Executive Summary

Hydrogen in the Automotive and Mobility Sector: Understanding Ontario's Strategic Opportunities

Technologies, Infrastructure Requirements, and
Deployment Opportunities for the Sector

Quarterly Specialized Report

March 2026

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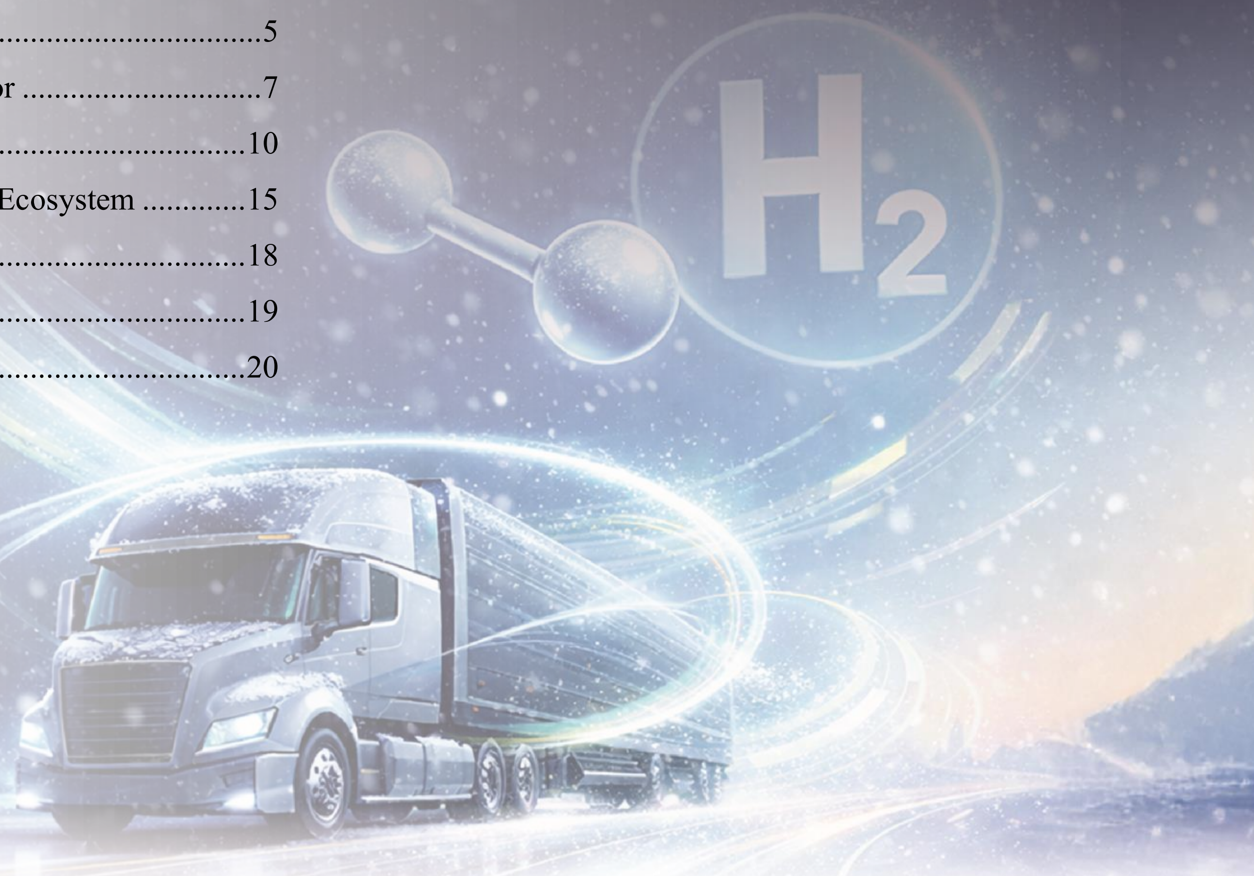


Executive Summary

Hydrogen is emerging as a strategically important complement to electrification in Ontario's clean mobility advantage, particularly in applications where electrification faces practical or technical limits. As the province advances its decarbonization objectives, hydrogen offers a pathway to address heavy-duty, high-utilization, and energy-intensive transport segments that are difficult to electrify at scale. Ontario's clean electricity system, established industrial base, manufacturing strengths, and large freight corridors create favourable conditions for targeted hydrogen deployment within the mobility ecosystem.

Hydrogen mobility applications show the strongest near-term potential in heavy-duty use cases, including long-haul and regional freight trucking, transit and coach buses, port and airport ground vehicles, material-handling equipment, and mining and off-road fleets in northern and remote regions. These segments benefit from fast refuelling, reliable performance in cold climates, and the ability to maintain high vehicle uptime. Stakeholders consistently emphasized that hydrogen is not a universal solution, however, it is well suited to operational contexts where vehicle uptime, payload requirements, and refueling speed are critical.

Ontario's automotive and advanced manufacturing base provides a strong foundation for the growth of hydrogen mobility. The province has established capabilities in fuel-cell systems, power electronics, vehicle integration, controls, and advanced materials, along with experience supporting emerging vehicle technologies through research, testing, and demonstration. These strengths position Ontario companies to participate in the expanding hydrogen technology supply chain, as vehicle platforms and refuelling networks continue to develop.

