



Hydrogen
Ontario

Hydrogen Ontario
ERO Submission on Low-Carbon Hydrogen Strategy
Renewal
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Table of Contents

- 1. About Hydrogen Ontario..... 4**
- 2. Executive Summary..... 4**
- 3. Key Recommendations..... 6**
- 4. Context..... 10**
- 5. Barriers to adoption..... 11**
 - 5.1. Production Costs..... 11
 - 5.2 Lack of innovation capital..... 13
 - 5.4. Lack of refueling Infrastructure..... 14
 - 5.5. Lack of demand side incentives..... 15
- 6. Consultation Questions..... 16**
 - 1. What additional financial, policy or regulatory supports can the Government of Ontario pursue, in collaboration with the federal government, to accelerate hydrogen production and end-use, and how can the costs and benefits be balanced effectively?..... 16
 - 1.1. Production cost..... 16
 - 1.1.1. Complementary hydrogen investment tax credit..... 17
 - 1.1.2. Guaranteed Electricity Rate..... 18
 - 1.1.3. Hedging Contracts..... 18
 - 1.2. Infrastructure..... 20
 - 1.3. Heavy-Medium Duty Vehicle (HDMV) Rebates..... 21
 - 1.4. Innovation Capital / Heavy-Industry Adoption..... 22
 - 1.5. Government Procurement..... 23
 - 2.a. How can the expansion of hydrogen production and utilization drive economic growth and create high-quality jobs in Ontario?..... 23
 - 2.1. Economic Growth and Investment Attraction..... 23
 - 2.2. Address the need for qualified labour..... 25
 - 2.b. What strategic initiatives or policies could help ensure these opportunities are maximized? Additionally, which industries could integrate hydrogen technologies that currently do not, and what barriers are preventing wider adoption?..... 26
 - 3. How could Indigenous communities be included in and benefit from hydrogen development in Ontario?..... 28
 - 4. How would hydrogen produced from electricity drawn from Ontario's grid impact the province's electricity system and how should this demand be prioritized relative

to other electrification demands?.....	28
5. How could low-carbon hydrogen development be included in the government’s future integrated energy planning?.....	30
6. What are the best market opportunities for low-carbon hydrogen in the short-to-medium term, both for cost-effective production (including the development of hydrogen "hub" communities) and for end-use from an economic and decarbonization perspective? What infrastructure can Ontario leverage in order to make the province a leader in the hydrogen economy?.....	31
6.1. Cost effective production.....	31
6.2. Market Opportunities for short-medium term end-use.....	31
6.3. Existing Infrastructure that can be leveraged.....	32
7. What insights can be gained from existing research and market analysis of the hydrogen sector, particularly in understanding key partners and potential demand in Ontario and globally? What areas of new research or further study could best enhance knowledge of the hydrogen market and development of hydrogen technology?.....	33
7.1. Insight: Enormous economic/ job creation and decarbonization potential....	33
7.2. Insight: The importance of hydrogen hubs to address barriers to adoption..	34
7.3. Insight / New Research: Ontario Hydrogen Hub Locations & Structure.....	34
7.4. New Research: Key infrastructure nodes / locations for refueling stations...	35
7.5. New Research: Economic baseline report.....	35
7. Appendix.....	36
1. Timeline & Budget Considerations.....	36
2. Grid Carbon Intensity by Province.....	39

1. About Hydrogen Ontario

Hydrogen Ontario (“H2ON”) is a provincial affiliate of the Canadian Hydrogen Association (“CHA”), representing over 100 companies across the hydrogen value chain from production to transportation and storage to end-use.

2. Executive Summary

Ontario’s Low-Carbon Hydrogen Strategy aims to develop a **strong hydrogen economy** by **leveraging the province’s strengths**, such as **advanced manufacturing**, a **skilled workforce**, and a **low-carbon electricity grid**.

Key opportunities for hydrogen adoption lie in **high-emission sectors like petrochemicals, steel, cement, and transportation** that need to decarbonize.

Global policies, like the EU’s Carbon Border Adjustment Mechanism (CBAM), **emphasize the need for decarbonization to remain competitive** in the global clean economy, which also presents a tremendous economic and job creation opportunity for our province. A failure to decarbonize will drive up prices for Ontarians, including for housing.¹

The strategy projects up to 100,000 jobs by 2050. H2GO Canada projects about 70,000 jobs by 2030 but achieving this **requires initial government support**. This support will **drive adoption** and **help hydrogen production reach economies of scale**, positioning the province as a leader compared to other jurisdictions.

Since **achieving price parity with incumbent fuels is more feasible in the transportation sector**—and switching to hydrogen-powered trucks, vocational vehicles, cooling trailers, and public transit fleets can happen relatively quickly—**this sector is well-suited for early adoption**. The transition to hydrogen in transportation is also less costly compared to modifying industrial processes. The same holds true for mobile power generation, e.g. to replace diesel generators in the film or construction industry.

¹ CRU Group, Commodity markets will be transformed by high carbon prices, April 2023, access at URL: https://www.crugroup.com/en/communities/thought-leadership/sustainability/commodity-markets-will-be-transformed-by-high-carbon-prices/?utm_source=chatgpt.com

Industries that use hydrogen as a feedstock, such as oil refineries, **are also strong candidates for early adoption**. Replacing carbon-intensive hydrogen with low-carbon hydrogen in these industries typically requires lower capital investment (CAPEX) compared to other sectors.

To facilitate this shift, it's essential to address key barriers by introducing **policies that lower hydrogen production costs and reduce the high purchase price of hydrogen-powered trucks, buses, trains, and vocational vehicles**. Additionally, **public investments are needed to develop refueling infrastructure** tailored to different vehicle types.

Swift action is crucial to the success of Ontario's hydrogen strategy. The strategy should include a **clear timeline, sufficient budget, and specific key performance indicators (KPIs)**. These KPIs should measure factors like the Levelized Cost of Hydrogen (LCOH), total investment in the hydrogen value chain, job creation, and hydrogen demand.

Conclusion

Ontario's hydrogen strategy has **the potential to drive economic growth, create high-quality jobs, and achieve significant decarbonization**. Realizing this potential requires **bold government action, targeted policies, and investments in infrastructure and innovation** to overcome existing barriers and secure Ontario's competitiveness in the global clean economy.

3.Key Recommendations

The successful development of Ontario's hydrogen sector requires a policy mix that covers demand, supply, infrastructure and technology innovation. Hydrogen Ontario suggests the following key action items against a timeline of 3 years, starting with some "low hanging fruit". An overview is included in the Appendix.

2025

Supply Side

- **Direct the IESO to start consultations on a low or capped electricity rate** for low-cost, low-carbon hydrogen production or a hedging contract mechanism modelled on CfDs in the power sector. From a practicality standpoint, a **revamped Interruptible Rate Pilot (IRP)** might be a good option to provide a **lower or guaranteed low electricity rate for low-carbon hydrogen production** that will help lower the cost of hydrogen production.
- **Advocate for the federal government to remove barriers that are currently preventing companies from achieving the full 40% of the CH ITC** e.g. carbon intensity requirements, eligible pathways etc. In the interim provide a stackable provincial low-carbon hydrogen investment tax credit that is pathway agnostic and allows Ontario based electrolytic hydrogen producers to receive the full 40%.
- **Advocate for the federal government to make hydrogen eligible under the Clean Fuels Fund 2.0.**
- Request that the **Ministry of Environment, Conservation and Parks (MECP) expand Ontario's Clean Transportation Fuels Regulation** to make **low-carbon hydrogen and Sustainable Aviation Fuel (SAF) production eligible** for blending as well as generating and selling credits under the regulation.

- Direct the IESO to amend its **Indigenous Energy Support Program** to **include hydrogen production projects** as well as those **helping to reduce diesel dependency and build integrated energy systems** in indigenous communities.

