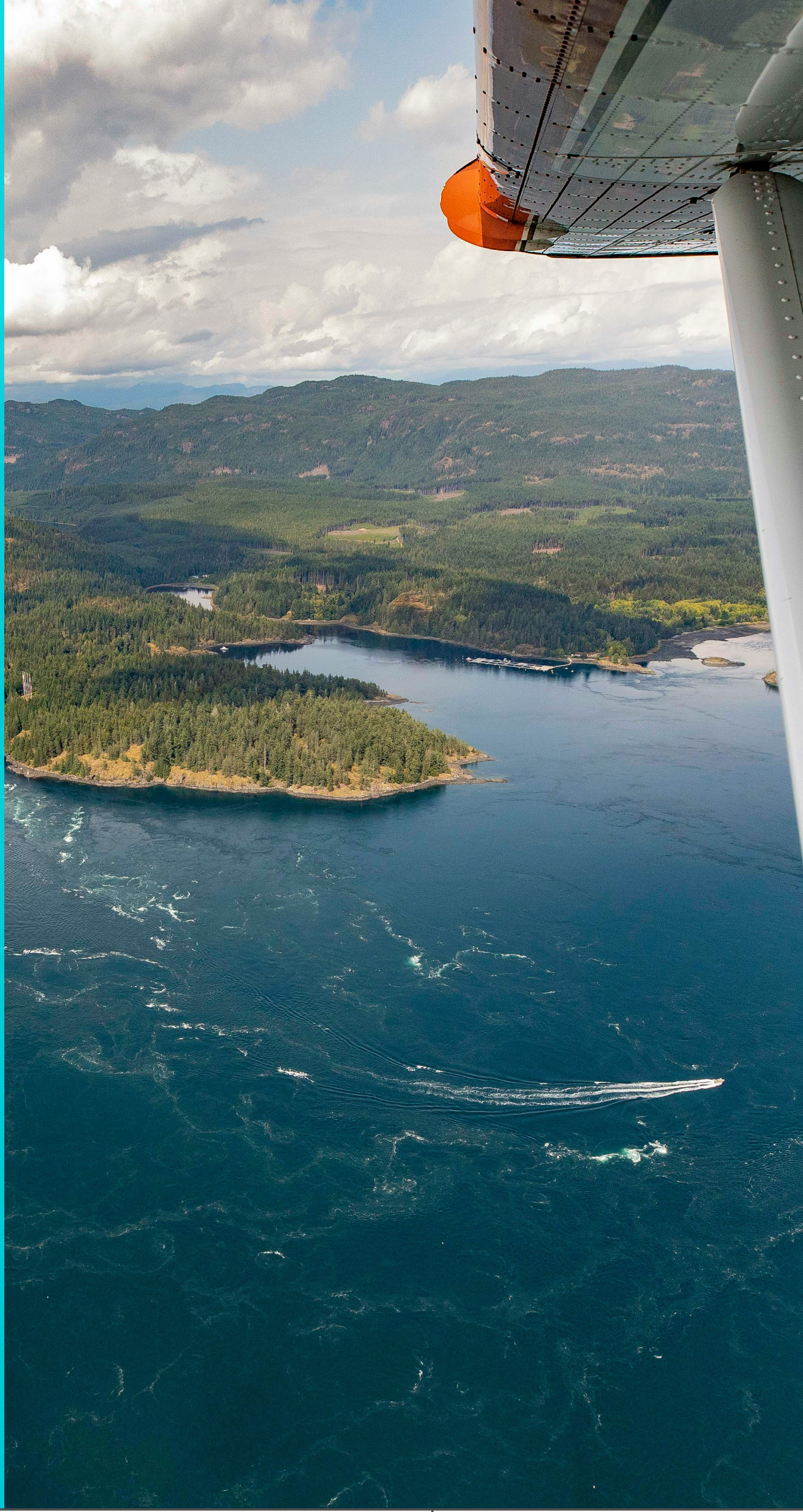
OPPORTUNITY ASSESSMENT

ENVISIONING A VANCOUVER ISLAND HYDROGEN HUB IN 2035



FORESIGHT CANADA

JULY 2025

Acknowledgements

With gratitude and respect, we acknowledge that the lands on which Foresight operates are the traditional, ancestral, and unceded territories of the First Nations, Inuit, and Métis peoples. This study is focused on Vancouver Island, the traditional and unceded territory of 50 First Nations in three distinct tribal regions, Coast Salish, Nuu chah nulth, and Kwakiutl. We are grateful to have hosted the in-person workshop on the unceded territory of the Snuneymuxw, Snaw-naw-as, and Stz'uminus peoples.

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About Foresight

Foresight Canada helps the world do more with less, sustainably. As Canada's largest cleantech innovation and adoption accelerator, we de-risk and simplify public and private sector adoption of the world's best clean technologies to improve productivity, profitability, and economic competitiveness, all while addressing urgent climate challenges.

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Glossary

Term	Definition
Ammonia	A colourless, toxic gas with a pungent odour. Chemical formula is NH_3. Ammonia is commonly used in fertilizer production and its applications for use as a clean fuel is currently being explored.
Battery electric vehicle (BEV)	A zero-emissions vehicle that is powered by electricity from a battery.
Blue hydrogen	Common term used to refer to hydrogen produced from methane through reformation processes, paired with carbon capture, utilization, and storage (see definition of CCUS). The fraction of CO_2 that is captured varies depending on the process.
Carbon capture, utilization, and storage (CCUS)	Refers to a suite of technologies that capture carbon dioxide (CO_2) from point sources or directly from the atmosphere, store it in geological formations, or use it in a variety of applications.
Carbon intensity	A measure of total carbon emissions of something per unit of production or economic activity. For example: for hydrogen, carbon intensity is measured as the mass of CO_2 equivalents emitted per kilogram of hydrogen produced (kg CO_2e/kg H2).
Clean energy transition	The global shift away from fossil fuel-based energy systems to renewable energy systems.
Combustion	A chemical reaction that produces heat and light in the form of a flame (e.g., burning).
Cryogenic tanker	A ship designed to store and transport liquefied gases, such as hydrogen, at very low temperatures.
Decarbonization	The process of reducing the levels of carbon emissions associated with a system or process.
Electrolysis	A process by which electric current is passed through a substance to create a chemical change. When referring to production of hydrogen, electric current is passed through water to produce hydrogen and oxygen.

Term	Definition
Energy carrier	An energy carrier is a transmitter of energy. Includes electricity and heat as well as solid, liquid, and gaseous fuels such as hydrogen.
Fuel cell	A power generation device that uses hydrogen and oxygen as fuel to produce electricity, with water and heat as the only by-products.
Fuel cell electric vehicle (FCEV)	A zero-emissions vehicle that runs on a fuel cell powered by hydrogen.
Green hydrogen	Common term used to refer to hydrogen produced by electrolysis (see definition of electrolysis) using electricity generated from renewable energy sources.
Greenhouse gas (GHG)	Any gas in the Earth's atmosphere that absorbs infrared radiation (heat) emitted from the Earth's surface and reradiates it back, creating the greenhouse effect. Include gases such as carbon dioxide (CO_2), methane, and water vapour.
Hydrogen	The chemical element of atomic number 1. A colourless, odourless, highly flammable gas that can be used as a chemical feedstock or energy carrier.
Hydrogen carrier	A carrier is a molecule containing hydrogen (such as ammonia) that can be easily transported and then broken down to isolate hydrogen for use at its destination.
Low-carbon hydrogen	Common term used to refer to hydrogen produced from methods that produce fewer to no carbon emissions. Includes hydrogen produced by electrolysis, methane reforming with CCUS, and methane pyrolysis (green, blue, and turquoise hydrogen). The Government of Canada categorizes low-carbon hydrogen as that which has a carbon intensity that does not exceed 67.8 gCO_2e/MJ.
Methane pyrolysis	A process to produce hydrogen from natural gas/methane that produces solid carbon as a byproduct instead of CO_2.
Methane reforming	Industrial processes used to produce hydrogen from natural gas. Includes methods such as steam methane reforming (SMR) or auto-thermal reforming (ATR). SMR and ATR produce carbon dioxide as well as hydrogen.

Term	Definition
Methanol	A clear, colourless liquid alcohol. Chemical formula is CH_3OH. Methanol is commonly used as an industrial substance and its applications for use as a clean fuel is currently being explored.
Molecule	Two or more atoms bonded together.
Natural gas	A gaseous, naturally occurring hydrocarbon consisting primarily of methane.
Net zero	A stage where economies emit no greenhouse gas emissions or offset any emissions.
Renewable energy	Energy created from natural processes that are replenished at a rate that is equal to or faster than the rate at which they are consumed. Includes energy generated from solar, wind, geothermal, hydropower, and ocean resources, solid biomass, biogas and liquid biofuels, but biomass is considered renewable only if its rate of use does not exceed its rate of regeneration.
Sustainable Aviation Fuel (SAF)	Sustainable aviation fuel (SAF) is a term that refers to fuels derived from non-fossil sources that have the same approximate composition and energy content but significantly lower life-cycle carbon emissions of conventional jet fuel.
Synthetic fuel	A term used to describe any manufactured fuel that has the approximate composition and similar energy content of a fuel derived from crude oil sources.
Turquoise hydrogen	Common term used to refer to hydrogen produced from methane through pyrolysis (see definition of methane pyrolysis).
Technology Readiness Level (TRL)	A measurement of the maturity of a given technology, from conception to proven commercial stbility, on a scale of 1-9.

Introduction

Hydrogen is a versatile energy carrier that, when produced sustainably, could play an important role in reducing British Columbia's (BC's) greenhouse gas (GHG) emissions. It can be utilized in fuel cells to power vehicles, in industrial processes as a heat source or feedstock, and as a means of storing and transporting energy. However, to realize this potential growth the sector must overcome a key challenge facing hydrogen development in BC: matching supply and demand.

Released in 2021, the BC Hydrogen Strategy highlights a regional hydrogen hub model as a solution to this challenge. [1] By co-locating hydrogen production and end-use applications, these hubs can ensure a balanced market while accelerating the growth of the local economy. This strategic approach can optimize resource utilization and create synergies among different sectors.

As part of the implementation of the BC Hydrogen Strategy, the BC Clean Energy and Major Projects Office (CEMPO) is working with Foresight to examine the potential for hydrogen hub development in the following regions where project development is underway and potential sources of demand exist: The Lower Mainland, Northeast BC, Interior BC (Kootenays and Okanagan), and Vancouver Island.
Vancouver Island has several unique attributes that are advantageous to developing a hydrogen hub:

- **Low-carbon electricity:** BC's renewable hydroelectric power provides a low-carbon pathway for hydrogen production. There are also opportunities for independent renewable power producers on Vancouver Island.
- **End-use applications:** Potential demand-side applications for hydrogen use in the region include trucking, marine and port operations, use in remote communities, and export.
- **Energy security:** There is a strong demand among local communities and First Nations on Vancouver Island to have more local and reliable clean energy sources.

