization Third IMO GHG Study 2014 (Accessed November 8, 2025)

[293] This price per unit is the YTD average from the Maritime Atlantic Fuel Summary documents (Received September 22, 2025).

[294] Marine Service Noord Volumetric Energy Density of Alternative Marine Fuels (Accessed November 8, 2025)

[295] Life Cycle Assessment of Greenhouse Gas and Criteria Air Pollutant Emissions from Conventional and Biobased Marine Fuels (Accessed November 8, 2025)

[296] This price per unit of $614 USD to CAD was converted using a point in time conversion rate; Oil Monster Halifax Bunker Fuel Price (Accessed November8, 2025)

[297] Methanology My-Methanol (Accessed November 8, 2025)

[298] An average coefficient was calculated and converted to gCO2e/MJ; A New Transportation Energy Review: Methanol Catalytic Synthesis from CO2 Green Hydrogenation (Accessed November 8, 2025)

[299] Based on a point in time exchange rate from USD to CAD and a liquid methanol density of 0.792 kg/L at 20°C (1 metric tonne = 1000 kg), the price range of $800–$2400 USD per tonne converts to approximately $1.11–$3.33 CAD per liter, with an average of $2.22 CAD per liter; Markets & Data Global E-Methanol Market Assessment, By Energy Source (Accessed November 8, 2025)