Ontario's broader hydrogen ecosystem is progressing, although it remains at an early stage of commercialization. Existing industrial hydrogen production is largely concentrated in the Sarnia–Lambton region, where there is potential to increase access to lower-carbon hydrogen pathways over time. New capacity is also emerging, including the Niagara Hydrogen Centre, which will begin producing green hydrogen in 2026 using clean electricity. On the policy front, regulatory developments, including the Special Projects regulation and the Geologic Carbon Storage Act, have created enabling conditions for pilot and future commercial carbon capture, utilization and storage (CCUS) projects. These measures are critical for reducing emissions from existing hydrogen production. While these developments represent meaningful progress, cost competitiveness, long-term policy certainty, and investment confidence remain key challenges identified by stakeholders.

At the same time, infrastructure readiness represents an opportunity for development. Hydrogen refuelling infrastructure in Ontario is at an early stage with only a small number of stations and pilot sites in operation. Expanding strategically located refuelling stations along the along the 401 and 402 freight corridors present an opportunity to enable early uptake in the trucking sector. Stakeholders consistently emphasized that modular or packaged refuelling systems located at ports, airports, transit depots, logistics hubs, and industrial sites could accelerate fleet-based adoption while reducing infrastructure risk during the initial stages of market development.

In this context, concentrating early activity in locations where production and demand naturally converge becomes essential. A regional hub approach offers a practical framework for advancing hydrogen deployment in Ontario. Hydrogen hubs in Niagara, the Greater Toronto and Hamilton Area (GTHA), and Sarnia–Lambton can cluster production, demand, infrastructure, and investment. By linking mobility applications with industrial loads and existing energy assets, these hubs support phased development and enable learning through early pilots. Concentrating initial activity where supply and demand can be aligned also helps reduce costs and lowers project risk.

Ontario's opportunity landscape spans both mobility deployment and supply chain development. Near-term mobility opportunities are concentrated in freight transportation, public transit, logistics operations, and off-road and resource-based activities. On the supply-chain side, opportunities include fuel-cell stacks and modules, hydrogen storage tanks, refuelling and compression equipment, vehicle integration services, and related digital and control systems. To enable these opportunities, workforce and skills development, supported by testing and validation infrastructure, will be essential as technologies advance.

Policy and regulatory frameworks remain central enablers of hydrogen mobility. Stakeholders highlighted the importance of electricity price certainty for electrolysis, clear and predictable CCUS rules, streamlined permitting processes, consistent safety and codes frameworks, and stable incentive programs to support early adoption. Coordination across provincial, federal, and municipal levels will be essential to reduce uncertainty and support investment decisions.

Within this context, OVIN plays a critical role as a platform for de-risking hydrogen technologies through enabling research, development, testing, and demonstration. By supporting pilot projects, convening industry and public-sector partners, and connecting emerging technologies to Ontario's manufacturing ecosystem, OVIN helps accelerate learning, build evidence on real-world performance and costs, and support pathways to commercialization.

Taken together, hydrogen can support Ontario's economic competitiveness and emission-reduction goals when deployed in targeted, high-value mobility segments. By advancing a hub-based approach, strengthening enabling policies, supporting early pilots, and leveraging Ontario's manufacturing strengths, the province can advance hydrogen mobility in a commercially grounded and responsible manner. This report provides an overview of Ontario's hydrogen mobility ecosystem based on research and expert insights, outlining key challenges and opportunities to inform future program development.

1. Hydrogen Fundamentals

Hydrogen is best understood as an energy carrier rather than a primary energy source. Although hydrogen is the most abundant element in the universe, it is rarely found on Earth in a pure, usable form. Instead, it is typically bound to other elements, such as oxygen in water or carbon in natural gas, and must be extracted through energy-intensive processes before it can be used as a fuel. As a result, the environmental performance, cost, and scalability of hydrogen depend heavily on how it is produced and delivered.

Once produced, hydrogen exhibits several unique characteristics that distinguish it from other energy carriers. By weight, hydrogen contains significantly more energy than conventional fuels, making it particularly attractive for applications where mass is a constraint, such as heavy-duty transport and long-distance mobility. At the same time, hydrogen has low volumetric energy density, meaning that it occupies a large volume at ambient conditions. Practical use therefore requires hydrogen to be compressed, liquefied, or chemically bound, each of which introduces additional cost, energy losses, and infrastructure complexity.

Hydrogen can be converted back into usable energy through multiple pathways. In fuel cells, hydrogen is combined with oxygen in an electrochemical reaction to produce electricity, with water and heat as the only by-products at the point of use. Hydrogen can also be combusted in turbines or modified internal combustion engines. While hydrogen combustion does not produce carbon dioxide, it can generate nitrogen oxides under high-temperature conditions, requiring advanced combustion design and emissions-control strategies.

Hydrogen production pathways vary widely in carbon intensity. Grey hydrogen is produced from fossil fuels without carbon capture and has a high greenhouse-gas footprint. Blue hydrogen incorporates carbon capture, utilization, and storage (CCUS) to significantly reduce emissions. Green hydrogen is produced via electrolysis using renewable electricity, while pink hydrogen uses nuclear electricity as the energy input. Biomass-based hydrogen and emerging technologies such as natural gas pyrolysis are also being explored as longer-term options, particularly where they can deliver low lifecycle emissions and additional co-product value.