This report is the third in a series of high-level assessments that intend to review regional potential for local supply and demand, and discuss opportunities and challenges associated with hydrogen hub development in the region, over the next decade.

The report is divided into three sections:

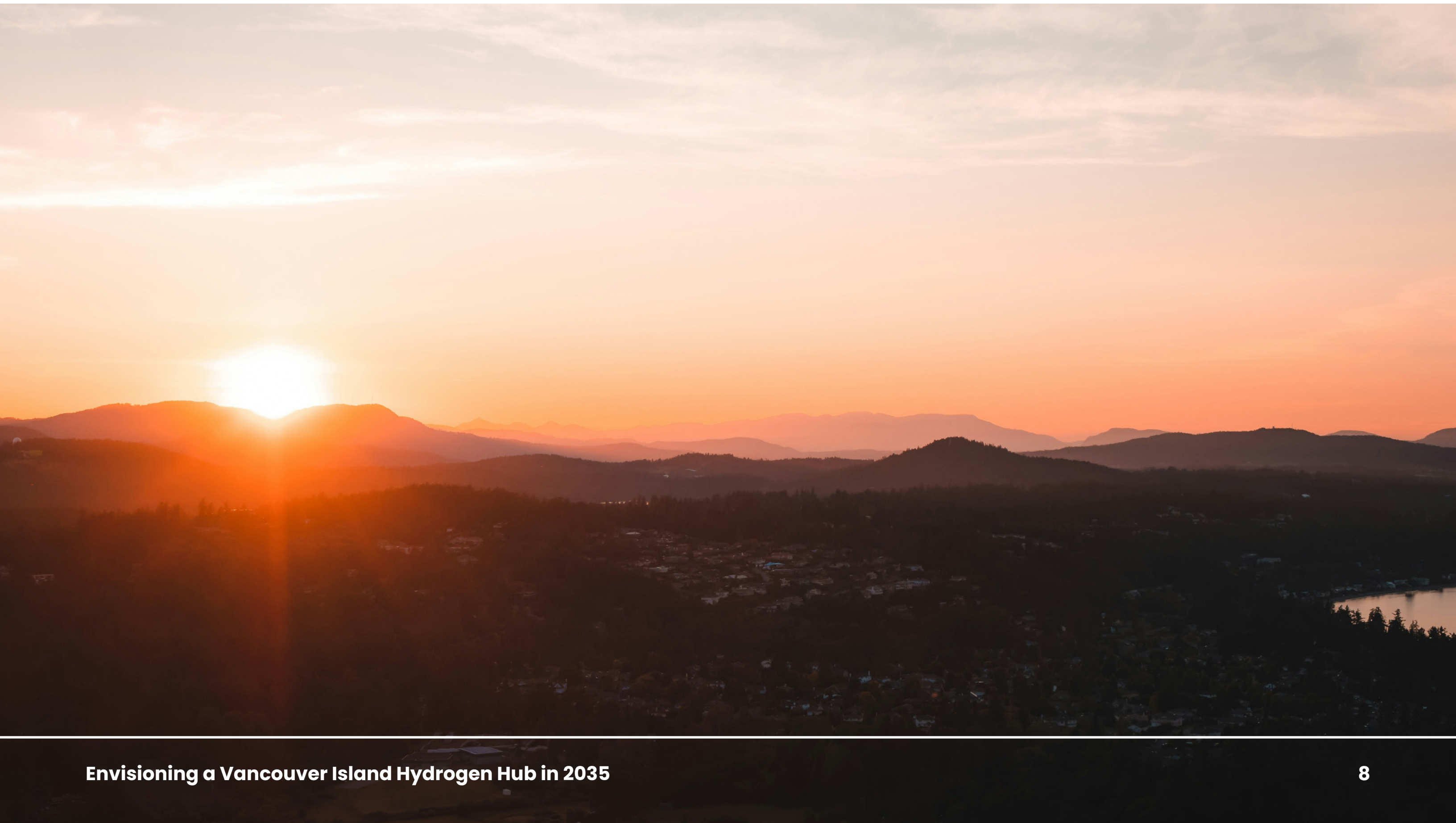
1. **Supply:** This section reviews potential sources of supply in the region, including feedstocks, production methods and locations, and transportation and storage.

2. **Demand:** This section explores the potential sources of hydrogen demand within the region, cost trends, and forecasts for demand growth.

3. **Regional Considerations:** This section assesses the competitive landscape and opportunities for collaboration with neighbouring jurisdictions, as well as workforce considerations.

Each section's insights were collected from a literature review, interviews, and an in-depth workshop hosted in Nanaimo in March 2025, with potential hub partners and local experts. In the case of research or insights that are consistent province-wide, such as hydrogen production methods, this report includes the same information as previous Lower Mainland and Northeast BC reports.

The development of a hydrogen hub on Vancouver Island by 2035 represents an opportunity for the region to fill the emissions reduction gaps that cannot be addressed by direct electrification, thereby accelerating the transition to net zero.



Mapping a 2035 Hydrogen Ecosystem

To provide future decision-makers and project proponents with a visualization of a hydrogen ecosystem in the region, Foresight developed a map marking areas of future supply, demand, and research and development (R&D), as well as key infrastructure.

Supply-Side

On Vancouver Island, hydrogen production is emerging, and many projects are still in the conceptual stage. Key supply-side considerations for the development of a regional hydrogen hub include production methods, locations, and transportation and storage. This section will explore each of these considerations further.

Feedstocks and Production Methods for Low-Carbon Hydrogen

Green Hydrogen

Hydrogen can be produced through a process known as electrolysis, which utilizes electricity to split purified water into its elements: hydrogen and oxygen. Hydrogen produced in this manner is known colloquially as “green” hydrogen when renewable sources of electricity are used as the feedstock (e.g., wind, solar, or hydro). As identified in Table 1, on a provincial scale, electrolysis is projected to produce some of the least carbon-intensive hydrogen thanks to BC’s predominantly hydroelectric grid. This is likely to be the most suitable hydrogen production method for Vancouver Island due to the availability of water and clean electricity. HTEC is planning a green hydrogen production facility in Nanaimo

Green hydrogen production also requires significant electricity, around 50-55kWh/kg of hydrogen. BC Hydro is planning grid expansions to meet increasing demands, and ensuring affordable and reliably available clean power will be a key factor for large-scale green hydrogen projects anywhere in BC.

Blue Hydrogen

The production of "blue" hydrogen involves extracting hydrogen from methane (CH_4) molecules and capturing the resulting CO_2 for either sequestration or utilization. There are two prominent technology pathways used to produce hydrogen: steam methane reforming (SMR) and auto thermal reforming (ATR). SMR is commercially proven and is the primary process through which hydrogen is produced globally. It involves a chemical reaction that uses high temperature steam and methane to yield hydrogen and carbon dioxide (CO_2). ATR is a variation of SMR that has a greater thermal efficiency and involves a simpler production stream where CO_2 is more concentrated in the process gas, making capture easier. When equipped with carbon capture technology, hydrogen produced via either one of these processes is called "blue." While variations using both technologies offer the potential to reach high levels of carbon capture (above 90 per cent) and are therefore considered "low-carbon," they are still at the prototype stage (TRL 5) according to the International Energy Agency.[2] Other blue hydrogen technologies are at TRL 7-9 depending on maturity and deployment (e.g., SMR (partial capture) and CCUS at industrial scale).

Natural gas is transported to Vancouver Island from the Lower Mainland and there are limited clear and technically feasible opportunities for carbon capture, utilization and storage (CCUS). Therefore, this is unlikely to be an economically competitive source of supply for this region. There are studies exploring the potential for offshore carbon storage on Vancouver Island; however, the carbon intensity and cost of the hydrogen production would increase if storage is not located next to production sites.[3,4] Blue hydrogen production is projected to be more suitable in other hubs, such as the Northeast, where there are existing oil and gas upstream operations and greater geologic storage opportunities for CCUS.

Turquoise Hydrogen

Another method of producing hydrogen using natural gas as a primary feedstock is pyrolysis, known as "turquoise" hydrogen. Pyrolysis technologies, which use high temperatures to break the chemical bonds in methane into hydrogen and solid carbon, have the potential to produce relatively low-carbon-intensity hydrogen. The solid carbon byproduct can also be used as a commodity. There are various natural gas pyrolysis technologies available, and variants of solid carbon can be used in different industries (e.g., rubber, construction materials, pigment for inks).[5] For this production method, natural gas would need to be transported to Vancouver Island. There is one natural gas pipeline from the mainland to Vancouver Island operated by FortisBC. There are some industries on Vancouver Island that may have a demand for solid carbon, such as plastic and rubber processing and manufacturing.[6]

Biomass Gasification

Biomass-derived hydrogen is another source of supply that could be explored. Forestry operations on Vancouver Island, including timber harvesting and wood processing, account for a key economic activity in the region. Agriculture, including livestock farming and orchards, also contribute to regional organic waste streams. This biomass could be used as a feedstock for low-carbon hydrogen through gasification or pyrolysis. Gasification processes convert organic materials, such as agricultural residues, wood waste, or other biomass into syngas. The syngas can then be processed to separate hydrogen gas from carbon and other components. While it has not yet achieved widespread commercialization, the technology has progressed beyond the prototype stage and ongoing developments continue to advance its readiness and scalability. Biomass waste gasification with CCUS and biomass pyrolysis technologies currently stand at TRL 5 and 6, respectively. However, the specific TRLs can vary based on individual technologies and their integration levels.

Scaling up to commercial levels requires the establishment of reliable and efficient supply chains for woody biomass, the primary potential feedstock. [7] However, BC's bioeconomy is currently facing multiple challenges that may limit the viability of this pathway. Recent research from Foresight uncovered a number of challenges faced by the BC forestry sector, the largest of which is "the declining availability of economically available fibre." [8] This calls into question the long-term security of biomass supply for investors and value-added project proponents (either bioeconomy or clean fuels projects).

Fibre supply has declined in the province due to "mountain pine beetle infestations and forest fires, combined with drivers like conservation and endangered species protection." [8] This declining supply of logs has downstream consequences, as the flow of forestry residuals such as hog fuel, sawdust, and shavings are constrained when primary industries (e.g., mills) recede. Furthermore, Foresight's conversations with industry leaders over the past two years have found that the high transportation costs of recovering BC's waste wood from logging sites within forested areas remains prohibitive.

An additional barrier to consider is competition from RNG production, which also seeks biomass as a feedstock. Woody and agricultural biomass can both be used to produce RNG. Currently, there is one RNG production facility in the region at Hartland Landfill, which converts landfill waste into RNG. [9] If RNG derived from woody and agricultural biomass is a pathway that continues to expand in BC, there is reason to expect demand for these feedstocks to be competitive.

Given these considerations, it is not expected that this technology pathway will contribute to hydrogen production in the region by 2035.