Connecting Supply & Demand

- Provide a **Building Ontario Fund (BOF) set aside for hydrogen distribution, refueling and transportation infrastructure** to de-risk investments. These kinds of investments already fall into BOF's priority areas: transportation, municipal and community infrastructure (e.g. refueling infrastructure for hydrogen buses, trains, garbage trucks, snow ploughs etc.)
- **Amend the Aboriginal Loan Guarantee Program (ALGP)** to include hydrogen infrastructure and developments.
- **Renew the Hydrogen Innovation Fund (HIF).** To **drive economic development**, endow it with a **larger funding envelope** and include funding for **research** as well as **innovative hydrogen technology, industrial decarbonization** and **infrastructure** pilots. Consult with stakeholders for program design considerations.
- Provide funding to **Hydrogen Ontario** to identify hub regions and funding requirements in Ontario outlining **how provincial hydrogen hubs could act as GMMs, connecting and stimulating supply and demand.**

Demand Side

- Request that the Ministry of Finance augment **Ontario's Manufacturing Investment Tax Credit** for **hydrogen related manufacturing investments to 30%.**

Red Tape / Awareness Building

- Provide **funding to Hydrogen Ontario** to support the **roll out of the renewed hydrogen strategy** including **stakeholder engagement** and **public awareness building.**

- Work with other provinces to **harmonize labour requirements** and to ensure that **Ontario gas fitters can travel and operate freely across Canada**. Ensure **continuation** of the **Skills Development Fund** to get **more gas fitters trained and hydrogen certified** and to **encourage the uptake of CSA's hydrogen certification** programs.

2026

Supply Side

- Implementation of **low / capped electricity rate or CfD mechanism for low-cost low carbon hydrogen production**.

Connecting Supply & Demand

- Establish an **Ontario Hydrogen Office** similar to BC's Hydrogen Office or the U.S. DOE Hydrogen Fuel Cell and Technologies Office. The Ontario Hydrogen Office would be a single point of contact for **initial project concepts** and **investment facilitation**, regional hydrogen **hub development**, **coordination of regulatory, permitting, and environment requirements**, hydrogen policy and enabling frameworks as well as indigenous participation. It could also function as a **Green Market Maker (GMM)** modelled on H2Global.

Demand Side

- Request that the Ministry of Transportation **mandate Metrolinx' new leadership to reinvestigate the transition of the GoTransit system to hydrogen trains and buses** once the new strategy is in place and the first policy mechanisms are implemented. The **government plays a crucial role as a first adopter since government procurement sends a powerful market signal**. The government could also identify other areas where it could purchase hydrogen vehicles, hydrogen gensets or **hydrogen powered heating and cooling solutions** etc.

- **Provide top up funding for industrial decarbonization projects** via the industrial portion of the Emissions Performance Standards (EPS) Program. Emitters who paid into the EPS Program should be offered additional public funding for capital-intensive industrial decarbonization projects when applying for funding under the industrial portion of the Emissions Performance Standard Program administered by the Ministry of the Environment, Conservation & Parks (MECP).

2027

Supply Side

- Advocate for **Ontario to become an eligible jurisdiction** under the **federal CCUS tax credit**.

4. Context

Ontario's Low-Carbon Hydrogen Strategy presents a clear vision for developing a robust hydrogen economy by leveraging the province's existing strengths. These include advanced manufacturing expertise, a skilled workforce, a low-carbon electricity grid, established supply chains, and renowned universities and research institutions with strong R&D capabilities. Ontario also benefits from a diverse range of industrial hydrogen users, offering substantial potential for growth.

For instance, the petrochemical and chemical industries in the Sarnia-Lambton area currently consume approximately 150,000 tons of grey hydrogen annually. Transitioning this consumption to low-carbon hydrogen, and eventually expanding it, represents a significant opportunity for decarbonization.

Other sectors with a high-emissions profile are exploring hydrogen as a cleaner alternative. These include steel, cement and fertilizer production as well as transportation (long-haul trucking fleets, return-to-base and vocational fleets, aviation, boats and marine applications), regional and municipal transit, utilities and communities as well as companies requiring portable and off-grid power solutions. The adoption of hydrogen is crucial for Ontario to achieve its decarbonization goals in these hard-to-abate sectors.

Globally, decarbonization policies are shaping trade dynamics. The European Union, one of Ontario's key trading partners, has introduced a Carbon Border Adjustment Mechanism (CBAM) to mitigate competitiveness impacts related to decarbonization. CBAM initially targets high-emission industries such as cement, iron and steel, aluminum, fertilizers, electricity, and hydrogen. A similar mechanism has been under consideration in the United States.

Ontario's hydrogen sector has significant economic potential. The Low-Carbon Hydrogen Strategy estimates the creation of 100,000 jobs by 2050 under a moderate growth scenario. Additionally, a report by H2GO Canada projects that

the sector could generate up to 70,000 jobs by 2030.² H2ON is collaborating with its members to further validate these projections. However, unlocking this potential requires substantial government support.

To make low-carbon hydrogen cost-competitive with conventional fuels, policy measures are needed to incentivize adoption and achieve economies of scale in production. Investment in innovative technologies, processes, and infrastructure must be de-risked through strategic mechanisms. Furthermore, demand-side policies are essential to drive low-carbon hydrogen uptake across industries and support the decarbonization of Ontario's key sectors.

Ontario's remote First Nations communities, currently dependent on diesel fuel, could also benefit from clean hydrogen solutions. These solutions can provide affordable energy for electricity, heating, and cooling. Achieving this requires strategic partnerships and incentives to encourage industry involvement in these initiatives.

Bold and decisive action is needed to realize the full potential of Ontario's hydrogen economy, driving job creation, economic growth, and decarbonization across the province.

5. Barriers to adoption

5.1. Production Costs

One critical barrier to the widespread adoption of low-carbon electrolytic hydrogen in Ontario is **the high cost of electricity**, which accounts for approximately 60-80% of the cost of electrolytic hydrogen. To ensure that low-carbon hydrogen becomes a viable and competitive alternative to natural gas and diesel, it is crucial to address the electricity pricing structure for electrolytic hydrogen producers. The support will contribute to the attraction of investment

² Ontario's Low-Carbon Hydrogen Strategy: A path forward, 04/2022. access at URL: <https://www.ontario.ca/files/2022-04/energy-ontarios-low-carbon-hydrogen-strategy-en-2022-04-11.pdf>

capital to Ontario buoyed by the low carbon electrical grid which would serve to generate carbon credits and environmental attributes.

While the Canadian Hydrogen Investment Tax Credit (CH ITC) is an attempt to lower the costs of low-carbon hydrogen production, due to the carbon intensity requirements³ of the grid, grid connected electrolytic hydrogen producers in Ontario currently only qualify for 15% of the 40% tax credit.⁴

Other provinces such as BC and QC have provincial low-carbon fuel standards in place, on top of the federal Clean Fuel Standard (CFS), that allow hydrogen producers to generate and sell production credits. While Ontario has a well thought-through Cleaner Transportation Fuels Regulation (CTFR), low-carbon hydrogen production is currently not eligible as a way to generate and sell credits under the regulation. This is a missed opportunity to decarbonize the transportation sector while supporting cost-effective low-carbon hydrogen production and commensurate job creation. We advocate for a low-carbon fuel standard in Ontario with minimum low-carbon hydrogen requirements in the energy sector.

In addition, other jurisdictions, such as British Columbia and New York state, for example, are also providing incentives and offering lower, fixed electricity rates specifically for hydrogen production to make low-carbon hydrogen more economically viable. These incentives come in the form of renewable energy programs, time-of-use rates, and other strategies aimed at reducing the cost of electricity for electrolytic hydrogen producers.