Hydrogen Production Pathways and Color Typology

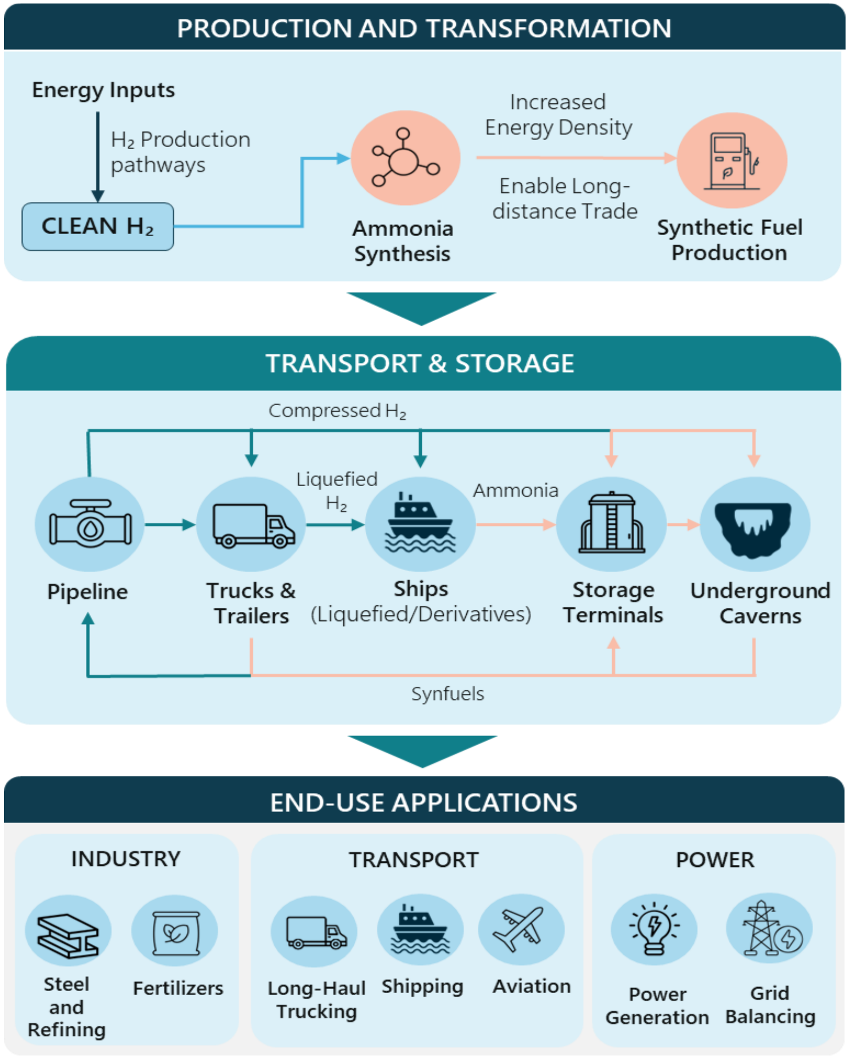
Grey H_2	Grey Hydrogen is produced from fossil fuels, typically natural gas, through steam methane reforming (SMR). The CO_2 generated during this process is released into the atmosphere, resulting in a high carbon footprint.
Blue H_2	Blue Hydrogen is also produced from fossil fuels but is paired with CCUS. This process captures a significant portion of the CO_2 emissions and stores them underground, leading to a reduced carbon footprint compared to grey hydrogen.
Green H_2	Green Hydrogen is produced via the electrolysis of water, powered by renewable energy sources such as wind, solar, or hydro. This process splits water into hydrogen and oxygen, with no direct CO_2 emissions, resulting in a very low or zero carbon footprint.
Pink H_2	Pink / Purple Hydrogen is also produced through the electrolysis of water, but it is powered by nuclear electricity. This method also has a low-carbon footprint, similar to green hydrogen.

From a decarbonization perspective, hydrogen is most relevant in sectors where direct electrification is difficult, costly, or impractical. These include heavy industry, high-temperature process heat, long-haul freight transport, and applications requiring long-duration energy storage or high operational flexibility. Hydrogen is also being explored for use by data centres, primarily as a low-carbon replacement for diesel backup generators using hydrogen fuel cells, and in some cases as a supplementary power source to support large, power-dense facilities where grid capacity or reliability is constrained.

Cost drivers and the economics of different hydrogen production pathways determine where hydrogen can realistically compete and how fast it can scale. In practice, investment and policy decisions depend on whether low-emissions hydrogen can reach cost parity with fossil fuels under realistic assumptions for fuel prices, capital costs, and policy support. For grey or blue hydrogen (fossil-fuel based), the main cost drivers remain natural gas prices and the specific infrastructure required for carbon sequestration. For green hydrogen, production costs are mainly driven by electricity prices, electrolyser capital cost and other supporting equipment and financing costs.

In the hydrogen value chain, clean hydrogen supply is produced and can be used directly or transformed into derivatives such as ammonia and synthetic fuels to increase energy density and enable long-distance trade. It is then transported and stored as compressed or liquefied hydrogen, or in derivative form via pipelines, trucks, ships and storage terminals or underground caverns, before being consumed in end-use sectors such as steel, refining, fertilizers, long-haul transport, shipping and flexible power generation.

Clean Hydrogen Value Chain: From Production to End Use



Source: Hydrogen Council 2022

2. Hydrogen in the Automotive and Mobility Sector

Globally, hydrogen is gaining momentum as a complementary pathway to electrification across the automotive and mobility sectors. While battery-electric vehicles have achieved rapid adoption in light-duty segments, hydrogen offers operational advantages in applications where range, payload, refuelling time, and vehicle utilization are critical constraints.