Waste or Byproduct Hydrogen

An existing source of supply is "waste" or "byproduct" hydrogen: hydrogen that is already being commercially produced as a byproduct of chemical processes. Byproduct hydrogen is typically released during industrial activities, such as chlor-alkali production and petrochemical refining, where it is not the primary product. This hydrogen can be captured and utilized, reducing waste and providing a recovered energy resource. Byproduct hydrogen is already playing a role as an early-stage source of supply in the province and will continue to in the short term. [10] By-product hydrogen opportunities have not yet been identified on Vancouver Island.

Production Technologies

In Table 1, we list the production technologies most likely to scale as part of a Vancouver Island hydrogen hub. The table includes each technology's approximate TRL, which measures the maturity of a given technology, from conception to proven commercial stability. It also includes carbon intensity, a measure of the GHG emissions per unit of energy produced, based on analysis from NorthX Climate Tech, formerly known as the BC Centre for Innovation and Clean Energy (CICE). [11] All the pyrolysis and electrolysis technologies listed in the table have projected carbon intensities below the low-carbon threshold of 36.4 gCO2e/MJ adopted in the BC Hydrogen Strategy; the threshold is meant to be a starting point to define low-carbon production, and represents a 60 per cent reduction "below the intensity of hydrogen produced from natural gas." [12]

Table 1. Emerging low-carbon hydrogen production pathways for Vancouver Island (carbon intensities including upstream emissions). [1]

Feedstock	Technology	TRL (1-11)[2]	2030 Carbon Intensity (gCO2e/MJ) in BC [11]
Electricty (On-Grid)	Alkaline electrolyzer	9	16.2
	Polymer electrolyte membrane (PEM) electrolyzer	9	15.3
	Solid oxide electrolyzer	8	11.9
Natural Gas	Pyrolysis, Thermal	3-4	19.6
	Pyrolysis, Plasma	8	18.2
	Pyrolysis, Catalytic	6	19.5

[1] Note that while the carbon intensity figures in this table are among the best publicly-available projections, project proponents cannot rely on them exclusively. Projects intending to secure the federal Clean Hydrogen Investment Tax Credit must use the Government of Canada's Fuel Life Cycle Assessment Model, which has different assumptions from NorthX Climate Tech referenced in Table 1. Further information is available here.

Electricity Supply

BC Hydro's 2021 Integrated Resource Plan (IRP), which projects the province's electricity needs over a 20-year planning horizon, has an "accelerated electrification" contingency plan that assumes the province meets its CleanBC emissions targets. [13] The plan lists future gaps between projected supply and demand, and notes that additional resources will need to be procured to meet the needs of the low-carbon transition, including new sources of electricity demand such as hydrogen production. The IRP identifies a need for additional regional capacity resources on the South Coast (which includes the Lower Mainland and Vancouver Island) by 2027. The plan also includes a capacity load-resource balance analysis for Vancouver Island, showing the forecasted capacity needs versus existing and committed resources. The modelling indicates that additional capacity resources are not required for the Vancouver Island region until fiscal 2034. Targeted updates for future capacity resource options and transmission lines to Vancouver Island will be a key focus. BC Hydro is currently developing its 2025 IRP, which should discuss these opportunities and challenges further. [14]

Given the uncertainty of these future constraints and where new sources of generation will originate, it is reasonable to suggest that on-grid hydrogen production might compete with other grid users (electric vehicles, heat pumps, industrial electrification) in the future. Time will tell as new sources of electricity supply are secured; however, given the requirements of both electrification and hydrogen production technologies, the province will have to carefully consider how new hydrogen projects will impact the wider goals of economy-wide emissions reductions across all sectors.

As part of the Clean Energy Strategy, the province set a new commitment to conduct competitive calls for power every two years. [15] In April 2024, BC Hydro launched a call for proposals and 10 renewable energy projects were accepted. These will provide nearly 5000 GWh per year of clean electricity. The Brewster Wind Project is one of the accepted projects and proposes a 30-turbine wind farm northwest of Campbell River. [16,17,18]

Vancouver Island is one of the most populated areas of the province, and substantial growth in housing, building, transportation, and industry is driving electricity demand—notably in Victoria, Saanich, Langford, Nanaimo and Colwood. [19] BC Hydro has four hydroelectric systems, with six generating stations on Vancouver Island that generate about 471 MW or 4 per cent of BC Hydro's total capacity. Energy supply is also supported by transmission infrastructure and facilities on the mainland. [19]

In January 2024, BC Hydro's updated 10-year Capital Plan announced funding for regional and community infrastructure investments across BC. This includes $3 billion in capital projects on Vancouver Island over the next decade. The planned upgrades include a new substation in the Langford area and replacing and upgrading transmission lines. BC Hydro is also investigating the feasibility of grid-scale batteries on Vancouver Island to provide additional capacity to address anticipated growth and improve reliability in the region.

On north Vancouver Island, work is being undertaken to upgrade the existing systems supplying Port Alice and the substation in Woss. This will give BC Hydro more options to restore outages and allow more customers to connect to the system.
It should also be noted that—like the rest of the province—Vancouver Island is facing climate-related constraints that can affect the reliability of future electricity supply for all uses, including hydrogen production. For example:

- **Hydrological Changes:** Climate change will alter precipitation patterns, increase temperatures, and change the timing and volume of spring runoff. These changes can impact hydroelectric power generation, which relies on consistent water flows.

- **Drought Conditions:** Extended periods of dry and warm weather, as experienced in recent years, have led to low water levels in some reservoirs. This affects the ability to generate hydroelectric power consistently. BC has experienced some of its driest and hottest extended periods on record over the last few years, including a record drought in 2023, impacting water availability for power generation. In particular, watersheds on Vancouver Island are comparatively small to other areas of the province so the effects of droughts can be felt more quickly. [20]

- **Extreme weather events:** Wildfires, flooding, and droughts can disrupt electricity supply and damage infrastructure. BC Hydro noted that an increasing number of customers are experiencing weather-related power outages with 1.4 million customers impacted in 2024. Three powerful storms hit the South Coast and Vancouver Island in November and December of that year. [21]

Although BC Hydro is the main electricity provider on Vancouver Island, there are 18 independent power producers on Vancouver Island. [22] The Island Generation facility in Campbell River is a 275 MW natural-gas-fired combined cycle plant and represents approximately one-third of the generation capacity on Vancouver Island. [23] The 99 MW Cape Scott wind farm, located on the northern tip of Vancouver Island, is one of four within BC. There are 8 hydroelectric dams, 4 run-of-river (ROR) generators, and 4 biomass generation facilities. Further clean energy projects are proposed across the island including solar projects on the southeast coast of the island, 24 wind projects on the west coast of the island 25 and ROR hydroelectric projects. ROR hydroelectric projects use natural elevation differences and stream flows in mountainous regions to generate electricity.

Indigenous-Led Projects

There is a range of Indigenous-led projects in the region and a strong interest in clean energy opportunities from First Nations. The T'Souke First Nation (west of Victoria) operates BC's largest First Nation-owned solar project. [26] Wei Wai Kum First Nation has partnered with Capstone Infrastructure to assess the feasibility of a wind farm north of Campbell River. [27] Many other First Nations are developing or have developed community energy plans to identify clean energy opportunities to reduce power outages, improve heating efficiency of homes, lower costs and improve quality of life. [28,29,30] There is a strong interest from First Nations in the potential of low-carbon hydrogen, particularly to improve the stability and reliability of electricity supply.

Water Supply

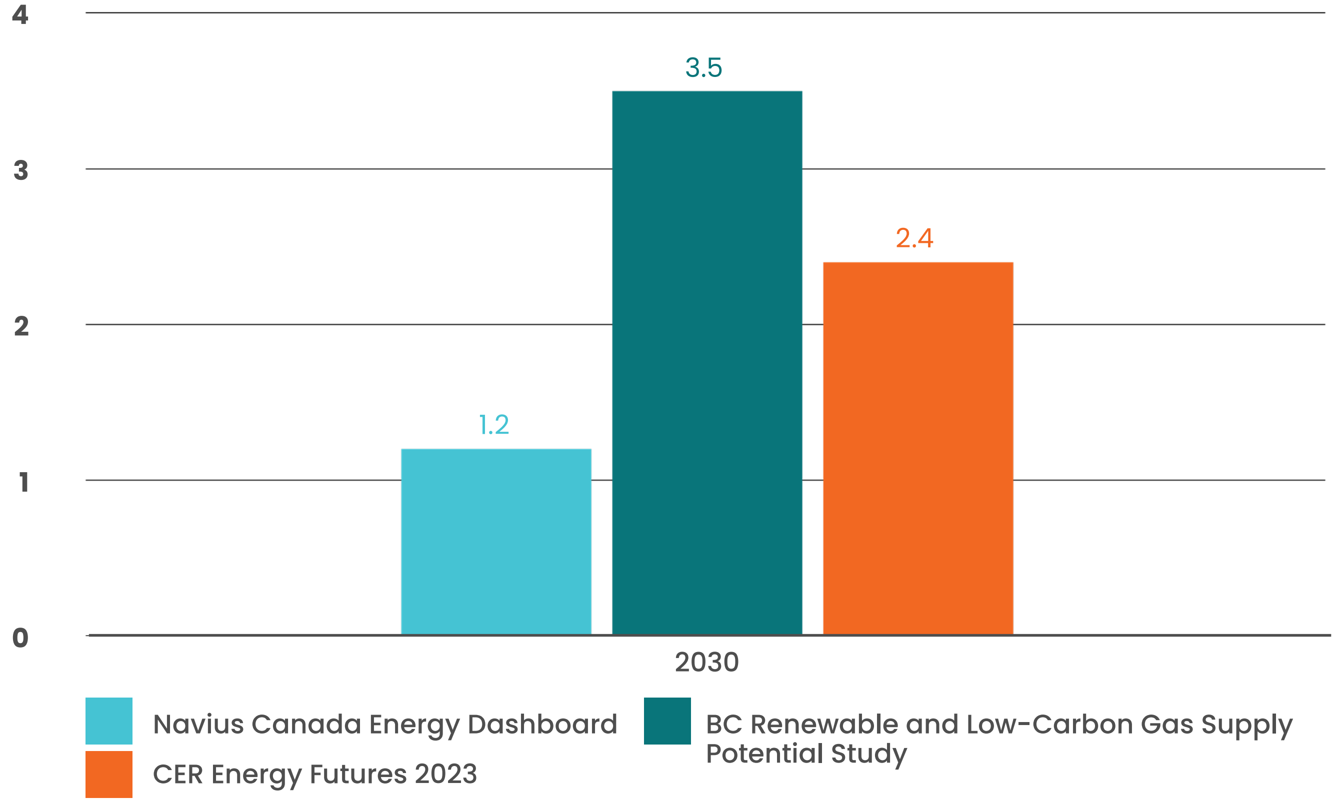
Vancouver Island has abundant seawater availability. Water used for electrolysis generally needs to be of a certain level of purity. Catalysts used in seawater electrolysis often face stability challenges due to the high concentration of salt ions and other impurities, resulting in corrosion and electrochemical degradation. Researchers are working to develop direct seawater electrolysis technologies for hydrogen production, whereby seawater can be used without pre-treatment; however, this is not a commercially or technologically viable approach at the time of writing. [31]

Desalination can also be undertaken to convert seawater to ultrapure water at the quality required by electrolyzers. This involves additional processes and technologies, which can add to the water footprint and carbon intensity of green hydrogen production. To produce 1 m^3 of ultrapure water for electrolysis, around 1.5 m^3 of freshwater is required, or up to 2.5 m^3 of seawater. Depending on the desalination technology, 5-10 kWh of electricity for every m^3 of ultrapure water is required, compared to 2-3 kWh of electricity for freshwater. Although this additional energy consumption is significantly lower than the electrolysis process as a whole, the advantage is that freshwater would not be required. There may be additional barriers and considerations for using seawater. It is important to respect the cultural significance of waters and fishing to First Nations communities, minimize impacts on marine life, and ensure regulatory compliance.