The jurisdictions offering these kinds of incentives have a competitive advantage in attracting investment and growing their hydrogen sectors. In New York State, eligibility is based on specific criteria, such as job creation, energy efficiency measures, and commitment to the State's economic development goals. This state level support mechanism resulted in Plug Power's \$290M investment in and construction of a state-of-the-art green hydrogen fuel production facility and

³ EY, Canada's proposed clean hydrogen investment tax credit, April 2024, access at URL: https://www.ey.com/en_ca/technical/tax/tax-alerts/2024/tax-alert-2024-no-21#clean-hydrogen-itc-rates / Deloitte, Comments on CH ITC legislative proposal, September 2024, access at URL <https://www2.deloitte.com/content/dam/Deloitte/ca/Documents/tax/ca-clean-economy-investment-tax-credits-24-09-2024-EN.pdf>

⁴ Carbon intensity and associated credit percentage - see [Appendix 1](#)

electric substation at the Western New York Science, Technology and Advanced Manufacturing Park located in the Town of Alabama, Genesee County.

5.2 Lack of innovation capital

Another barrier is the **lack of access to innovation capital**. Public funding for innovative technology pilots is needed to support the development of alternative low-cost hydrogen production pathways as well as cost-effective end user applications. In addition, companies with innovative technologies particularly struggle to raise capital that will help them commercialize and scale. This situation has been further challenged by the recent Sustainable Development Technology Canada (SDTC) funding freeze and the agency's transformation. SDTC is supposed to be folded into the National Resource Council (NRC) which will form the Canada Innovation Corporation (CIC). CIC is planned to be operational in 2026-27.⁵

This is where the provincial government is needed to either provide dedicated funding or a backstop mechanism, for example a specific funding or loan-guarantee program, to de-risk private investments in innovative technologies. This is similar to what Emission Reductions Alberta (ERA) is offering for innovative solutions and pilots in key growth areas such as hydrogen.

Ontario's Hydrogen Innovation Fund (HIF) provided support to qualifying projects focused on the use of hydrogen to support the electricity grid. Although the funding was well placed with viable projects, it was limited in scope and total funding to support hydrogen pilots or the development of innovative hydrogen technologies outside of this scope.

Ontario has traditionally played a leadership role in the development of new power and energy technologies as well as in the auto-manufacturing sector. All the building blocks for a successful hydrogen industry exist and there is a clear opportunity for Ontario to maintain a leadership position.

⁵<https://www.canada.ca/en/innovation-science-economic-development/news/2024/06/minister-champagne-announces-a-new-governance-framework-for-cleantech-funding.html>

5.3. Lack of programs to de-risk H2 integration in industrial processes

In order for Ontario's heavy industries such as ammonia production, steel and cement manufacturing or oil refining and upgrading to stay competitive in an evolving global clean economy, decarbonization of their production processes will be crucial. For these industries, low-carbon hydrogen is one of the best options to achieve this. As the switch to using hydrogen often requires major capital envelopes with high associated risks which could leave companies with stranded assets, initial transition support is needed to de-risk those investments. A funding mechanism similar to what ERA is providing leveraging Alberta's Technology Innovation and Emissions Reduction Regulation (TIER)⁶ and a program similar to ERA's *Annual Industrial Transformation Challenge* could provide the needed support.⁷ Similarly to TIER, Ontario's Emissions Performance Standard (EPS) program could be leveraged to provide a portion of the funding that is then matched with further public as well as private capital. The answer to question 1 *"What additional financial, policy or regulatory supports can the Government of Ontario pursue, in collaboration with the federal government, to accelerate hydrogen production and end-use, and how can the costs and benefits be balanced effectively?"*, [point 4, further expands on this idea](#).

5.4. Lack of refueling Infrastructure

One of the key barriers to the widespread adoption of hydrogen fuel-cell trucks and other hydrogen-powered vehicle applications in addition to the cost, the price of hydrogen and volume uncertainty, is the **lack of refueling infrastructure** along major transportation corridors. A **structured refueling infrastructure build out is key to decarbonizing the transportation sector across the province**. It would also **enable auto-makers to test their FCEVs in Ontario**. Due to a lack of infrastructure, this is mostly happening in Western Canada right now. This means jobs and economic opportunity lost for Ontario, despite the province's auto-manufacturing and R&D capabilities (e.g. autonomous vehicles).

⁶ <https://www.alberta.ca/technology-innovation-and-emissions-reduction-regulation>

⁷ <https://www.eralberta.ca/media-releases/alberta-announces-50-million-from-tier-fund-to-reduce-emissions-improve-competitiveness-through-eras-annual-industrial-transformation-challenge>

Hydrogen is earmarked as the preferred fuel to decarbonize the trucking industry where active time in transit drives earnings. Fuel Cell Electric Vehicles (FCEV) are **much lighter and provide longer driving ranges** compared to their battery electric equivalents. This means **more freight, less trucks**. In addition, **refueling times are much shorter**, and the **state of charge is not affected by a decrease in temperature**. This is why hydrogen also makes sense for return-to-base vehicles that can't afford long charging times. Moreover, in cases where hydrogen infrastructure is already available for other applications, it creates efficiencies. For FCEVs, **less charging stations and space** are needed given the shorter dwell times required for refueling as described by the National Academies Press: "Hydrogen refueling of light- and medium-duty FCEVs takes minutes, while even fast-charging of BEVs takes hours. Therefore, an order of magnitude more FCEVs can be refueled at a hydrogen station."⁸ In addition, there may not be enough electricity to power the BEV charging stations that would be required to decarbonize Ontario's transportation sector in the immediate future, during peak energy demand scenarios.

5.5. Lack of demand side incentives

As mentioned above, the **purchase of a new ZEV fleet is often cost prohibitive**. This is why other jurisdictions offer ZEV incentives in addition to those the federal government offers. The **absence of competitive policies** in Ontario represents a major market barrier that needs to be overcome to set Ontario's industries on an equal footing with their counterparts in other jurisdictions. Ontario has the opportunity to stay competitive by incentivizing the purchase of ZEVs which would secure further auto-manufacturing investments and jobs in the province at the same time. Auto-manufacturing has played a key role for the economic growth of our province. With the EV/ EV battery sector growing slower than predicted⁹, hydrogen-powered vehicles can provide another opportunity for growth as well as job creation and retention in the Ontario auto-manufacturing industry.

⁸National Academies Press: Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy—2025-2035 (2021), Chapter: 6 Fuel Cell Electric Vehicles, National Academies of Sciences, Engineering, and Medicine. 2021. Washington, DC: The National Academies Press at URL: <https://nap.nationalacademies.org/read/26092/chapter/8#180> (access: 2/12/2024).

⁹ <https://electricautonomy.ca/ev-supply-chain/2024-12-02/canada-ev-battery-supply-chain-challenges/>

6. Consultation Questions

1. *What additional financial, policy or regulatory supports can the Government of Ontario pursue, in collaboration with the federal government, to accelerate hydrogen production and end-use, and how can the costs and benefits be balanced effectively?*

To accelerate hydrogen production and end-use, the barriers to adoption highlighted under point 5 above need to be addressed.

1.1. Production cost

By leveling the playing field with incumbent fuels, the Ontario government would unlock the full economic potential of hydrogen in the province while enabling Ontario's industrial sectors to remain competitive. CANCEA estimates a "staggering \$218.8 billion boost of Ontario's economy between 2024 and 2050 fostering an annual average of 44,343 jobs" resulting from a focus on CCS and hydrogen gas systems.¹⁰ H2GO's Report *Forecasting Low-Carbon Hydrogen Market Characteristics in Ontario to 2050* projects 70,000 jobs in the Ontario hydrogen sector by 2030 if the full hydrogen potential is leveraged.¹¹

The federal government has implemented several policies and programs aimed at reducing the cost of hydrogen production.