In road transport, hydrogen deployment has focused primarily on buses, heavy-duty trucks, and depot-based logistics fleets. These applications benefit from fast refuelling, predictable duty cycles, and centralized infrastructure. International experience shows that early hydrogen truck deployment tends to cluster along major freight corridors, supported by strategically spaced refuelling stations that enable long-haul and regional operations. This corridor-based approach reduces infrastructure risk and allows hydrogen supply and demand to scale together.

Fuel Cell Electric Vehicles (FCEVs) convert hydrogen into electricity on board and are particularly well suited to long-haul freight and high-utilization duty cycles. Compared with battery-electric trucks, FCEVs preserve payload capacity and offer refuelling times comparable to diesel. These attributes are especially important for commercial freight operators operating under tight delivery schedules and payload constraints. At the same time, FCEVs remain more expensive upfront and require coordinated investment in hydrogen supply and refuelling infrastructure.

Hydrogen internal combustion engines (H_2-ICEs) represent a transitional option that adapts conventional engine architectures to operate on hydrogen. While less energy-efficient than fuel-cell systems, H_2-ICEs offer advantages in terms of operational familiarity, durability, and faster deployment using existing manufacturing platforms and supply chains. In certain heavy-duty and off-road applications, H_2-ICEs can provide near-term emissions reductions while leveraging existing assets.

Hydrogen-derived fuels extend hydrogen's relevance to additional modes such as marine, aviation, and rail. Ammonia is being explored as both a hydrogen carrier and a zero-carbon marine fuel, while synthetic e-fuels provide drop-in solutions for aviation and shipping. These fuels remain energy- and capital-intensive and are generally viewed as options for hard-to-electrify segments where no viable direct electrification pathway exists.

Despite growing global activity, hydrogen mobility remains a small share of total hydrogen demand. Most deployments are still at pilot or early commercial scale, and widespread adoption is constrained by high costs, limited refuelling infrastructure, and technology-maturity considerations. Successful deployment to date has therefore relied heavily on fleet-based models, corridor strategies, and public-sector support.

Barriers

Hydrogen deployment continues to face a cluster of interrelated barriers, led by economics and infrastructure constraints. Low-emissions hydrogen remains more expensive than unabated fossil-based hydrogen. The IEA's *Global Hydrogen Review 2025* explicitly identifies this persistent cost gap as a central barrier to investment and to achieving project final investment decisions (FIDs).

On the demand side, fuel cell electric vehicles (FCEVs) and associated equipment typically carry higher upfront capital costs than diesel or battery alternatives, while hydrogen prices at refuelling stations keep operating fuel costs elevated. As a result, total cost of ownership (TCO) assessments for heavy-duty trucks indicate that fuel cell trucks are only competitive in specific scenarios, particularly where hydrogen prices are low and duty cycles are favourable, rather than as a default option across fleets.

These economic challenges are compounded by sparse and uneven infrastructure. Global reviews of hydrogen mobility and fuel-cell transport repeatedly highlight the limited number and uneven geographic distribution of hydrogen refuelling stations as a major barrier, especially outside a small set of early markets in East Asia, Europe, and California. The viability of refuelling networks is also heavily dependent on upstream transmission and distribution (T&D) systems. The high capital cost of dedicated hydrogen pipelines and large-scale, centralized electrolysis creates a significant "chicken-and-egg" investment hurdle, because these upstream assets often require guaranteed, high-volume demand to justify initial expenditure.

Technical maturity and non-economic factors add additional friction. Durability and longevity of fuel-cell power systems remain critical challenges, particularly for heavy-duty applications that require long lifetimes and high utilization. These performance factors influence residual values and warranty terms, both of which are commonly embedded in TCO assumptions and financing decisions. Beyond technology maturity, regulations, codes, and standards (RCS) are frequently identified as key non-technical barriers. Harmonized rules for high-pressure storage and refuelling are essential building blocks for a scalable hydrogen mobility system and reduce uncertainty for OEMs, infrastructure developers, and permitting authorities.

Finally, public acceptance remains a meaningful soft barrier. Consumer research indicates that safety perception can constrain uptake, with concerns often centred on high-pressure leaks and historical associations with hydrogen flammability. These perceptions can persist even where modern FCEVs are engineered to meet rigorous safety standards, underscoring the importance of clear communication, training, and consistent safety protocols as deployment expands.

Enablers

Hydrogen uptake is being enabled by a combination of policy frameworks, public procurement, industry strategies, cost reductions, and hub-based deployment models. On the policy side, carbon pricing and clean-fuel standards can directly improve the economics of low-carbon hydrogen. Low-Carbon Fuel Standard (LCFS) frameworks, such as those in California and British Columbia, award credits to fuels with lower lifecycle carbon intensity and explicitly include hydrogen used in transport. In practice, this creates an additional revenue stream, beyond fuel sales, that can help offset higher production and delivery costs during early market development.

Governments are also using public procurement to create early, bankable demand. Fleet procurement, particularly for transit and municipal operations, can support first deployments, provide real-world learning, and improve confidence for follow-on investment in refuelling and supply infrastructure. One example is the deployment of 300 fuel cell buses through the Joint Initiative for hydrogen Vehicle across Europe (JIVE) and JIVE 2 projects co-funded by the European Union's Clean Hydrogen Partnership.