Modelling Supply

There are differing projections of how much hydrogen will be produced in BC within the next decade and by what means. Using Navius Research's net zero modelling in its Canada Energy Dashboard, we observe a projection of 1.2 PJ (approximately 10,000 tonnes) of BC hydrogen production supply in 2030 and 2.9 PJ (approximately 24,167 tonnes) in 2035. [25] Navius's model projects all of this supply to come from electrolysis technologies. The BC Renewable and Low-Carbon Gas Supply Potential Study differs slightly, with approximately 3.5 PJ projected in 2030 (0.8 PJ from electrolysis, 1.5 PJ from pyrolysis, 0.9 PJ of waste hydrogen, and 0.3 PJ of biomass gasification). [7] In contrast, the Canada Energy Regulator's (CER) net zero modelling projects approximately 2.4 PJ of hydrogen production in 2030 and approximately 12 PJ in 2035; but 100 per cent of this supply is from biomass gasification in 2030, and in 2035 electrolysis technologies account for 20 per cent of provincial supply (approximately 2.4 PJ).

Figure 1. Projected BC hydrogen production in 2030.



Transportation and Storage

After production, hydrogen can be transported by truck, rail, or pipeline. Hydrogen requires specialized storage and transportation methods, such as compression, liquefaction, or conversion to alternative carriers like ammonia, methanol or liquid organic hydrogen carriers (LOHCs). Each method has its own technical and economic trade-offs, and the choice depends on factors like distance, volume, and end-use requirements. [33]

Growing hydrogen supply may require a "bulk hydrogen transportation corridor to accommodate large-scale adoption." [34] In response, FortisBC is exploring the repurposing of its gas pipeline infrastructure to enable a "blended hydrogen stream." [34] However, generalizing blending limits is considered "problematic because hydrogen compatibility depends on existing infrastructure component factors." [35] Considerations for blending include the pipeline material and condition. In January 2024, FortisBC and Enbridge—with support from the province—announced that they have commissioned a comprehensive blending feasibility study for their distribution networks. [36,37]

Transportation is an important part of the life-cycle emissions associated with hydrogen. According to NorthX Climate Tech, transporting hydrogen by truck would add an average of 2.8 g CO_2eq per MJ of hydrogen (in this case measured over an 80 km distance). [11] In contrast, the use of existing pipeline infrastructure for distribution would minimize transportation emissions.

Transporting hydrogen poses significant costs. According to the Transition Accelerator report "The Techno-Economics of Hydrogen Pipelines," transporting hydrogen can account for up to 70 per cent of its total cost. The report highlights that pipelines are the most cost-effective method for transporting large volumes of hydrogen over long distances, but the initial capital costs for new pipeline infrastructure are substantial. [38]

Compared to other regions in BC, there is limited transportation infrastructure on Vancouver Island. There is one main highway artery on the east of Vancouver Island running north to south. Highway 1 connects Victoria to Nanaimo, which becomes Highway 19 connecting Nanaimo to Port Hardy via Campbell River. Transportation of hydrogen via truck is likely to be the most feasible option.

There is existing natural gas pipeline infrastructure on the east of the Island from Campbell River to Victoria, managed by FortisBC. However, there is no pipeline infrastructure on the west of the Island. There are also no operational railways on Vancouver Island that would be sufficient for the transportation of hydrogen.

For more information on the risks, opportunities and infrastructure needs associated with transporting hydrogen in BC, including the use of carriers such as Methanol, Ammonia and LOHCs, readers are encouraged to review Foresight's detailed report: "Hydrogen Transportation And Infrastructure Analysis." [39]

What We Heard: Local Feedback on Supply

In our workshop, participants were gathered and asked: "What are the key challenges and opportunities related to increasing the production, distribution, and transportation of hydrogen in the region?" The following themes represent the summarized feedback collected by facilitators.

Feedback and Land Availability

- There is limited natural gas availability on Vancouver Island, as most natural gas is transported from the mainland.
- Existing electricity supply challenges on Vancouver Island, particularly in remote regions, mean that there is a growing demand for clean energy solutions.
- Diverse renewable energy projects are planned across the island, including First Nations-led initiatives.
- The transmission capacity for power to the Island from the mainland is limited.
- The island has an abundant supply of seawater.
- Freshwater availability varies across the island. In areas such as Nanaimo, there is a good quality water supply. In other regions, such as Cowichan, there are water scarcity challenges.
- Some pulp and paper mills on the island are reducing operations or closing down, presenting opportunities for adaptation—these sites may have existing water and electricity connections.
- There is strong interest in hydrogen production across the island, and production facilities are planned for Nanaimo.
- Vancouver Island communities and residents value self-sufficiency and energy sovereignty.

Transportation Infrastructure

- The island has one main highway, which is both a challenge and an opportunity. Although distribution to different regions may be challenging, it provides a focused route for producers and suppliers.
- Pipeline infrastructure on the island is limited to the east.
- Deep-sea and marine ports on Vancouver Island provide potential opportunities for shipping hydrogen as a transportation method.
- Existing ferry routes designated for transporting dangerous goods between Vancouver and Victoria could be used to transport hydrogen.
- Currently, there are no feasible rail transportation options on Vancouver Island.
- The cost of transportation infrastructure upgrades could be a challenge.

Economic Feasibility

- Further clarity is needed on the costs and benefits of hydrogen production, including the potential for job creation and economic development for local communities.
- Remote operations can also lead to increased cost of production and transportation.
- There may be increased capital costs as a result of inflation and potential tariffs.

Regulation and Permitting

- Project proponents reported challenging regulatory and approval processes at the provincial, municipal, and federal levels.
- Uncertainty in permitting timelines and approval creates barriers for projects.

First Nations-Led Projects

- With 50 First Nations communities across the island, First Nations-led clean energy projects that promote energy sovereignty and economic development are of interest.
- To raise awareness of hydrogen opportunities, education around hydrogen and a clearer understanding of the costs and opportunities is needed.

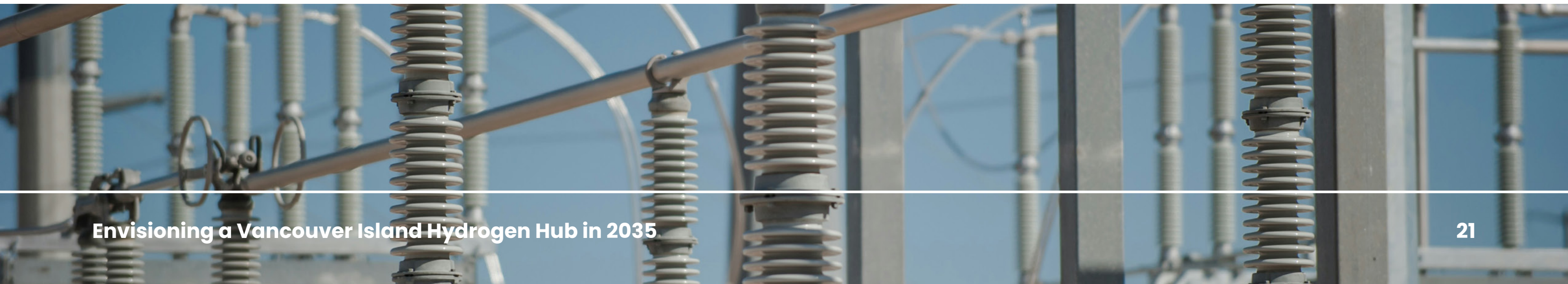
Supply-Side Recommendations for Hub Partners

- **Focus on pyrolysis and electrolysis technology adoption.** Based on feedback from the workshops and existing literature, if hydrogen supply were to develop further in the region, electrolysis and pyrolysis technologies appear best suited to fill the role. Because this is an evolving sector that can experience rapid changes in technology costs and readiness, governments, utilities, and industry groups will need to closely monitor the progression of each technology variant. Project proponents can identify the best opportunities to disseminate the information. Being responsive to new data and research will be critical to limit the risk of stranded assets. The sector is currently in an exploratory phase. Project proponents must prepare to adapt and rapidly scale the most effective technologies as new data on carbon intensities, energy consumption, and costs becomes available over the next ten years. **[Recommendation Lead: Province, Utilities]**

- **Provide further public clarity on electricity infrastructure adaptation and growth.** There is concern from potential hub partners (local communities and industry) and project proponents about the future availability of clean electricity and the reliability of infrastructure. The province should work with BC Hydro to disseminate key information about projected electricity demand and availability and better communicate the challenges ahead to local rights holders and partners. There is a need for greater clarity on BC Hydro's approach to its modelling and share how it is planning for increased demand, as well as build resiliency in the system. This will secure the confidence of hydrogen project developers, investors, and local governments. The 2025 IRP is a good opportunity to strengthen communication on these challenges. **[Recommendation Lead: Province, Utilities]**

- **Streamline and harmonize regulations and processes to enhance investment appeal.** Consistent legislation and rebate policies are needed to foster a favourable investment environment. Workshop attendees highlighted challenges related to complex approval and permitting processes, particularly within local government. Providing greater clarity in these areas would provide a more attractive and reliable environment for investors, supporting the development of a hydrogen hub ecosystem. **[Recommendation Lead: Province and Local Government]**

- **Promote and support First Nations-led projects.** First Nations communities expressed strong interest in the potential of hydrogen production projects on Vancouver Island. Project proponents should engage with First Nations groups early and identify opportunities for collaboration so that they have the opportunity and support to lead hydrogen production projects. **[Recommendation Lead: All Partners]**



Demand-Side

The Canada Energy Regulator's (CER) net zero modelling projects approximately 5-6 PJ of economy-wide hydrogen demand in BC in 2030, and 17-20 PJ by 2035. However, virtually all of this demand (over 90 per cent) is projected to come from the transportation sector, with a small portion from industry. [40] BC's 2024 climate accountability reporting corroborates this sectoral distribution through its own modelling conducted by Navius Research. The modelling scenario—only available to 2030, where the province meets its CleanBC climate targets—projects 2030 hydrogen demand will be slightly higher at 8 PJ (~66,667 tonnes of H_2), coming almost entirely from heavy-duty trucks and rail, with a small portion from heavy industry. [41] There is no publicly available modelling for the Vancouver Island region alone; therefore, assumptions must be made based on provincial-wide forecasts.