It has complemented the Clean Fuel Regulation (CFR) with the Clean Fuel Fund (CFF) to de-risk capital investments required to build new or expand existing clean fuel production facilities. Support is also available for feasibility and front-end engineering and design (FEED) studies. The fund is currently being updated for the 2026-30 period. In the government's current plans for CFF 2.0 however, hydrogen is ineligible for funding outside of the indigenous stream.

¹⁰ Economic Contribution of CCS and H2 Investments in Ontario, 2024-2050, CANCEA, October 2023.

¹¹ Forecasting Low-Carbon Hydrogen Market Characteristics in Ontario to 2050, H2GO Canada, September 2023.

In addition, due to the carbon intensity requirements¹² of the Canadian Hydrogen Investment Tax Credit (CH ITC), grid connected electrolytic hydrogen producers in Ontario currently only qualify for 15% of the 40% tax credit.¹³ This percentage will further decrease as the carbon-intensity of the Ontario grid is forecasted to increase. Moreover, a number of production pathways such as methane pyrolysis currently don't qualify for the CH ITC.

This is an opportunity for the Ontario government to support the industry and provide a **complementary hydrogen investment tax credit, a lower or guaranteed low electricity rate for low-carbon hydrogen production and/or hedging contracts combined with a double-sided auction process.** The latter could be modelled on the H2Global mechanism, also referred to as a Green Market Maker (GMM), designed to de-risk investments in production projects, guarantee low-carbon hydrogen production cost competitiveness, and allow for a low level of commitment (short-term contracts) on the offtaker side. In essence, GMMs such as H2Global are *“intermediaries that step into the value chain to buy and sell green commodities via a price discovery and optimisation mechanism to achieve the lowest costs from producers and highest willingness to pay from offtakers respectively. The residual ‘green price gap’ can be covered by concessional capital, most often government funding. H2Global is the first and only concessional capital-backed Green Market Maker operating globally [...] and has pioneered an approach that can be replicated across sectors and regions, jump-starting markets and absorbing risk.”*¹⁴

All of the options are discussed in the following sections.

¹² EY, Carbon Intensity and associated credit percentage, April 2024, access at URL: <https://globaltaxnews.ey.com/news/2024-0723-canadas-proposed-clean-hydrogen-investment-tax-credit-discussed>

¹³ [See Appendix 1](#)

¹⁴ Mission Possible Partnership, Unleashing market forces to scale green industry. The role of Green Market Makers, p. 8, Washington DC, USA, 2024 at URL: https://gmm.missionpossiblepartnership.org/downloads/Mission_Possible_Partnership-24-Unleashing_market_forces_to_scale_green_industry-The_role_of_Green_Market_Makers_EN.pdf

1.1.1. Complementary hydrogen investment tax credit

A provincial hydrogen investment tax credit needs to be stackable with the federal CH ITC, be pathway agnostic and designed in a way so that Ontario based hydrogen producers achieve a 40% credit.

1.1.2. Guaranteed Electricity Rate

Preliminary market research indicates that **an all-in electricity rate of no more than \$30/MWh would help electrolytic hydrogen to be cost-competitive with alternatives** (e.g. grey hydrogen at \$2-3/kg). To put this request into perspective: Since 2019, the hourly wholesale energy price in Ontario has averaged less than \$27/MWh.

The previous Interruptible Rate Pilot ("IRP") introduced by the IESO had promising features but ultimately did not meet the specific needs of the hydrogen industry. For example, the term of the program was limited to just three years, only existing facilities qualified, and the existing cap on projects of 50 MW, constrained the number and financial viability of hydrogen facilities.

A revised rate mechanism, tailored to the unique operating needs of hydrogen producers will help drive investment in Ontario's hydrogen sector and create substantial economic and environmental benefits for the province: **Electrolytic hydrogen facilities are flexible resources**. Depending on the technology, **the facilities can respond to market signals very quickly** - an electrolyzer can react within seconds - and they have the **ability to address grid reliability needs**. In addition, during times of peak demand, **these facilities can curtail consumption for 4, 8, or even over 12 hours in duration**. This is **akin to other resources that provide premium value to the Ontario grid such as long-duration storage, hydroelectric power and natural gas generating facilities**.

1.1.3. Hedging Contracts

There are two types of hedging contracts: 1. Hedging contracts that have traditionally been used in the power / renewable energy sector to compensate for the initial price premium of electricity from renewable energy projects. They

de-risk investments in production projects and compensate for the green premium on the supply side (Contracts for Difference, CfD). 2. Hedging contracts that are targeted towards the demand side and compensate for the green premium on the demand side, incentivize hydrogen demand and de-risk industrial decarbonization projects (Carbon Contracts for Difference, CCfD).¹⁵

Hedging contracts targeted towards the demand side could be used to provide investment certainty and encourage first industrial projects e.g. in steel, cement, refineries and chemical production or offtake in the transportation sector, as they compensate for the added costs required to transition to low-carbon operations.

In Germany, CCfDs include an early termination option after three years in the event that the decarbonized operations become cheaper than the conventional process. The early termination feature attempts to address the delicate balance between suppliers in need of long-term offtake agreements and offtakers that are unwilling to commit long-term, knowing that the price of low-carbon hydrogen will come down. This way, long-term offtake agreements can be made but immediately terminated when the competitive market starts to drive prices down.

The UK, France, the EU (Hydrogen Bank) as well as Japan and South Korea have already successfully applied or are preparing CfD schemes for hydrogen production projects, by compensating the delta between the production costs and the required market price, determined by incumbent fuels. Once the gap decreases, the support can be phased out.¹⁶

The Green Market Makers (GMMs) mentioned above contract with parties on the supply and demand side following a competitive auction process on both sides and apply a Contract for Difference (CfD) logic in that they compensate the price delta between production costs and the required market price but they do not issue CfDs or CCfDs.

In Ontario, a provincial Hydrogen Office or regional Hub Offices could be designed to function as GMMs. Alternatively, supply and demand hedging contracts can be an effective way to kickstart the hydrogen industry and allow it to reach economies of scale faster.

¹⁵ Agnieszka Ason, Senior Visiting Research Fellow, OIES Julio Dal Poz, Managing Director, FTI Consulting, Contracts for Difference: the Instrument of Choice for the Energy Transition, The Oxford Institute for Energy Studies, April 2024, p. 18 accessed at URL:

<https://www.fticonsulting.com/uk/insights/reports/-/media/d91292b0db4249a7b30b416cd72e1c41.ashx>

¹⁶ *ibid.*

1.2. Infrastructure

The federal government currently provides funding for hydrogen refueling infrastructure through CIB's Charging and Hydrogen Refuelling Infrastructure (CHRI) Initiative. This program is designed to accelerate the deployment of zero-emission vehicle (ZEV) infrastructure by providing financing to private sector projects that involve public fast charging or hydrogen refueling stations in Canada. In addition, NRCan provides funding for hydrogen refueling infrastructure through its Zero-Emission Vehicle Infrastructure Program (ZEVIP) which covers 50% of total project costs, with a maximum contribution per charging station depending on its type and capacity. There are, however, several issues that Ontario companies are facing:

1. Potential early adopters are reluctant to purchase hydrogen vehicles in Ontario even if they can absorb the higher purchasing costs. This is because the supply of low-carbon hydrogen, its production, transportation and dispensing into the hydrogen vehicles as well as its price point are uncertain.
2. There's currently no funding program for infrastructure enabling the transportation of hydrogen, e.g. via pipelines.
3. Other jurisdictions including Alberta, Quebec and New York State provide additional funding mechanisms for hydrogen refueling infrastructure which seem necessary to offset the high investment costs and risks currently associated with developing hydrogen refueling infrastructure.

For Ontario to remain competitive and to secure jobs, investments and other forms of economic value creation in the province, an infrastructure funding program that would level the playing field with the aforementioned jurisdictions needs to be considered and implemented at pace.