On the industry side, OEM strategies and falling costs are important enablers. Major truck and bus manufacturers have established hydrogen roadmaps and formed joint ventures to share development costs and accelerate scaling. For example, Daimler Truck and Volvo created the Cellcentric joint venture to industrialize fuel-cell systems for heavy-duty vehicles. Hyundai has also committed to scaling its XCIENT Fuel Cell truck platform based on real-world deployment experience. In parallel, global assessments indicate that alkaline and PEM electrolyser costs have fallen significantly and are expected to decline further as manufacturing scales, supporting longer-term improvements in hydrogen cost competitiveness.

Many national strategies now centre on hydrogen hubs or industrial clusters that aggregate supply and demand to de-risk investment. In the United

States, the Regional Clean Hydrogen Hubs (H2Hubs) program is intended to accelerate commercial-scale deployment by funding a national network of co-located producers, consumers, and infrastructure. By clustering diverse off-takers, hubs can help secure the long-term volumes needed to finance large production assets. However, near-term implementation can be subject to fiscal and regulatory uncertainty.

Hydrogen in Existing EV Charging Grid Infrastructure

As electric vehicle adoption accelerates, constraints within the electricity grid are emerging as a practical barrier to expanding fast and fleet-based charging. In many locations, total generation capacity is sufficient, but the ability to deliver power to specific sites is limited by local distribution infrastructure, long upgrade timelines, and high capital costs. These constraints are particularly acute at fleet depots, logistics hubs, and high-power fast-charging sites where simultaneous charging can overwhelm transformers and substations.

Hydrogen fuel cells are increasingly being explored as a complementary solution to address these grid limitations. Rather than replacing the electricity system, hydrogen can function as a distributed energy resource that supplies clean, on-site power for EV charging when grid capacity is constrained or unavailable. In practice, hydrogen integration can take several forms. Fuel cell systems can supplement grid power during peak demand periods, reducing strain on local infrastructure and deferring costly upgrades. In more constrained or remote locations, they can provide standalone power for EV charging where grid connection is not feasible in the near term. When supplied with low-carbon hydrogen, these systems allow EV charging to remain aligned with emissions-reduction goals.

Early real-world deployments demonstrate how this model is being applied. Pilot projects in the United Kingdom have tested hydrogen fuel cell chargers that deliver fast EV charging without relying on the electricity grid, highlighting applications for temporary, mobile, or remote charging sites. In the United States, hybrid charging systems combine hydrogen fuel cells with grid connections and battery storage to support high-power charging at sites where peak loads exceed local grid capacity. Other projects integrate hydrogen production, storage, fuel cell generation, and EV charging at a single location, improving resilience and enabling continued operation during grid interruptions.

While deployment remains at pilot and early commercial scale, hydrogen fuel cells offer a flexible option for addressing grid bottlenecks, improving charging reliability, and enabling fleet electrification in locations where conventional grid upgrades are costly, slow, or uncertain.

3. Ontario's Strategic Context for Hydrogen

Ontario's hydrogen opportunity is shaped by its energy profile, industrial structure, and decarbonization objectives. The province has one of the largest energy systems in Canada, with end-use demand dominated by refined petroleum products and natural gas. While electricity already plays a significant role, many high-energy applications, such as heavy industry and long-distance freight cannot easily transition to electricity alone due to performance, cost, and operational constraints.

Ontario's clean electricity system provides a strong foundation for low-carbon hydrogen production. Nuclear and hydroelectric generation offer stable, low-emissions power that can support electrolysis-based hydrogen production, particularly when aligned with system-level objectives such as grid balancing and efficient use of off-peak capacity. This electricity advantage is a key differentiator for Ontario relative to many other jurisdictions.

The province also benefits from a robust research, development, and innovation ecosystem. Universities, federal research institutions, and applied research centres across Ontario are actively engaged in hydrogen-related research, spanning production technologies, fuel cells, storage, safety, and energy-system integration. These activities support technology development, workforce training, and the creation of spin-off companies. Provincial public-sector organizations are also actively engaged in applied hydrogen research and demonstration. Ontario Power Generation, through its subsidiary Atura Power, is advancing hydrogen production projects that integrate electrolysis with existing electricity assets, such as the development of large-scale electrolytic hydrogen production and the evaluation of hydrogen production linked to nuclear generation. Additionally, Enbridge Gas has operated a power-to-gas facility in Markham since 2018, producing hydrogen via electrolysis and blending it into the natural gas distribution system. This facility has functioned as a long-running demonstration of hydrogen production, storage, and blending within regulated gas infrastructure, generating operational data and informing technical standards.

Ontario's hydrogen research & development activity is increasingly organized around regional clusters that combine industrial infrastructure, applied research, and demonstration projects. The Sarnia–Lambton region is supported by existing petrochemical operations, hydrogen feedstock production, and potential geological storage. Research parks and post-secondary institutions in the region are also engaged in pilot-scale hydrogen production, storage, and utilization projects that link laboratory research with industrial-scale applications. Other regions in Ontario also contribute to applied hydrogen research. Niagara Falls, for example, is emerging as a centre for hydrogen production research linked to hydroelectric generation, while Bruce County is being assessed for hydrogen production opportunities associated with nuclear power. These regional initiatives provide testbeds for evaluating hydrogen technologies under real-world operating conditions and for understanding how hydrogen can be integrated into existing energy and industrial systems.