Potential End-Uses in 2035

In BC, experts have outlined a variety of potential end uses for hydrogen, which are listed in the following table. While publicly available modelling does not indicate that all these sources of demand will appear in the next decade, some may be generated in the long term and are worth noting in this assessment.

Legend	
Hydrogen Suitability Indicator Colour	**Suitability (2025 - 2035)**
H–H	Well Suited for the Region
H–H	In Development/Further Evidence Needed
H–H	Not Suitable for the Region

Table 3. Potential end uses of hydrogen on Vancouver Island.

End-Use	Description
Transportation Fuel	Modelling by the CER found that in Canada, “hydrogen primarily fuels long-haul transportation in heavy trucks, marine shipping, and hydrogen-based fuels are used to help decarbonize aviation.” [42] Navius Research’s Canada Energy Dashboard supports the conclusion that hydrogen’s main use in BC will be as a transportation fuel. [32] **Heavy-Duty Vehicles (HDVs)** Fuel cells use hydrogen as a fuel to create electricity, water, and heat. Fuel Cell Electric Vehicles (FCEVs) are being explored as an internal combustion engine replacement for on and off-road transportation applications that have limited cost-effective decarbonization options. In most cases, Battery Electric Vehicles (BEVs) are projected to be the most energy-efficient and cost-effective method of decarbonizing on-road transportation over time. [43] This is particularly true in the case of light-duty vehicles—23 per cent of light-duty vehicles sold in BC in 2023 were BEVs. [44] This is also true of most medium-duty vehicles, including buses, drayage, short-haul, and urban freight vehicles. [45] However, battery technology does not currently have near-term prospects to meet the demands of most of the heaviest vehicles. There is a large and growing opportunity to build the provincial hydrogen sector around the heavy-duty market. FCEVs are the most promising solution to replace heavy diesel class 8 vehicles that need to travel long, mountainous distances and carry large cargo loads. A cost analysis from National Renewable Energy Lab (NREL) projected FCEVs to be cost-competitive in the US for these types of long-haul trucks by 2035. [46] HTEC is building a hydrogen production facility in Nanaimo that is due to be operational by January 2027. The facility will be a part of the H2 Gateway—a network of 20 refuelling stations and three production facilities—to support the adoption of an initial fleet of 100 heavy-duty, zero-emission fuel cell electric trucks (FCETs). The trucks will be managed and leased through HTEC’s Vehicle Leasing Corporation. This leasing model minimizes the risk of investing in supply without adequate demand and lowers adoption barriers and risks for other end-users.

Transportation Fuel

Shipping and Ferries

In heavy shipping and other forms of marine transportation, fuel cells are being explored as one decarbonization solution. Other options, such as ammonia (a hydrogen carrier) and battery-electric ships, are also being investigated, though they come with their own set of challenges; the toxicity and energy density of ammonia poses issues, and the range limitations of batteries is a hurdle. An alternative is methanol, a liquid fuel and hydrogen carrier with industrial applications that shows promise as a source of energy. “Green” or low-carbon methanol can be produced using biomass, or by reacting green hydrogen with captured carbon dioxide. [47] Maersk and many of the world’s largest shipping companies are leaning heavily into the potential use of methanol, and European leaders such as the Port of Rotterdam have already successfully performed methanol bunkering. [48] Of note locally, the Pacific Northwest to Alaska Green Corridor Project is exploring a low-carbon marine corridor between Alaska, British Columbia, and Washington. The project has an initial focus on cruise ships with the potential to expand to other marine sectors. The Greater Victoria Harbour Authority is a participant in the initiative and has plans to decarbonize port operations. There may be other opportunities to leverage the Pacific Northwest network to accelerate offtake of zero-emission maritime fuels. [49]

Vancouver Island has deep water ports including Ogden Point Terminal in Victoria, Duke Point terminal in Nanaimo, and Port Alberni. As an island, there are various other smaller ports and harbours that accommodate cruise ships, ferries, or smaller marine vessels. There are no commercial hydrogen fuel cell, ammonia, or solely methanol-powered ships currently operating on Vancouver Island. However, there is industry interest: two methanol-fueled tug boats are expected to enter service in the Vancouver harbour in 2025 and two electric tug boats are already in operation. [50,51] Ports can be pivotal in transportation and energy networks, acting as a hub that links shipping, trucking, and broader systemic operations. [49]

Tourism is also a major part of Vancouver Island’s economy, with cruise ships visiting Victoria and Nanaimo. In 2024, Victoria had 316 ship calls and approximately 700,000 passengers disembarking ships to explore the area. [52] There is one global example of a hydrogen-powered ferry that operates in Norway, as well as plans for the world’s first hydrogen-powered cruise ship. [53] Hydrogen could also be used for auxiliary services on cruise ships, such as water boilers, and in port operations, including cranes and off-road vehicles. [54] In April 2025, DP World successfully piloted a hydrogen fuel cell rubber-tired gantry crane at Vancouver Port, supporting the decarbonization of port operations. [55]

Transportation Fuel

Aviation

Hydrogen can be a key feedstock for the production of low-carbon sustainable aviation fuels (SAF). [56] The groundwork for SAF production in Canada is being laid: the Canadian Council for Sustainable Aviation Fuels roadmap sets an ambitious target of producing a billion litres of sustainable aviation fuel by 2030. Hydrogen can also be used in fuel cells or combusted in modified turbine engines. Technical challenges include the low volumetric energy density of hydrogen, which requires large and heavy storage tanks, and the high costs of hydrogen production. The role of hydrogen as a direct fuel is projected to expand after 2040, but is not expected to play a role within the upcoming decade. [56] Alternatives being considered include biofuels and battery-electric aircraft. However, the former is limited by feedstock availability and the latter by energy density constraints.

Commercial battery electric aircrafts have been tested successfully by Harbour Air in the Lower Mainland, and ongoing research, development, and piloting of fuel cell technologies is taking place in the region. [57,58] To better understand the local potential for SAF, the Province and Vancouver Airport (YVR) invested $250,000 in a “sustainable aviation fuel opportunities study.” [59] YVR has also introduced the BC Low Carbon Jet Fuel Incentive Program (BC-LCJFIP). This program aims to encourage the adoption of low-carbon jet fuel across BC by providing incentives to airlines to help offset costs. [60] There is one international airport on Vancouver Island and eight domestic airports.

Rail

Similar to on-road vehicles, rail operators are piloting hydrogen fuel cell technologies as an alternative to fossil fuel-powered locomotives. Despite having an existing railway line, rail transportation is not currently operational on Vancouver Island. Future developments or the reintroduction of rail transportation could consider hydrogen; there are trials of hydrogen locomotives in BC and Alberta. [61] Canadian Pacific Kansas City (CPKC) also successfully trialled a high-horsepower hydrogen locomotive between Sparwood and Golden. [61] If the technology is successfully commercialized within the next decade, it could play a valuable role. However, the limited rail infrastructure would need to be addressed. [62]

Industrial Decarbonization

In industries where direct electrification technologies do not exist or are not technically or financially feasible, hydrogen holds potential as a decarbonization solution. While the public modelling detailed above suggests that hydrogen is not expected to be a major source of emission reductions in the next decade, Vancouver Island has a few potential sources of demand in industries such as transportation, shipping, and agriculture.

Hydrogen as an Industrial Feedstock

Hydrogen is used for feedstock in various sectors like oil refining, ammonia production, methanol production, and steel manufacturing. Although there may be a demand for e-methanol in shipping on Vancouver Island or ammonia due to farming industries, there are currently no production facilities on the island.

Hydrogen for Heat

In many industrial processes, fossil fuels are used as energy sources and combusted to produce high temperature heat. Low-carbon hydrogen can be combusted directly in boilers, furnaces, and turbines to generate heat without producing CO_2 emissions. In any industry with a demand for high-temperature heat, fossil fuels could be replaced by hydrogen or other renewable fuels. There are no current demonstration projects using hydrogen for heat in the region; however, the technology is being commercialized in other regions. While the sector is facing difficulties and increased closures, pulp and paper companies in BC have demonstrated interest in testing hydrogen for high-temperature applications, such as replacing natural gas for the drying of wood chips or other forms of biomass drying in sawmills.

Hydrogen fuel cells can convert hydrogen into electricity with zero point-source emissions. In industrial sites, there is a possibility that hydrogen fuel cells could provide on-site power generation for facilities, complementing grid electricity. After production, hydrogen can be stored until needed and used as a source of power generation during peak demand or when intermittent resources are unavailable, either through a fuel cell or combustion.

Using hydrogen for energy storage could also complement renewable electricity deployment in remote communities that are not grid-connected. This could help communities transition away from a reliance on diesel power generation and reduce power outages. [63] The CleanBC Remote Community Energy Strategy (RCES) has set a target to reduce diesel consumption in remote communities by over 80 per cent relative to 2019, by 2030.

In some cases, excess electricity from renewable sources like solar and wind can be used to produce hydrogen by electrolysis. The hydrogen can be stored and used to generate electricity or as a fuel when needed. Hydrogen can be stored as a gas in high pressure tanks, as a liquid in cryogenic insulated tanks, or as a chemical compound. Hydrogen could offer remote communities more complementary options for meeting their electrical and power needs, particularly with hydrogen applications in transportation and complementing microgrids. [64]

This approach would only be sensible if the cost and carbon intensity of the hydrogen used was lower than diesel, and if it was deployed in climates where battery storage proves to be prohibitively ineffective. The relative efficiency (energy conversion loss) of hydrogen compared to electrification is low, and community use would require new infrastructure for storage and distribution.

Energy Storage

A study by Fraser Basin Council and Dunsky suggests that renewable energy and battery storage offer a cost-effective pathway to decarbonize remote communities and achieve BCs goal of reducing diesel consumption. [63] Integrating hydrogen into the energy mix could potentially result in a LCOE comparable to scenarios using only renewables. However, this cost competitiveness largely depends on the 40 per cent federal Investment Tax Credit. In order to fully decarbonize remote communities, hydrogen integration alongside renewables could be a cost effective pathway, but further community-specific studies are necessary to confirm this potential.

The latest research from NorthX Climate Tech suggests that in BC, the likeliest use case for hydrogen as a form of long-term energy storage is on industrial sites that will have already invested in hydrogen infrastructure and co-located supply and demand. In these sites, it could be used as a backup to smooth out power demand or provide competitive combined power and heat. [65] Otherwise, its levelized cost is uncompetitive. [65]

In the west and north of Vancouver Island, there is increasing demand for clean energy improvements as there are regular outages. However, many regions would need to also consider on-site renewables to support hydrogen production. The Orkney Islands in the UK has demonstrated how hydrogen energy storage can benefit island communities. Orkney has an over-abundance and intermittent supply of renewable wind and wave electricity that is lost when the grid reaches capacity. The surplus renewable energy is used to produce hydrogen that can be stored and used at a later date. The hydrogen can be used for heat, ferries, and planes. This has provided the local community with additional jobs and an exportable commodity. [66,67] The Building Innovative Green Hydrogen Systems in Isolated Territories (BIG HIT) project is working towards a fully integrated model on Orkney. [68]

Built Environment Heating - Blending

Some companies are exploring using hydrogen to reduce the carbon intensity of gas supply by blending it with natural gas and injecting it into the pipeline network for commercial and residential building customers.