The Building Ontario Fund (BOF) should be mandated to de-risk investments in hydrogen refueling and transportation infrastructure. Given the huge economic and emission-reduction potential for hydrogen in the transportation space, these investments are in the public interest and will be revenue generating further down the line. They also fall into BOF's priority areas: transportation, municipal and

community infrastructure (e.g. hydrogen buses, trains, garbage trucks, snow ploughs etc.)

A renewal of the Hydrogen Innovation Fund (HIF) could allocate funding for refueling stations at key transportation nodes and award the most innovative and cost efficient solutions. Based on that, further public funding could be deployed.

However, in order to mitigate the uncertainty around the supply of low-carbon hydrogen, its production, transportation and dispensing, as highlighted throughout the submission, a mix of different policy mechanisms is required beyond a public funding program for refueling infrastructure and potentially pipelines: e.g. a hedging mechanism for low-cost hydrogen production on the supply side as well as demand-side hedging contracts to secure offtake.

1.3. Heavy-Medium Duty Vehicle (HDMV) Rebates

As outlined above, the federal government currently offers incentives for hydrogen fuel cell heavy-medium duty vehicles through the iMHZEV program which is set to phase out by March 31, 2026 or when the funding is exhausted, whichever comes first. Other jurisdictions such as Quebec¹⁷, Nova Scotia and New York State¹⁸ are offering complementary incentives to the ones provided on a federal level. We recommend that the Ontario government provide an extension of the federal program starting in 2026 which will make auto-manufacturing investments in the province more attractive and support the expansion of this sector. All low-emission vehicles, including dual fuel applications and other relevant equipment such as Transportation Refrigeration Units (TRUs) should be considered. The scope of the incentives needs to be reviewed on a regular basis, e.g. every 4 years. Overall, as highlighted multiple times throughout the submission, it is important to ensure that supply and demand side policies go hand-in-hand with public-private infrastructure investments to kickstart the hydrogen industry and leverage its full economic and job creation potential in the

¹⁷ QC Incentive:

<https://www.quebec.ca/en/transports/electric-transportation/financial-assistance-electric-vehicle/new-vehicle/amount-financial-assistance>

¹⁸ NY State incentives. Information at <https://afdc.energy.gov/laws/10452>

province.

1.4. Innovation Capital / Heavy-Industry Adoption

Ontario innovations in the hydrogen space as well as industrial decarbonization projects e.g. in transportation, cement, steel and refining, could be supported by an Emissions Reductions Alberta (ERA) type agency, matching private and capital sector funding.

Given its experience with innovation projects and in building partnerships as well as consortia with industry and academia, the Ontario Centre of Innovation (OCI) could take on this mandate. ERA is leveraging Alberta's Technology Innovation and Emissions Reduction Regulation (TIER)¹⁹ to fund its programs, e.g. ERA's *Annual Industrial Transformation Challenge*.²⁰ The public funding portion has the important function of de-risking investments in decarbonization projects. Similarly to TIER, Ontario's Emissions Performance Standard (EPS) program could be leveraged to provide the public funding portion that is then augmented with further public funding, depending on the emission reduction potential of the project. Any public funding that is deployed needs to be matched with private capital.

In addition, the province could provide a Loan Guarantee Program to de-risk investments in emerging technologies that drive innovation in the sector across the value chain.

As mentioned above, the rate payer funded Hydrogen Innovation Fund (HIF) was a good start but very much focused on grid related research projects and endowed with a very small funding envelope that is not sufficient for hydrogen pilots or the development of innovative hydrogen technologies that will move the needle on hydrogen deployment in our province. Any renewal of the fund needs to draw on larger pools of capital.

¹⁹ <https://www.alberta.ca/technology-innovation-and-emissions-reduction-regulation>

²⁰ <https://www.eralberta.ca/media-releases/alberta-announces-50-million-from-tier-fund-to-reduce-emissions-improve-competitiveness-through-eras-annual-industrial-transformation-challenge>

1.5. Government Procurement

The government plays an important role as a first adopter of any kind of innovation but especially when it comes to hydrogen. Its purchasing power would not only send the market signals needed to kickstart the hydrogen economy in the province but potentially attract investments. If Metrolinx was to transition the GoTransit network to hydrogen, for example, this could attract (further) investments by companies building hydrogen trains and buses such as Alstom, New Flyer (buses), MTB Transit Solutions / Diesel Tech Industries (DTI)²¹ and Siemens. Both Alstom and Siemens already have hydrogen trains on the tracks in Europe, which will enable them to make further technology improvements before hitting the North American market. However, deploying their hydrogen trains in North America requires major design adaptations that can only be justified by a bigger purchasing order. If Ontario moves first and provides such a purchasing order, it also puts itself in a good position to negotiate investments in the province which may include developing trains specifically designed for the North American market. In addition, hydrogen trains avoid the need to invest in catenary which is labour and cost intensive and a potentially lengthy process due to the community engagement requirements associated with building a huge web of overhead lines.

2.a. How can the expansion of hydrogen production and utilization drive economic growth and create high-quality jobs in Ontario?

2.1. Economic Growth and Investment Attraction

As noted in the introduction, the Low-Carbon Hydrogen Strategy report cites that the sector could result in 100,000 jobs by 2050. A report by H2GO Canada highlights that the hydrogen sector in Ontario could create as many as 70,000 jobs by 2030.

Having success domestically is a necessity for Ontario based companies to be able to export and/or expand. Incentives and clean economy or decarbonization investment programs in other provinces such as Alberta, BC and Quebec or in the jurisdictions of key trading partners such as the U.S. and the EU make

²¹ MTB and DTI retrofit buses by installing DTI's Hydrogen Dual-Diesel Dual Fuel System

manufacturing more attractive outside of Ontario. Similarly, for foreign companies to invest and establish their operations in Ontario, whether it is electrolyzer, hydrogen storage systems, hydrogen generator systems parts, fuel cell or ZEV manufacturing, Ontario needs to have a flourishing hydrogen economy (market size) and provide conditions that are as attractive as in other, competing jurisdictions, e.g. EU, U.S., Quebec etc.

The US Department of Energy (DOE) gave \$50M each to projects involving Cummins, Electric Hydrogen, Plug Power, and Thyssenkrupp Nucera, most of that to support setting up or expanding US-based factories. France has given more than 200M Euros to McPhy, Elogen, Genvia, and John Cockerill to support their factories.

The Alberta government offers industrial diversification funding through the Alberta Petrochemicals Incentive Program (APIP) which supported the set up of Air Products' natural gas to hydrogen production facility. APIP offers companies a grant worth 12 percent of their eligible capital costs when building new plants for petrochemical, hydrogen, fertilizer or fuel products, or expanding existing ones. The program was designed to put Alberta on a level playing field and compete against similar programs offered by American states like Louisiana and Pennsylvania.²²

As mentioned in our response to question 1., there's also a real opportunity to attract first-of-a-kind investments in Ontario if the province leverages its purchasing power as a first adopter, e.g. of hydrogen trains and buses which may incentivize train and bus manufacturers such as Alstom, New Flyer and Siemens to make investments in Ontario based manufacturing facilities.

Having hydrogen related manufacturing capabilities in Ontario and being a technology exporter means those skilled jobs are created in our province. Supporting local manufacturing also helps to secure local equipment supply amidst potential tariff escalation and desires to reshore manufacturing.

²² <https://www.alberta.ca/alberta-petrochemicals-incentive-program#jumplinks-6>

In addition, the European Union, one of Ontario's key trading partners, has recently implemented a Carbon Border Adjustment Mechanism ("CBAM") to compensate for the competitiveness impacts of decarbonization policies. In the US, a similar mechanism has been considered. The EU CBAM initially targets high-emission sectors, including cement, iron and steel, aluminum, fertilizers, electricity, and hydrogen.