Ontario's hydrogen research ecosystem is supported by a network of innovation platforms that connect research to commercialization. The Ontario Vehicle Innovation Network (OVIN) provides infrastructure, testing facilities, and business support for hydrogen and alternative powertrain technologies through its regional technology development sites. These sites enable prototyping, validation, and demonstration of hydrogen-related technologies, particularly in transportation applications. Industry coordination and collaboration are supported through Hydrogen Ontario, which brings together industry, academic, and public-sector stakeholders to share knowledge and align research and innovation priorities. Additional incubators and accelerators across the province support hydrogen-related startups in areas such as electrolyser components, fuel cell systems, hydrogen storage, and industrial applications, helping early-stage technologies progress toward deployment.

Policy and funding frameworks at both the federal and provincial levels are central enablers of hydrogen development. Federal initiatives, including the Clean Hydrogen Investment Tax Credit and the Clean Fuels Fund, improve project economics and reduce investment risk. Provincially, Ontario's Low-Carbon Hydrogen Strategy, Hydrogen Innovation Fund, and the establishment of a regulatory framework for geologic carbon storage create enabling conditions for both green and blue hydrogen deployment.

Current and Planned Hydrogen Production Projects

Ontario's hydrogen production landscape has an established industrial base with significant hydrogen production capacity. Most notably, the Sarnia-Lambton region already produces and uses more than 150,000 tonnes of grey hydrogen each year as feedstock for refining, petrochemicals, and fertilizer production, which represents the largest concentration of hydrogen production in the province. This existing activity creates a practical foundation for low-carbon hydrogen production since these facilities can incorporate CCUS technologies to transition from grey to blue hydrogen as regulatory conditions evolve. At the same time, Ontario is beginning to advance low-carbon hydrogen production through a series of pilot, demonstration, and early commercial projects.

Cost Drivers and Competitiveness of Low-Carbon Hydrogen

Hydrogen's cost competitiveness in Ontario is primarily driven by production pathway, energy input prices, facility scale, and the ability to capture additional value streams such as carbon co-products. The Transition Accelerator study (2023), funded through the Hydrogen Innovation Fund, assesses the role of hydrogen in supporting a net-zero electricity system in

Table 1: Current Hydrogen Production Plants in Ontario

Project Name	Niagara Hydrogen Centre	Markham Energy Storage Facility (Hydrogen Blending Pilot)
Location	Niagara Falls, ON	Markham, ON
Developer / operator	Atura Power (OPG)	Enbridge Gas & Hydrogenics/Cummins
Technology (electrolysis, SMR, biomass, etc.)	Electrolysis (PEM)	Electrolysis (PEM)
Scale (MW, t/day)	20 MW	2.5 MW
Status: operational, construction, announced, concept	Construction was completed in 2025. Commercial operation in second half of 2026	Operational (commissioned 2018)
Primary off-takers (industry, mobility, export)	Industry & mobility (heavy-duty trucking, transit)	Buildings (natural gas customers via 2 percent H_2 blending)

Ontario by examining hydrogen demand scenarios, production pathways, and system-level impacts, with a particular focus on cost, feasibility, and electricity system integration. The study found that while Ontario has the technical capability to produce low-emissions hydrogen, market conditions indicate that hydrogen remains more expensive than conventional fuels across most applications.

These pathway-level cost findings are reinforced by the Ontario Ministry of Energy and Electrification's Cost-Effective Energy Pathways Study for Ontario, which evaluates hydrogen deployment within least-cost, system-wide net-zero scenarios. The study finds that hydrogen plays a targeted role in Ontario's cost-effective energy transition, with supply scaling primarily after 2035 and concentrated in hard-to-electrify industrial applications and select electricity system uses. Across modeled pathways, hydrogen production initially relies on natural gas-based pathways with carbon capture, while production from natural gas without CCUS is phased out over time. In later years, biomass-based hydrogen with carbon capture contributes to supply, alongside limited imports, reflecting both cost and resource constraints.

Beyond production-level costs, a H2GO Canada study (2023) examines the broader capital and operating cost implications of scaling a hydrogen economy in Ontario through to 2050 under different scenarios. This study finds that building a hydrogen economy in Ontario requires significant upfront investment. Under the status quo scenario, total capital investment is estimated at approximately C$85 billion by 2050, covering hydrogen production facilities, delivery infrastructure, and refuelling stations. Capital spending is also front-loaded over time. Most investments occur between 2025 and 2040, during the initial build-out of production and delivery infrastructure, before tapering as the system matures and assets are fully utilized.

The H2GO Canada analysis demonstrates that investment in a coordinated, domestically focused hydrogen strategy can contribute to substantial net socio-economic and environmental benefits. In particular, the modelling estimates:

- Cumulative greenhouse gas emissions reductions of up to 874 Mt CO_2e by 2050, driven by hydrogen replacing higher-carbon fuels across transportation, industrial, and buildings sectors.
- Peak job creation of approximately 160,000 to 230,000 jobs, depending on the scenario, reflecting both construction-phase employment and ongoing operations and maintenance.
- Delivered hydrogen costs falling to approximately C$5 per kilogram under scenarios that prioritize domestic production and technology learning, with some pathways achieving negative abatement costs (approximately–C$35/$tCO_2$) once avoided emissions and co-product revenues are considered.