There would be logistical and safety challenges with this approach, as blending beyond a roughly 20 per cent volume would require that existing pipelines be retrofitted or new pipelines be constructed to accommodate hydrogen gas requirements. [69] As mentioned in the supply section, FortisBC and Enbridge have commissioned a comprehensive blending feasibility study to determine the feasibility of blending hydrogen with natural gas in existing pipelines and infrastructure.

Furthermore, a recent analysis by NorthX Climate Tech found that "blending hydrogen at approximately 20 per cent by volume" into the provincial gas grid could yield emissions reductions of only 1.7 per cent to four per cent, and should be considered a low-priority use of hydrogen. [11] Research by the Canadian Climate Institute corroborates this; a new report found that building heat will not be a cost-effective use of hydrogen in the long term (buildings account for only a small portion of low-carbon gas use in a cost-optimized net zero modelling nationwide). [70]

Blending is unlikely to be a high-priority use of hydrogen on Vancouver Island due to the limited natural gas pipeline infrastructure. Other approaches to decarbonizing the built environment such as retrofits, demand-side management, and dual-fuel heat pumps are likely better suited.

Export Commodity

Some consider hydrogen to be a potential export commodity for BC given growing global demand as countries set ambitious targets to reduce greenhouse gas emissions. Hydrogen is seen as a key enabler of the transition to a low-carbon economy, particularly in sectors where electrification or other renewable energy solutions may be challenging or insufficient. Major economies such as Japan, [71] South Korea, [72] China, [73] and the United States [74] have announced hydrogen strategies and initiatives to support the development and deployment of hydrogen technologies.

BC is geographically well-positioned to export to major markets in Asia. Its deep-sea ports and robust transportation infrastructure (road and rail networks) facilitate easy access to these markets. However, this is a long-term ambition and unlikely to factor into the Vancouver Island hub in the next decade, especially given the current state of supply. Large-scale hydrogen export would also need to overcome significant costs and technology challenges. [75,76]

Cost Trends

The cost of hydrogen can fluctuate significantly as it is contingent upon the specific technology pathway employed. These costs are influenced by many factors, including the price of feedstocks (such as natural gas or electricity), the capital investments required, ongoing operational expenditures, and transportation costs. Costs are generally projected to decline as economies of scale are achieved. For example, in its 2023 Energy Futures report the CER assumed that electrolyzer capital costs will decline by 80 per cent by 2030. [42] Additional factors that will vary over time include taxes and possible offsetting revenue streams for the producer (e.g., solid carbon).

HTEC's current retail price for hydrogen at its fuelling stations in the Lower Mainland is $14.70 per kg. [77,78] The BC Hydrogen Strategy estimated that a competitive production cost would need to be no higher than $3 per kg by 2030 (~$25 per GJ based on an assumed hydrogen energy content of 120 MJ per kg). [1]

Table 4. Projected 2030 production cost at a national level.

Source	2030 Hydrogen Production Cost Projection	Production Method
Canada Hydrogen Strategy[12]	$1.38 - $4/kg	SMR + CCS
Transition Accelerator[79]	$1.38/kg	SMR + CCS
	$3.17/kg	Electrolysis
Canada Energy Regulator[42]	$1.50 - $10.50/kg	All technologies
ESMIA[80]	$1.71 - $2.03/kg	All technologies

Three BC studies over the last five years completed analyses to project cost curves for each major hydrogen production method. The results are available in the following table.

Table 5. Projected 2030 production cost in BC.

Production Method	Projected 2030 Production Cost in BC		
	The Potential for Methane Pyrolysis in BC (2024)[8]	B.C. Renewable and Low-Carbon Gas Supply Potential Study (2022) [10]	BC Hydrogen Study (2019) [49]
Electrolysis	\$6.07 - \$9.87/kg	~\$35 - ~\$41/ GJ (\$4.2 - \$4.92/kg)	\$5.13 - \$7.38/kg
Pyrolysis	\$2.71 - \$6.71/kg	~\$18/GJ (\$2.16/kg)	\$1.68 - \$2.28/kg
ATR + CCS	\$2.71/kg	-	-
SMR + CCS	-	~\$18/GJ (\$2.16/kg)	\$2.14/kg

Unlike the other literature, the NorthX Climate Tech report "The Potential for Methane Pyrolysis in BC" went a step further and undertook valuable analysis to present cost projections for delivered hydrogen for each technology. The study found that "hydrogen compression, loading, and transport can add significant costs to the total levelized cost of hydrogen (LCOH), between \$0.2/kg to \$6/kg depending on the transport distances, volumes, and transportation method." The federal Hydrogen Strategy presented a target cost for delivered hydrogen—including all production and transportation-related costs—of \$1.5-\$3.5/kg after 2030. [12]

While the best available public estimates indicate that hydrogen production costs will be near the BC Hydrogen Strategy's target for global competitiveness of \$3/kg, new research signals that processing and transportation costs are expected to significantly add to the final price, particularly in smaller production quantities. This is especially important to consider in the context of a co-located hydrogen hub where demand is not expected to reach large quantities in the next decade.

What We Heard: Local Feedback on Demand

In our workshop, participants were gathered and asked: “What are the key challenges and opportunities related to the end use of hydrogen in the region?” The following themes represent the summarized feedback collected by facilitators.

Regional Readiness

- While there is demand for alternative clean energy opportunities such as hydrogen on Vancouver Island, the infrastructure, economic viability, and workforce readiness need to be addressed.
- The high up-front cost of hydrogen technology and infrastructure is a major barrier to adoption, particularly for organizations that may want to transition fleets.
- There is a limited availability of hydrogen-powered vehicles and core production technologies.
- Key infrastructure such as highways, railways, and transmission lines is limited. Public infrastructure investment must be a priority to ensure demand-side actors have the means to adopt new technologies.
- With energy supply already a challenge in some areas of Vancouver Island, new sources of renewable energy may better serve the local communities directly than contribute to green hydrogen production.
- The availability of ports provides a regional advantage and could make Vancouver Island a central hub for further hydrogen adoption; however, some technologies are nascent.

Transportation End Uses

- Heavy-duty trucking is seen as a viable end use, as demonstrated by HTEC’s planned production facility and leasing model in Nanaimo.
- The number of ports provides an opportunity for central hubs of hydrogen demand, with a focus on auxiliary, off-road machinery such as cranes and cargo handling equipment.

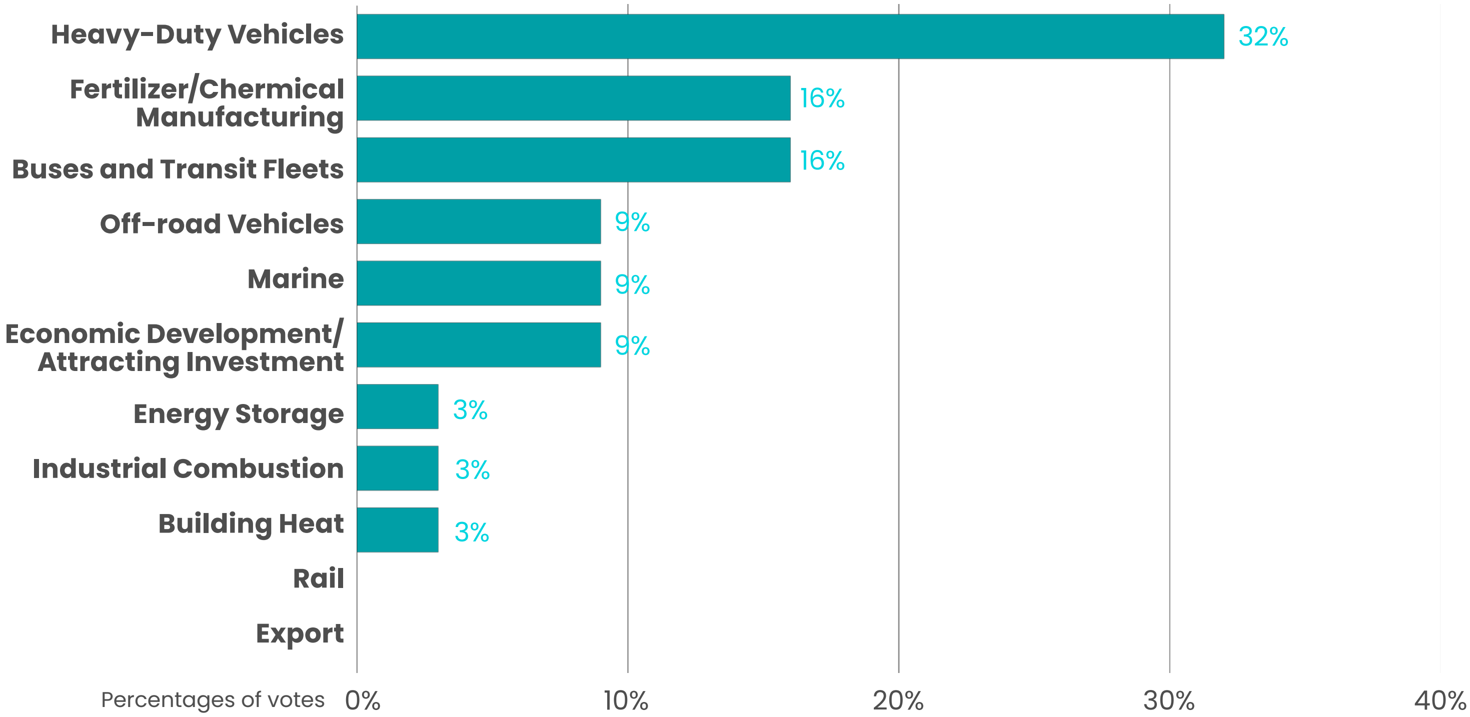
Stimulating Demand and Market Availability

- To ensure a balanced market, both supply and demand for hydrogen must be developed concurrently, with demonstrated use cases.
- There may be a smaller market on Vancouver Island with limited opportunities to scale given the geographical isolation.
- Heavy-duty vehicles, including long-haul class 8 trucks and off-road vehicles used for the forestry and shipping industries, should be high-priority areas.
- Hydrogen could serve as a backup electricity generation system during power outages which would help reduce the reliance on diesel for remote or off-grid communities.

Public and Industry Perception

- Demonstration projects can help build social license and industry understanding of new technologies.
- There is uncertainty and a lack of information regarding the cost-effectiveness of hydrogen adoption. In addition to market certainty and stable government policies, potential regional investors need more information on the learnings of early adopters to encourage investment.
- Public and private rights holders and communities need further educational opportunities regarding the benefits and potential of hydrogen for decarbonization and its contrast to other decarbonization pathways.