In order for Ontario's heavy-industries such as steel, cement and petrochemical production to remain competitive in the global clean economy and to keep these industries as well as related direct and indirect jobs in the province, these industries need to decarbonize. Low-carbon hydrogen is an opportunity to achieve this while creating additional jobs in Ontario's manufacturing sector (e.g. vehicles / vehicle parts, fuel cells, electrolyzers, storage systems etc). For example, a cement plant could use hydrogen to reduce scope 1 and 2 emissions significantly. The oxygen from the hydrogen production could be used to decarbonize the cement production process while the hydrogen could be used to replace diesel cement trucks or to produce ammonia to power the barges transporting the limestone to the production site. The transformation of the plant's operations will rely on and stimulate local hydrogen production and hydrogen related manufacturing (hydrogen power cement trucks and parts, ammonia powered barges, refueling station systems etc).

Furthermore, Ontario's remote First Nations communities, currently reliant on diesel fuel, could benefit significantly from clean hydrogen solutions, providing affordable energy for electricity, heating, and cooling as well as economic self-sufficiency.

2.2. Address the need for qualified labour

As highlighted above, with the expansion of the hydrogen sector in Ontario, there will be a significant need for qualified labour.

CSA Group has developed a hydrogen technician certification and related training. It is important to note however, that these technicians would need to work under a P Eng in order to be insured at a rate that is economically feasible for the companies. This "industrial exception" regime keeps the labour costs for at scale

production down, but may not be ideal for an industry at nascent stages (focus on ad hoc projects, custom work, installations etc).

Until such time that hydrogen technologies are manufactured at scale in Ontario, and companies can leverage the “industrial exception” for cost savings, licensed gas fitters with hydrogen certificates will likely be the major labour source for hydrogen across the province. The issue is that fuel certificates for gas fitters are not harmonized across Canada and that this group of professionals is in high demand, e.g. by the geothermal industry.²³ Ontario could work with other provinces to harmonize labour requirements and to ensure that Ontario gas fitters can travel and operate freely from Ontario to BC and AB, and vice versa. We have 63,000 gas fitters in Ontario at present, but only several hundred hydrogen certificates have been issued to date. Gas fitters will likely be doing the bulk of work in Ontario’s emerging hydrogen industry as they would be the most cost effective option until the industry reaches scale. Therefore the Ontario government should ensure a continuation of the Skills Development Fund to get more gas fitters trained and hydrogen certified and to encourage the uptake of CSA’s hydrogen certification programs.²⁴

2.b. What strategic initiatives or policies could help ensure these opportunities are maximized? Additionally, which industries could integrate hydrogen technologies that currently do not, and what barriers are preventing wider adoption?

As outlined above, the hydrogen sector is at a point where it needs a mix of demand and supply side policies in addition to policies that de-risk major capital investments so its economic potential can fully unfold. The necessary capital investments span hydrogen refueling infrastructure as well as the integration of hydrogen into the conventional processes of Ontario’s heavy industries.

Ontario’s hard to abate industries such as steel, cement, fertilizer production, refineries, petro-chemical production, transportation and power generation could

²³ <https://www.tssa.org/search-results?q=fuel+certificates>

²⁴ <https://www.ontario.ca/page/skills-development-fund>

all integrate hydrogen technologies which would help reduce their scope 1 and 2 emissions significantly.

In addition, hydrogen could be used to replace diesel generators in the construction and film industry or for integrated energy systems in remote communities.

The following factors that have been detailed above are currently preventing the wide-spread adoption of hydrogen in those industries:

- Lack of mechanisms to de-risk large capital investments in new decarbonized production processes, e.g. in the steel and cement industry. This is where an Emissions Reductions Alberta TIER type public-private funding mechanism could be beneficial. With the Ontario Centre of Innovation as a potential agent, Ontario is well equipped to establish such a mechanism geared towards decarbonization. The proceeds from Ontario's Emissions Performance Standards Program (EPS) - both from heavy-industry as well as electricity generation - could be augmented with public funding and required to be matched with private capital when spent on decarbonization projects.
- Hydrogen price uncertainty prevents a switch to hydrogen across the board. This is where CfDs, a Green Market Maker mechanism or a low / guaranteed electricity rate as hedging mechanisms could make a difference.
- Absence of hydrogen infrastructure for adoption in heavy-medium duty transportation and transit. This is where public procurement, investments and/or funding are needed. A range of adopters seem to assume that building refueling infrastructure is not their responsibility. Hydrogen truck manufacturers either don't have the required capital available and/or can't raise the capital needed without a purchase order. This is an area where demand-side CfDs combined with ERA TIER type funding or a provincial loan guarantee program may be able to de-risk the major capital investments that are needed to jump start the market. In addition, the Building Ontario Fund (BOF) could include a set aside for hydrogen.

3. How could Indigenous communities be included in and benefit from hydrogen development in Ontario?

The Aboriginal Loan Guarantee Program (ALGP) could be amended to include hydrogen infrastructure and developments. Similarly to the criteria set out in Ontario's Long-Term Electricity Procurement RFP 2 (LT2), projects with indigenous partners / indigenous equity participation could be prioritized for public funding or fiscal support. In addition, a provincial or the federal hydrogen investment tax credit could be higher for projects with indigenous participation or those that favour skills development and create employment in indigenous communities, similarly the US tax credit mechanisms under the Inflation Reduction Act (IRA).

IESO's Indigenous Energy Support Program could also be amended to include hydrogen production projects as well as those helping to reduce diesel dependency and build integrated energy systems in indigenous communities²⁵.

4. How would hydrogen produced from electricity drawn from Ontario's grid impact the province's electricity system and how should this demand be prioritized relative to other electrification demands?

Hydrogen Ontario expects minimal impact of electrolytic hydrogen projects on the province's electricity system for a number of reasons. The electrolytic hydrogen production projects that are expected to become operational in the next five years will draw a combined capacity of less than 500 MW with 50% becoming operational in the 2028-30 time span. Developing a hydrogen production project takes between 3-5 years. So even if supply side policies were put in place in 2025, there won't be a significant number of electrolytic hydrogen production projects added to the Ontario landscape before 2030. Meanwhile we will also see alternative production pathways such as methane pyrolysis commercialize. Given the recent introduction of the *Resource Management and Safety Act* we may also see first CCS projects in Ontario allowing for the production of low-carbon hydrogen through steam methane reforming (SMR), for example. These pathways

²⁵<https://www.ieso.ca/Get-Involved/Indigenous-Relations/Indigenous-Energy-Support-Program/IESP-Overview>

take minimal grid electricity. Also, given that Ontario’s nuclear refurbishments have been proclaimed to be completed on if not ahead of schedule, there is a lot less strain on the Ontario grid to be expected in the 2030s when we may see more electrolytic hydrogen projects become operational. In addition, electrolytic hydrogen production projects are flexible resources which can peak shave and thus minimize grid load. The H2GO Canada Report cited above which assumes that the full potential of Ontario’s hydrogen sector is leveraged, states the following:

“The Base Case scenario projects total production of low-carbon hydrogen in Ontario are negligible until the late 2020s, and then rapidly increasing to roughly 600 megatonnes, annually, by the mid-2030s, relying mainly on grid-powered electrolysis and steam methane reforming.”