Automotive Manufacturing Base

Ontario remains one of North America's most significant vehicle manufacturing regions, providing a strong industrial foundation for the province's emerging hydrogen economy. The province is home to five major automotive assembly plants along with a dense supplier and research ecosystem. Several Ontario-based manufacturers are already integrating hydrogen into industrial operations, demonstrating how hydrogen can be embedded within existing manufacturing ecosystems. In the Sarnia–Lambton region, industrial parks such as Bluewater Energy Park and Bio-Industrial Park Sarnia offer serviced sites with access to rail, marine terminals, and existing hydrogen and industrial gas infrastructure. These assets reduce capital barriers for hydrogen-related manufacturing and support future scale-up.

Ontario's primary automotive and transportation corridor along Highway 401 extends from Windsor through the Greater Toronto Area to eastern Ontario. The concentration of vehicle assembly, component manufacturing, logistics activity, and continuous industrial operations along this corridor corresponds with some of the province's highest energy demand and most difficult decarbonization challenges. Heavy-duty transportation, high-temperature industrial processes, and round-the-clock manufacturing operations often face technical or economic limitations to full electrification alone. This creates a practical role for low-carbon hydrogen as a complementary energy solution alongside electricity, particularly in freight transport, industrial heat, and select manufacturing applications.

In addition, several of Ontario's electricity generation nodes and transmission corridors overlap with the primary automotive and transportation corridor along Highway 401. This alignment means that many of the regions with strong potential for electrolytic hydrogen production are the same regions where demand is expected to emerge first, such as vehicle-assembly hubs, logistics clusters, and heavy-duty freight routes.

Building on this profile, Ontario's emerging hydrogen production hubs are increasingly aligned with major industrial regions. Projects such as the Niagara Hydrogen Centre and Bruce Power's Project 2030 are advancing large-scale green and pink hydrogen production intended to serve industrial users, logistics operators, and fleet-based transportation applications.

Existing and Planned Hydrogen Refuelling Infrastructure

Ontario's hydrogen refuelling network remains at an early stage of development. Carlsun Energy is developing a public hydrogen refuelling station at Toronto Pearson International Airport, supported by C$1 million in funding from Natural Resources Canada. Once operational, this station is expected to serve both light-duty and heavy-duty vehicles. It will be strategically located along the Toronto–Windsor–Montréal freight corridor. The Toronto Pearson International Airport project illustrates how hydrogen refuelling can be integrated into major transportation hubs and is expected to expand public access to hydrogen fueling in Ontario.

Ontario's Automotive Corridor: Windsor-to-Ottawa

Source: InvestOntario Automotive

In terms of the hydrogen transportation network, Ontario currently has no dedicated hydrogen pipelines in operation. All hydrogen is transported via road to end users. In practice, this means compressed hydrogen is trucked in high-pressure tube trailers from production sites to fueling stations or industrial sites. Given the early stage of Ontario's hydrogen market (low volumes and dispersed demand), trucked distribution is the default approach, offering flexibility without the need for costly new pipelines. At the same time, the government is evaluating the expansion of the Ontario Energy Board's mandate to regulate dedicated hydrogen pipelines to protect consumers while facilitating further development of new hydrogen infrastructure. Ontario's hydrogen strategy emphasizes a "hub model", co-locating hydrogen production near major users (industrial clusters, freight corridors) to minimize transport distances and costs. This is why initial fueling stations are sited in the Greater Toronto Area and along Highway 401 close to both hydrogen supply points and heavy-duty demand.

Hydrogen in Rail and Other Modes

Hydrogen is also being evaluated for rail applications. Metrolinx previously conducted a feasibility study on hydrogen fuel cell trains as part of the GO Expansion program, assessing whether hydrogen could serve as an alternative to overhead electrification on non-electrified corridors. While no procurement decision has been made as of December 2025, the option remains under consideration. Alstom's Coradia iLint hydrogen train was piloted in Québec in 2023 to evaluate the technology's viability under Canadian operating conditions. The pilot concluded in late 2023 and the results from the pilot indicated that hydrogen-powered trains can operate safely and reliably, provided that a robust hydrogen ecosystem is in place to supply fuel.

Freight rail developments may also have implications for Ontario. Canadian Pacific Kansas City (CPKC) has progressed a hydrogen locomotive pilot in Alberta, retrofitting locomotives with fuel cell systems beginning in 2022. If these pilots continue to scale, hydrogen locomotives could eventually be deployed on specific Ontario freight routes, particularly yard-switching or short-haul operations where centralized refuelling is feasible.

Additional modes are in exploratory stages. At Toronto Pearson International Airport, interest exists in hydrogen for ground-side operations, such as fuel cell baggage tractors or shuttle vehicles, building on the airport's existing refuelling infrastructure. Marine applications on the Great Lakes have not yet advanced beyond conceptual studies, but the province has identified potential opportunities for hydrogen or ammonia-based fuels in ferries and port operations. In off-road sectors such as mining, hydrogen remains at the assessment stage, although global pilots of large fuel cell haul trucks have attracted attention within Northern Ontario's mining industry.

Overall, hydrogen deployment in Ontario's mobility sector remains early but is progressing through targeted pilots and feasibility studies. Near-term activity is concentrated in heavy-duty use cases, with passenger vehicles and broader modal adoption expected to follow as infrastructure, supply, and operational experience mature.

4. Opportunities for Ontario's Hydrogen Mobility Ecosystem

4.1 Leveraging Ontario's Clean Electricity Advantage to Accelerate Low-Carbon Hydrogen Leadership

Ontario's clean electricity system provides one of the province's most significant strategic advantages in the hydrogen economy. Low-carbon electricity is a prerequisite for producing low-emissions hydrogen through electrolysis, and electricity costs are a primary driver of hydrogen competitiveness. Expert interviews consistently emphasized that hydrogen cost remains the dominant barrier to adoption, particularly in mobility applications.