Figure 2. Workshop polling results: Likeliest sources of regional demand in 2035.



Demand-Side Recommendations for Hub Partners

1. **Focus the Vancouver Island hub's development around heavy transportation** The evidence outlined in this section and workshop feedback suggest that heavy transportation will be the primary source of hydrogen demand in the province. In the next decade, on-road class 8 vehicles will be a target with supportive infrastructure (e.g., refuelling stations) already being built. Policy-makers should work with utilities to plan infrastructure development and incentives accordingly, and closely monitor how the costs of hydrogen end-use technologies compare to electrification counterparts over time. Rapid cost declines are not off the table for new and evolving technologies (e.g., BEVs, FCEVs) and could change the consensus.
[Recommendation Lead: All Partners]

2. **Consider the various end uses within marine and shipping hubs.** There are opportunities within the industry to adopt hydrogen including cargo handling equipment, cranes, and other non-road vehicles to support port operations. This could be a consideration as technologies develop.
[Recommendation Lead: All Partners]

3. **Continue government funding for demonstration projects and communicate outcomes.** Continued government support for pilot and demonstration projects is critical to build confidence in potentially key end-use technologies and pave the way for commercialization (e.g., ICE Fund). Existing BC support for new projects is helping lay the foundation for sectoral growth. Furthermore, it is essential for project proponents and government funders to disseminate the findings and outcomes of early adopters, including information such as technical feasibility and limitations, return on investment, and carbon intensity, to build a greater understanding of technology development in the market.
[Recommendation Lead: Province, Industry]

Regional Considerations

Vancouver Island holds a strategic position, with two proposed hydrogen production facilities and access to various markets and end uses. This section will discuss the opportunities for the region to stand out and leverage synergies with neighbours.

Competitive Advantages

Vancouver Island has a diverse economic landscape and is divided into several key regions including the Greater Victoria area, Central Island, North Island, and the West Coast. The Greater Victoria area is well-known for its technology sector and as a political and cultural hub. The Central Island includes the City of Nanaimo and is notable for retail and service sectors. The North Island is more sparsely populated but is known for its forestry, mining, and fishing industries. The West Coast includes towns like Tofino where key economic activities are driven by the tourism and hospitality sector. [82]

Vancouver Island holds several competitive advantages for hydrogen development. The planned green hydrogen production facility by HTEC in Nanaimo highlights Vancouver Island's strategic importance within the Province's hydrogen ecosystem. The downturn of the forestry sector and the closing of pulp and paper mills offer an opportunity for adapting sites with existing electricity and energy supplies to potential production facilities. Pulp and paper mills are also significant water users, meaning existing water connections or agreements could be adapted for green hydrogen or electrolysis production methods.

There are various end-use cases for hydrogen across the region. The most viable are heavy-duty vehicles and potential markets for marine and shipping applications. In particular, port operations could act as a hub for demand with various end uses, including cranes, drayage trucks, and other non-road mobile machinery that tend to be powered by diesel.

The region is well-connected to the Lower Mainland and has access to other regions. However, further infrastructure development may be required to facilitate the movement of hydrogen to key industrial centres for use.

The government's commitment to reducing emissions and promoting clean technologies also creates a favourable environment in the Province as a whole. Incentives, grants, and supportive regulations encourage investment and innovation in the sector. At the provincial level, CleanBC programs and policies, including the Low Carbon Fuel Standard, Zero Emission Vehicle Act, Go Electric program, and others advance adoption of hydrogen technologies and its competitiveness with other energy sources.

Opportunities for Collaboration

The development of a Vancouver Island hydrogen hub presents significant opportunities for collaboration both within British Columbia and beyond, creating a synergistic network that could accelerate the growth of the hydrogen economy across Western Canada.

Vancouver Island

There are opportunities for collaboration between industries across Vancouver Island. This is demonstrated by HTEC's proposed production facility in Nanaimo at the Harmac pulp and paper mill. The project aims to open up new market opportunities for zero emission heavy-duty transportation applications. [83] Similar partnerships could be replicated across the island as the forestry industry looks to diversify beyond traditional timber and pulp production.

There are further opportunities for collaboration in the marine and shipping industries on Vancouver Island as ports can become hubs for multi-sectoral demand. As the shipping industry looks to decarbonize, demand is likely to increase for hydrogen and its derivatives such as e-methanol as a marine fuel. Beyond marine vessels, hydrogen can power various port operations, such as forklifts and cranes, and also extend to connected trucking and other land-based transportation. This will require collaboration from shipping and logistics companies, port authorities, regulators, and hydrogen producers and innovators.

Academic institutions also play a large role in clean energy technology development and adoption on Vancouver Island and will be instrumental in supporting the development of a hydrogen hub in the region. In particular, the Institute for Integrated Energy Systems (IESVic) and the Accelerating Community Energy Transformation (ACET) initiative at the University of Victoria are focused on identifying pathways to sustainable energy systems. [84] ACET is a research program that collaborates with communities to accelerate an equitable and resilient low-carbon energy transformation. The program has domestic and international partners and includes a research focus area on green hydrogen and e-fuels. [85] Research institutions can collaborate with industry to develop and test emerging hydrogen technologies and act as convenors connecting industry, government, communities, and Indigenous partners. They can also promote upskilling in the local workforce by offering dedicated training courses.

Intra-BC Collaboration

Vancouver Island's hydrogen hub could form strategic partnerships with other emerging hydrogen hubs in the province, such as those in the Lower Mainland, Interior BC (Kootenays and Okanagan), and Northeast BC. These collaborations could focus on knowledge sharing, technology transfer, and the development of integrated supply chains. Establishing regular and transparent communication networks via a steering group or advisory committee would be beneficial to leverage regional strengths and experience to overcome barriers.

International Collaboration

The US federal government invested USD $7 billion to establish the "Regional Clean Hydrogen Hubs Program." [86] In late 2023, the Pacific Northwest Hydrogen Hub (comprising Washington, Oregon and Montana) was one of seven selected to receive funding (though the funds have not yet been delivered). [87] Despite the competitive environment and the fact that at the time of writing the funding has not yet been received, the region's mutual focus on green hydrogen and decarbonizing heavy transportation and industry presents strong opportunities for collaboration. The Pacific Northwest Hydrogen Hub offers immense potential for technology, skills, and knowledge transfer. In particular, Vancouver Island is positioned close to the state of Washington with established trade routes.

It is also worth noting the proximity of Vancouver Island to Asian-Pacific markets. Japan, South Korea, Taiwan, and China are actively seeking reliable hydrogen suppliers. Vancouver Island's location on the Pacific coast offers a strategic advantage for exporting hydrogen. Japan has relatively limited potential for domestic renewable energy production and is assessing and incentivising clean hydrogen imports to support decarbonisation targets. [88,89] South Korea is also aiming to import 22.9 million metric tonnes of green hydrogen by 2025. In May 2024, the Korean Ministry of Trade, Industry, and Energy announced the launch of the world's first clean hydrogen power bidding market. This facilitates the sale and purchase of electricity generated from clean hydrogen that meets Korea's certification standards. [90]

Potential Barriers to Overcome

Regulatory and Policy Needs

Aligning hydrogen production, storage, and distribution regulations will be important for development in Western Canada. Standardized safety protocols and environmental regulations can mitigate these challenges. The Canadian Standards Association (CSA) Group is a membership-based organization developing hydrogen ecosystem standards, codes, and safety regulations across North America through a consensus-based process. Expert volunteers serve on over 30 CSA Group Technical Committees to develop and maintain the standards and guidelines. [91]

The transition from oil and gas regulations to a comprehensive framework for hydrogen, ammonia, and methanol projects may create short-term challenges. However, progress has been made with the introduction of the Hydrogen Facilities Regulation in 2025. [92] Coordination between various regulatory bodies, including the BC Energy Regulator (BCER), Technical Safety BC, and local municipalities is crucial to streamline the permitting process. BCER is now the primary authority overseeing hydrogen manufacturing, storage, and distribution in BC.

Even with provincial coordination and BCER's adoption as a regulator, uncertainty and inconsistency can still persist at the municipal and regional district levels. Local governments may have fewer resources and need to outsource expertise to support projects. This could be addressed by providing more education or support at all levels of government on how to approach permitting within the existing regulatory environment.

Infrastructure and Transportation

Alignment in infrastructure development is critical to facilitate the construction and operation of hydrogen production facilities and to transport hydrogen. Compared to other areas of the province, Vancouver Island relies heavily on highway transportation as there is no operational rail infrastructure on the island. A 2024 study by Deloitte and Vancouver Island Economic Alliance (VIEA) examined supply chain and economic challenges faced in the logistics of goods movement on Vancouver Island. [82] The study noted that the reliance on a few key transportation routes such as the Highway 1 Malahat corridor—a 25 km portion of Highway 1 running between Greater Victoria and the Cowichan District—creates traffic and safety concerns that disrupt supply chain efficiency. The study suggested that investing in infrastructure upgrades of critical transportation corridors can help enhance the efficiency and reliability of goods transportation. Other recommendations include adopting digital technologies and developing collaborative supply chain solutions to foster partnerships among suppliers, manufacturers and distributors.

Many of the main transportation routes are also prone to natural disasters, including flooding, landslides, and wildfires, which can disconnect some communities. Flooding of the Malahat in 2021 caused a complete temporary closure. In 2023, Highway 4 between Parksville and Port Alberni—the only regular connection between the east and west portions of Vancouver Island—was closed due to a wildfire. [93] Future closures present challenges as alternative routes are not heavy-freight or commuter friendly.

Further consideration for infrastructure development is needed to ensure reliable routes are available. This requires collaborative planning and investment with other hub locations to align the transportation of feedstocks and materials essential for hydrogen production and demand pathways. The economic feasibility of hydrogen projects is closely linked with road accessibility. Communities that lack adequate road access face challenges due to the cost of transporting hydrogen, building infrastructure, and obtaining replacement parts. In remote communities in particular, insufficient road access can delay the deployment of support personnel, making it harder to overcome operational challenges. This can be mitigated by supporting local skills development.

The Vancouver Island Railway, formerly known as the Esquimalt and Nanaimo rail corridor, extends from Victoria to Nanaimo, Lake Cowichan, Port Alberni, Parksville, Qualicum Beach, and Courtenay. Having served under various ownerships including Canadian Pacific Railway (CPR), VIA Rail, and Rail America, the railway passenger and freight services were discontinued. Many Vancouver Island residents have been strong proponents for restoring rail infrastructure on Vancouver Island. [94] Reinstating the railway could enhance transportation options and infrastructure reliability on Vancouver Island; however, significant barriers remain, including economic feasibility and achieving community consensus. Any reinstatement project should respect Indigenous Rights and Land Claims and advance opportunities for Indigenous ownership and partnership.