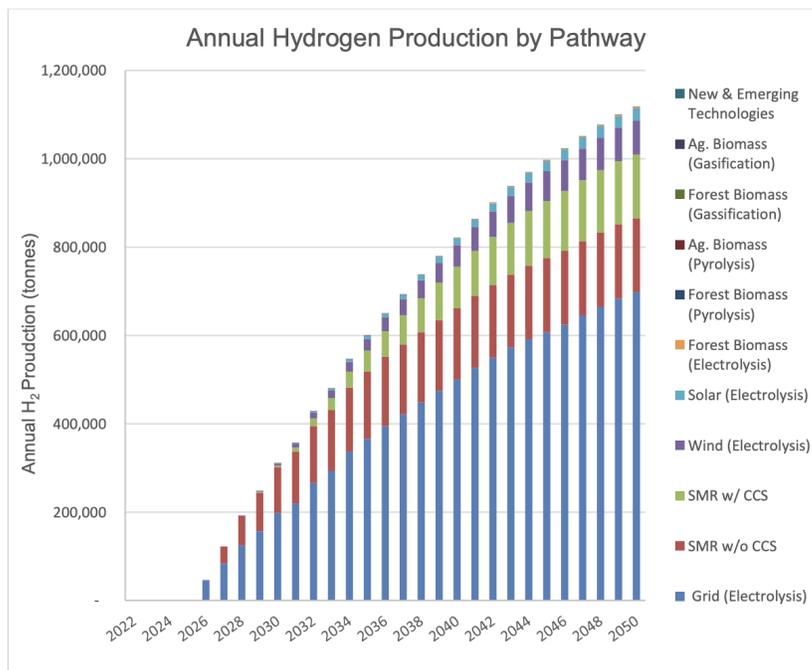


Figure 16: Annual Hydrogen Production by Pathway

5. How could low-carbon hydrogen development be included in the government's future integrated energy planning?

The H2GO Canada report forecast could be factored into the government's future integrated energy planning. *"Recognizing the competing demands for energy in Ontario, especially for electricity", the (H2GO) model generates "appropriately conservative estimates of hydrogen production. Electrification is central to the decarbonization plans of many energy end-uses, such as the transition from gasoline to plug-in power for electric vehicles. The study team endeavoured to reflect these constraints when assessing the availability of energy feedstocks in the production module. For example, the Base Case assumes that any hydrogen production pathways requiring grid-supplied power would make use of no more than 50 per cent of the unutilized generation capacity (i.e., the difference between the grid supply potential and actual electricity consumption) by 2050."*²⁶

However, especially if production pathways such as methane pyrolysis or alternative, non-electrolytic hydrogen production pathways (e.g. waste products to hydrogen) as well as SMR with CCS or off-grid renewables to hydrogen projects were to be developed more rapidly, e.g. through targeted government support, the predicted grid electricity need may not align with the H2GO Canada forecasting. In fact, it might be off already since the current environment is not ideal for the full economic potential of the hydrogen sector to unfold. So the hydrogen production projects the report foresees may become operational a lot later than the report predicts. In other cases, hydrogen may turn out to be the more viable option and merely replace electric solutions instead of adding to the forecasted electricity demand, e.g. in municipal and regional transit, in commercial fleets and industrial processes.

²⁶ Forecasting Low-Carbon Hydrogen Market Characteristics in Ontario to 2050, p.29, H2GO Canada, September 2023. Accessed at URL on 4/12/2024:
<https://static1.squarespace.com/static/6224c1708b4b4c7cd6823f2e/t/653acab920619c36bd8b8301/1698351811244/H2GO+Canada+OHFS+Report+2+-+Forecasting+Low-Carbon+H2+Markets+in+Ontario+to+2050.pdf>

6. What are the best market opportunities for low-carbon hydrogen in the short-to-medium term, both for cost-effective production (including the development of hydrogen "hub" communities) and for end-use from an economic and decarbonization perspective? What infrastructure can Ontario leverage in order to make the province a leader in the hydrogen economy?

6.1. Cost effective production

In order to produce low-carbon hydrogen effectively, there needs to be scale. In order for there to be scale, there needs to be a guaranteed price and volume so end users can commit offtake (see above). All pathways can be cost effective, with the most cost effective one currently being steam methane reforming (SMR) with CCS which is not yet possible in Ontario. Supporting the commercialization of emerging production pathways such as methane pyrolysis or similar production processes that have other by-products would be another way of accelerating cost-effective production pathways.

The most effective way to achieve competitive hydrogen production is the implementation of a Green Market Maker (GMM) or CfDs on both the supply and the demand side.

The most practical solution that currently presents itself in Ontario is a redesign of the Interruptible Rate Pilot (IRP) in consultation with the province's hydrogen stakeholders.

6.2. Market Opportunities for short-medium term end-use

In the short to medium term, replacing conventional vehicle fleets (medium-heavy duty trucks, cooling trailers, municipal / regional bus fleets, vocational vehicles such as snow-ploughs, garbage trucks etc) as well as diesel powered regional transit with hydrogen powered solutions makes sense both from a cost and emission reductions perspective.

Replacing carbon intensive hydrogen that is used as a feedstock, e.g. in refineries, with low-carbon hydrogen also seems to be a relatively simple way to reduce emissions.

On the use of hydrogen in regional transit: as mentioned above electrifying the GoTransit system hardly seems to make sense given the massive infrastructure investment this will require as well as the associated potential community backlash and the massive skilled labour shortage Ontario is facing. Opting for hydrogen would add to the successful deployment of the industry and potentially attract major investments. The Ontario government has an important role to play here as a first adopter, sending a powerful market signal. It ultimately comes down to an economic development decision.

6.3. Existing Infrastructure that can be leveraged

Enbridge's Dawn Hub, located in southwestern Ontario, is one of the largest and most important natural gas storage facilities and trading hubs in North America. Facilities like Dawn could potentially be integrated into the hydrogen economy. The storage is located in depleted natural gas reservoirs and salt caverns, making it both reliable and scalable. Dawn is connected to multiple pipeline systems, including Enbridge's own network, which allows for the movement of gas across borders and regions. This connectivity enhances its role as a major hub for natural gas distribution. In the future it could potentially play a role in hydrogen blending or hydrogen storage, as part of Ontario's energy transition. This however, would require technological advancements, as hydrogen molecules are much smaller than natural gas and require different handling and storage systems.

In the same area, Lambton is located on Canada's largest salt deposit. Seventy-six active caverns in Lambton County are currently used by local chemical and energy industries for storage which is the equivalent of two hundred storage tanks. There is up to 3.5 million cubic meters of storage capacity in existing salt caverns which could potentially be used to store hydrogen.

Hydrogen storage in salt caverns is also explored by Atura Power in the Windsor area.

7. What insights can be gained from existing research and market analysis of the hydrogen sector, particularly in understanding key partners and potential demand in Ontario and globally? What areas of new research or further study could best enhance knowledge of the hydrogen market and development of hydrogen technology?

7.1. Insight: Enormous economic/ job creation and decarbonization potential

Existing research and market analysis highlights the enormous economic potential of hydrogen in Ontario. H2GO Canada estimates 70,000 jobs by 2030. CANCEA forecasts an annual average of 44,343 jobs if Ontario invests in hydrogen and CCS. It concludes: *"Investing in hydrogen and CCS, particularly in hard-to-abate sectors such as cement, steel, and fertilizer manufacturing, serves as the catalyst for substantial economic expansion, both for the entire Ontario economy and for specific industry sectors. The broader Manufacturing sector stands to gain the highest returns from this initiative due to increased demand for manufactured goods, while the Utilities sector receives the second highest contribution in terms of average annual GDP and labour income, and the Retail Trade sector earns the second highest contribution in terms of average annual jobs created."*²⁷

Observing current developments in the Ontario hydrogen sector, we are seeing first projects in transportation and transit, hydrogen blending as well as portable power applications. The replacement of carbon-intensive hydrogen in industries where hydrogen is used as a feedstock, e.g. oil refineries, may be the next step due to the low CAPEX associated with the switch to low-carbon hydrogen.

²⁷<https://www.cancea.ca/wp-content/uploads/2023/10/Economic-Contribution-of-CCS-and-H2-Investments-in-Ontario-2024-2050-Oct-20-Final.pdf>

7.2. Insight: The importance of hydrogen hubs to address barriers to adoption

Hydrogen hubs are regional partnerships between the different economic players in one specific region designed to accelerate the development of regional hydrogen economies by connecting local supply and demand as well as facilitating R&D initiatives, deployment and collaboration. Every region has different strengths and opportunities that the hubs can help leverage while identifying needs for foreign direct investment and hydrogen deployment. There may also be a role for hydrogen hubs to act as Green market Makers (GMMs) if given the required concessionary funding to do so.