Power Availability

Green hydrogen is expected to be the primary source of supply in the region, which requires substantial electricity. The region will need to balance its power requirements with other residential and industrial demands, potentially requiring large investments in new renewable power generation and transmission infrastructure. Vancouver Island, along with the rest of the province, faces power availability challenges as outlined in the Electricity Supply section. Although BC Hydro is planning infrastructure upgrades in the region, there is an opportunity for more independent power producers and Indigenous-led renewable power projects.

Market Development and Demand

Vancouver Island shows potential for local hydrogen demand, particularly within its transportation sector (both marine and land-based) and in its remote communities. Market growth could be challenging due to its geographical isolation and smaller industrial base compared to other regions. Developing end-use applications for hydrogen and fostering partnerships with potential large-scale consumers may be key to the hub's future success. HTEC's Nanaimo production facility will stimulate demand and connections to the rest of the province. [95,59,78] As smaller domestic projects and demand grows, opportunities for hydrogen export can be explored.

Workforce Development Needs

The development of a hydrogen hub on Vancouver Island has the potential to create numerous multi-sectoral opportunities, necessitating a highly skilled workforce. This transition creates both challenges, notably retraining, and significant opportunities for economic diversification and new jobs. Broadly, the hydrogen industry will require diverse talent in a wide range of professions in order to grow, including:

- **Engineers:** Professionals skilled in chemical, mechanical, electrical, and process engineering.
- **Renewable Energy Experts:** Expertise in integrating hydrogen production with renewable energy sources, such as wind, solar, and hydroelectric power.
- **Safety and Compliance Officers:** Specialized training in safety protocols, hazardous materials handling, and compressed gas to ensure safe operations and adherence to industry standards
- **Technician and Operators:** Skilled technicians and plant operators to manage the day-to-day operations of hydrogen production plants, storage facilities, and distribution networks.
- **Digital Experts:** Professionals with digital skills and expertise in generative AI, design, data analytics, and automation.
- **Automotive Specialists:** Skilled trades and technicians to maintain and service FCEVs and refueling stations.
- **Business and Policy Professionals:** Professionals with project management, sales, and commercial skills to support the growth of the hydrogen economy, and experts who understand the regulatory and compliance requirements specific to the hydrogen industry.
- **Innovators and Researchers:** Experts who can innovate and improve hydrogen production methods, storage solutions, and application technologies.

To meet these needs, specialized training and education programs must be developed. At the early stages of a sector's growth, there is often a disconnect between what industry needs and what post-secondary institutions are offering. At a high level, this means a hydrogen hub would require:

- **Vocational Training:** Programs focused on specific technical skills related to hydrogen production, safety, and maintenance, as well as end-use technologies such as refuelling stations, vehicle and fuel cell maintenance.

- **Higher education programs:** Universities and colleges offering courses and degrees in hydrogen technology, renewable energy systems, and engineering.

- **Continuing education and upskilling opportunties:** Opportunities to train existing workforces through workshops, certifications, and on-the-job training. BCIT's Hydrogen Symposium identified three elements for an upskilling package: "1) certification for working with materials at extreme high pressure, 2) training in cryogenics for extreme low-temperature materials, and 3) hydrogen safety training." [96]

The workshop feedback highlighted an interest in developing skills and knowledge locally, and existing trade programmes—such as those at Vancouver Island University in Nanaimo- or Camosun College in Victoria—could be expanded to include these skills.

What We Heard: Local Feedback on Regional Considerations

In our workshop, participants were gathered and asked: "What are the competitive advantages associated with hydrogen hub development in the region (compared to other prominent hubs in development) and what are the opportunities to collaborate with neighbouring jurisdictions?" The following themes represent the summarized feedback collected by facilitators.

Regional Advantages

- There is a positive local attitude towards clean energy opportunities and green hydrogen.
- Industrial land and utilities formerly used by pulp and paper mills can be repurposed for hydrogen development.
- The island holds strategic access to domestic and international markets.
- Academic institutions, industry partners and other project proponents support a collaborative and innovative culture.

Regional Challenges

- There is limited public understanding of hydrogen's risks, uses, and benefits, including hydrogen's role compared to existing energy sources.
- There is limited transportation infrastructure, which may increase delivery and deployment costs.
- Growing demands for low-carbon energy across the province and strains on the grid raise questions about prioritization, particularly when some locations on the island have regular outages.
- The island's more remote location can increase costs across the supply chain.

Regional Opportunities

- First Nations are keen to develop new energy projects and infrastructure for the region.
- There is strong interest in green hydrogen end uses, particularly in transportation and remote communities.
- Leveraging positive existing local government and industry relations is crucial to exploring and removing barriers to development.
- Public concerns must be addressed through further educational resources and events.

Regional Recommendations for Hub Partners

- **Explore new ways to enhance knowledge transfer between regional partners and the other hubs.** The Vancouver Island hub would need to establish formalized collaboration channels between potential project partners, including local industry, First Nations, research institutions (such as ACET and IESVic), and local governments. The hub would need to operate in close collaboration with the Lower Mainland and other regional partners to enhance knowledge transfer.
[Recommendation Lead: All Partners]

- **Explore the creation of a regulatory task force.** To foster hydrogen project development, there is a need to streamline regulatory and permitting barriers across the province.. There may be a role for CEMPO to play in facilitating regular collaboration between industry, utilities, First Nations, and municipalities to identify the barriers project developers face and overcome them promptly. This recommendation aligns closely with the policy action in the BC Hydrogen Strategy to "Establish a working group made up of representatives from the hydrogen industry, regulatory agencies, and government to implement B.C. Hydrogen Strategy actions."
[Recommendation Lead: Province, Utilities, BCER]

- **Create a hydrogen workforce development strategy.** To effectively develop and retain talent, a collaborative strategy should include setting measurable and actionable targets for the hub's labour force. BC does not currently have a dedicated labour strategy for the clean economy. A dedicated hydrogen workforce strategy should build on the existing consultations to avoid duplication and rely on partnerships with post-secondary institutions on Vancouver Island and municipalities. Ongoing collaboration between academia and industry is essential to ensure that industry-relevant skills are taught and promoted as tangible career paths for workers of all ages entering the low-carbon workforce. Creative Links, in partnership with Fraser Basin Council and the Province, has undertaken a gap analysis identifying resources for hydrogen labour and skills development in BC; this could lay the strategy groundwork. [97]
[Recommendation Lead: Province, Industry, Post-Secondary Institutions]

- **Continue support for public education and awareness activities.** There is a limited public understanding of hydrogen province-wide. Further efforts are needed to disseminate the latest evidence regarding hydrogen's role in the local economy, covering aspects from carbon intensity and safety to optimal end uses and beyond. Accessible, summarized resources and "101" content can help dispel myths and increase public awareness of the role hydrogen can play in the decarbonization of local communities, thereby building buy-in. The Province has partnered with Fraser Basin Council and the Canadian Hydrogen Association to develop new hydrogen education materials to inform the public. This is a good first step and should be used as a building block for ongoing collaborations between the public, private, and nonprofit sectors to advance awareness and education.
[Recommendation Lead: Province, Local Governments]

Clean Energy Across BC

The BC government is committed to reducing emissions by 40 per cent by 2030 and reach net zero by 2050, which will require the adoption of a wide range of clean energy technologies and solutions. The IEA'S Global Energy Review 2025 noted that global energy demand grew by 2.2 per cent in 2024, faster than the average rate over the past decade. In order to continue to provide low-carbon and low-cost energy, the Province is exploring various clean energy opportunities, including expanding hydro capacity, developing renewable natural gas facilities, and further integrating wind, solar, and geothermal into the grid. The Province is actively investing in supporting technologies like energy storage solutions to manage intermittent renewable energy sources, upgrading the existing grid, and improving energy efficiencies. This energy diversification strategy also includes adapting current energy sources to be less carbon-intensive through technologies such as CCUS. With the growing demand for various fuels and technologies, hydrogen is expected to be complementary to the broader clean energy goals of BC going forward.

Conclusion

The feasibility of a Vancouver Island hydrogen hub by 2035 is intertwined with a complex interplay of factors. The region's upcoming projects and interest in the sector, along with feedstock availability, land, and renewable electricity, present an opportunity for a green hydrogen production hub. However, there are challenges, including infrastructure availability and concerns around future electricity availability. Further advancements and cost reductions are necessary for green hydrogen production and its supporting technologies, which will likely also necessitate new renewable energy sources. There are clear opportunities for strong partnerships with Indigenous communities and First Nations-led projects.

On the demand side, the pathway to success likely lies in prioritizing heavy-duty transportation, particularly trucking, off-road heavy-duty vehicles, and shipping as the primary drivers for hydrogen adoption in the region. While other potential end uses, such as port operations and energy storage hold promise, their current costs limit prospects. The current high cost of hydrogen production and transportation also remains a significant hurdle, underscoring the importance of ongoing research, development, and economies of scale to achieve cost competitiveness with traditional fuels.

Collaboration will be paramount to the hub's success. Collaboration opportunities with the Lower Mainland offer the potential for knowledge sharing, technology transfer, and shared market development. There may also be potential for integration with international markets in the future. However, this is contingent on overcoming regulatory and policy differences, infrastructure gaps, and securing affordable and reliable power—all of which are essential for fostering a conducive environment for investment and innovation. Furthermore, developing a skilled workforce through targeted training and education programs will be critical to support the growth and sustainability of the hydrogen industry in the region.

In conclusion, the development of a hydrogen hub on Vancouver Island presents a compelling opportunity for economic growth and decarbonization. However, its realization demands a concerted effort from all partners. Addressing supply-side challenges, fostering demand in priority sectors, promoting regional collaboration, and investing in workforce development are all crucial steps towards establishing a thriving hydrogen ecosystem in the region by 2035. This will require ongoing commitment, innovation, and strategic investments. By embracing the unique roles of hydrogen in a regional clean economy, Vancouver Island could position itself at the forefront of the next wave of clean economic growth in BC.

All Recommendations for Hub Partners

Category	Recommendation	Lead Partner(s)	Timeline
Supply-Side	**1.** Focus on electrolysis technology adoption and literacy	All Partners	2025-2030
	2. Provide further public clarity on electricity infrastructure adaptation and growth	Province, Utilities	2025-2030
	3. Streamline and harmonize regulations and processes to enhance investment appeal	Province	2025-2030
	4. Promote and support First Nations-led projects	All Partners	Ongoing
Demand-Side	**1.** Focus the Vancouver Island hub's development around heavy transportation	All Partners	2025-2030
	2. Consider the various end-uses within marine and shipping hubs	Province	2025-2030
	3. Continue government funding for demonstration projects and communicate outcomes	Province, Industry	2025-2030
Regional Considerations	**1.** Explore new ways to enhance knowledge transfer between regional partners and other hubs	All Partners	2025-2030
	2. Explore the creation of a regulatory task force	Province, Utilities, BCER	<1 year
	3. Create a hydrogen workforce development strategy	Province, Industry, Post-Secondary Institutions	2025-2030
	4. Continue support for public education and awareness activities	Province, Industry	Ongoing

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