A recent report by H2Global examines the roles of hydrogen hubs in connecting supply and demand and overcoming critical barriers to the widespread adoption of hydrogen. It concludes that "Hubs provide an opportunity to bundle offtake, thus increasing offtake security where companies are not willing to commit to long-term contracts." The authors further emphasize that "Integrated hubs that include both production and offtake facilitate learning by doing, infrastructure build-out, and the emergence of hydrogen ecosystems that include research facilities, engineering companies, and industrial and other users. They also have the potential to create new well-paying jobs, including for those potentially impacted by the phase out of fossil fuels." The report further highlights the U.S. Hydrogen Hub Program towards which the U.S. government has allocated \$8 billion as "the approach with the most comprehensive aspiration for hydrogen demand based on hydrogen hubs to date."²⁸

7.3. Insight / New Research: Ontario Hydrogen Hub Locations & Structure

The importance of connecting and stimulating supply and demand through hubs thus overcoming critical barriers ("the chicken-and-egg-problem") is crystal clear. Further research is needed to identify ideal hub locations and to investigate how Ontario based hubs could act as Green Market Makers (GMMs).

²⁸ H2 Global Foundation, Unlocking potential: Scaling demand through hydrogen hubs, p. 14, December 2024.

Potential hub locations in Ontario are the Sarnia-Lambton region, the Mississauga-Brampton area, the Greater Hamilton Area, Bruce County and Durham Region. **In order to be effective and to overcome the “chicken-and-egg-problem”, Ontario’s hubs require funding.** There needs to be a team of full-time employees managing the hub to leverage regional strengths effectively and to reach synergies.

Due to each region's different strengths and opportunities, the hub administration, set up and membership will differ from hub to hub. Some hubs will likely concentrate on R&D, some on industrial decarbonization, some on transportation and transit etc. A working funding model would therefore need to be fluid and adaptable to the different strengths and requirements the hubs would be supporting. Funding should also include the ability to enter into partnerships with other Ontario and U.S. hubs to maximize resources.

The Sarnia Lambton Economic Partnership (SLEP) for example has run a hub for the last 3 years. Funding would be helpful to move the needle on different pieces identified in the hub's strategy. There also needs to be an understanding and acceptance that hydrogen hubs in Ontario won't be working in isolation. Collaboration with each other as well as with players in other jurisdictions is a must in order for the supply/demand deployment to happen.

7.4. New Research: Key infrastructure nodes / locations for refueling stations

New research is needed to investigate key infrastructure nodes to identify strategic locations for hydrogen refueling stations in Ontario to make sure that any public investments yield “best bang for your buck”. The technico-economic model developed by Change Energy for the H2GO Canada Report could serve as a basis for this kind of research.

7.5. New Research: Economic baseline report

In order to determine the success of Ontario’s Low-Carbon Hydrogen Strategy, research needs to be done on the current number of jobs as well as current and

planned investments in hydrogen in Ontario. The research should also include economic modelling under different policy scenarios.

7. Appendix

1. Timeline & Budget Considerations

Policy category/ year	2025	2026	2027
Supply Side - no cost	Advocate for improvement of CH ITC on federal level to include alternative pathways, allow for higher carbon-intensity and remove other design inherent barriers		Advocate for Ontario to become an eligible jurisdiction under the federal CCUS tax credit.
Supply Side - no cost	Expand Ontario's Clean Transportation Fuels Regulation to make low-carbon hydrogen & SAF production eligible for generating and selling credits under the regulation.		
Supply Side -no cost	Advocate for the federal government to make hydrogen eligible under the Clean Fuels Fund 2.0.		
Supply Side - moderate cost	IESO Consultations on low or capped electricity rate for low-cost, low-carbon hydrogen production or a hedging contract mechanism modelled on CfDs in the power sector.	Implementation of low / capped electricity rate or CfD mechanism for low-cost low carbon hydrogen production.	

Supply Side / Indigenous participation - moderate cost	Direct the IESO to amend its Indigenous Energy Support Program to include hydrogen production projects as well as those helping to reduce diesel dependency and build integrated energy systems in indigenous communities.		
Supply / Demand Side - no/low cost	Provide a Building Ontario Fund (BOF) set aside for hydrogen refueling and transportation infrastructure to de-risk investments. These kinds of investments already fall into BOF's priority areas: transportation, municipal and community infrastructure (e.g. refueling infrastructure for hydrogen buses, trains, garbage trucks, snow ploughs etc.)	Advocate for the federal government to create a Green Market Maker (GMM) mechanism modelled on H2Global in collaboration with the US government, administered by the Clean Growth Fund (CGF) or Export Development Canada (EDC).	
Supply / Demand Side / Indigenous participation - low cost	Amend the Aboriginal Loan Guarantee Program (ALGP) to include hydrogen infrastructure and developments.		
Supply/ Demand Side - low cost	Provide funding to Hydrogen Ontario to identify hub regions and funding requirements in Ontario outlining how provincial hydrogen hubs could act as GMMs, connecting and stimulating supply and demand.		

Innovation / Supply / Demand side - high cost	Renew the Hydrogen Innovation Fund (HIF). To drive economic development, endow it with a larger funding envelope and include funding for research as well as innovative hydrogen technology, industrial decarbonization and infrastructure pilots.	Provide top up funding for industrial decarbonization projects via the industrial portion of the Emissions Performance Standards (EPS) Program. Emitters who paid into the EPS Program should be offered additional public funding for capital-intensive industrial decarbonization projects when applying for funding under the industrial portion of the Emissions Performance Standard Program administered by the Ministry of the Environment, Conservation & Parks (MECP).	
Demand Side - moderate cost	Request that the Ministry of Finance augment Ontario's Manufacturing Investment Tax Credit for hydrogen related manufacturing investments to 30%.	Request the Ministry of Transportation to mandate Metrolinx' new leadership to reinvestigate the transition of the GoTransit system to hydrogen trains and buses once the new strategy is in place and the first policy mechanisms are implemented. The government plays a crucial role as a first adopter since government procurement sends a powerful market signal. The government could also identify other areas where it could purchase hydrogen vehicles or hydrogen powered heating and cooling solutions etc.	
Demand Side - high cost			Provide rebates for the purchase of hydrogen vehicles and vehicle parts
Red Tape reduction - low cost	Work with other provinces to harmonize labour requirements and to ensure that Ontario gas fitters can travel and operate freely across Canada. Ensure continuation of the Skills Development Fund to get more gas fitters trained and hydrogen certified and to encourage the		

	uptake of CSA's hydrogen certification programs.		
Marketing - low cost	Provide funding to Hydrogen Ontario to support the roll out of the renewed hydrogen strategy including stakeholder engagement and public awareness building.		

2. Grid Carbon Intensity by Province

Power Carbon Intensity by Province (2021)
g CO₂/kWh



Province	Grid CI	H ₂ CI	ITC
PEI	4	0.2	40%
Quebec	17	1.0	25%
Manitoba	26	1.5	25%
British Columbia	40	2.3	15%
Ontario	46	2.6	15%
Newfoundland	46	2.6	15%
Yukon	101	5.8	0%
Northwest Territories	208	12.0	0%
New Brunswick	333	19.1	0%
Alberta	628	36.1	0%
Nova Scotia	746	42.9	0%
Saskatchewan	809	46.5	0%
Nunavut	1,034	59.5	0%
Canada	138	7.9	0%

Source: Environment and Climate Change Canada, pre-publication updated carbon intensities for Canadian grid electricity in the Full Life Cycle Assessment Model, December 2023 via CPXP