Ontario's combination of nuclear, hydroelectric, and growing renewable generation offers opportunities to support electrolytic hydrogen production where electricity prices and emissions intensity are favourable. Over time, aligning hydrogen production with system needs, such as off-peak generation and grid-balancing requirements, could help improve utilization of existing assets while reducing hydrogen production costs.

4.2 Advancing Priority Mobility Segments and Freight Corridors

The strongest near-term hydrogen mobility opportunities in Ontario are concentrated in applications requiring long range, fast refuelling, high payload capacity, and continuous uptime. These include heavy-duty trucking, transit buses, airport and port ground vehicles, material-handling equipment, and mining and off-road fleets.

Strategic deployment along major freight corridors such as Highways 401 and 402 can enable early hydrogen adoption while concentrating infrastructure investment. Corridor-based deployment allows refuelling stations to serve multiple fleets, improving utilization and reducing unit costs. Over time, these corridors can link Ontario's emerging hydrogen hubs and support broader network development.

4.3 Leveraging Public Procurement to Anchor Early Hydrogen Demand

Public procurement is one of the most effective tools for catalyzing early hydrogen adoption. Government fleets, transit agencies, municipalities, airports, and other public-sector entities can act as anchor customers, providing stable demand signals that justify investment in vehicles, refuelling infrastructure, and local supply chains.

Early public-sector leadership can help de-risk hydrogen technologies, accelerate learning, and attract original equipment manufacturers and integrators to the Ontario market. Without such anchor demand, private fleet operators are unlikely to absorb the higher upfront costs and infrastructure risks associated with early hydrogen deployment.

4.4 Building Out Hydrogen Refuelling Infrastructure at High-Throughput Nodes

Limited refuelling infrastructure remains a primary constraint on hydrogen mobility adoption in Ontario. Establishing hydrogen refuelling stations at high-throughput logistics nodes, such as airports, ports, border crossings, transit depots, and distribution hubs, offers a practical pathway to scale early adoption.

These locations concentrate high-utilization vehicles and predictable demand, making them natural candidates for early infrastructure investment. Co-locating refuelling infrastructure with production assets or large fleet depots can further reduce costs and infrastructure risk.

4.5 Strengthening Policy and Regulatory Foundations to Enable Market Confidence

Clear, predictable policy and regulatory frameworks are essential to building market confidence in hydrogen. Stakeholders emphasized the importance of streamlined permitting processes, harmonized codes and standards, and stable incentive programs that reduce uncertainty for project developers and investors.

Regulatory clarity around CCUS, electricity pricing for electrolysis, and hydrogen infrastructure, such as dedicated pipelines, will be particularly important as projects scale. A technology-neutral approach that focuses on emissions outcomes rather than production "colour" can support innovation while maintaining environmental integrity.

4.6 Activating Ontario's Industrial Base for Blue Hydrogen

Ontario's most mature hydrogen activity is concentrated in Sarnia–Lambton, where existing industrial operations already produce and consume hydrogen. This industrial base provides a practical platform for early low-carbon hydrogen deployment through CCUS-enabled blue hydrogen.

Recent advances in Ontario's CCUS regulatory framework strengthen this opportunity by enabling existing producers to decarbonize hydrogen output. These industrial projects can anchor early demand, increase production volumes, and support adjacent mobility applications such as refinery logistics fleets and regional freight.

4.7 Developing Regional Hydrogen Hubs

International experience demonstrates that hydrogen adoption is most viable when production and demand are co-located. A hub-based approach allows supply, infrastructure, and end-use applications to scale together while reducing transport costs and investment risk.

Ontario is well positioned to develop regional hydrogen hubs in Niagara, the GTHA, and Sarnia–Lambton. Each region offers distinct advantages based on existing infrastructure, energy assets, and demand profiles. Together, these hubs can serve as testbeds for real-world deployment and learning.

4.8 Growing a Domestic Hydrogen Supply Chain

Ontario's automotive and advanced manufacturing ecosystem positions the province to develop and manufacture key hydrogen components, including fuel-cell systems, storage tanks, refuelling equipment, and power electronics. Many of the skills and capabilities required for hydrogen systems align closely with existing automotive supply chains.

Supporting retooling and commercialization can help Ontario firms capture value in emerging hydrogen markets while supporting job creation and export growth.

4.9 Strengthening Skills, Safety, and Standards for Hydrogen

As hydrogen deployment scales, workforce skills and safety frameworks will become increasingly important. Technicians, operators, and first responders will require new competencies related to hydrogen systems, high-pressure storage, and refuelling equipment.

Ontario's colleges, universities, and training institutions are well positioned to develop targeted programs that build on existing mechanical, electrical, and automotive skill sets. Clear safety standards and permitting pathways will further support safe and efficient deployment.

4.10 Expanding Inter-Jurisdictional Collaboration

Hydrogen mobility will increasingly operate across borders, particularly for long-haul freight. Coordinated approaches with the U.S. and international partners can support harmonized standards, shared infrastructure planning, and collaborative demonstration projects.

Such collaboration can help Ontario-based firms integrate into global hydrogen value chains and accelerate technology learning.

4.11 Support a Gradual Transition Toward Hydrogen-Enabled Industrial and Mobility Ecosystems

Across interviews, participants consistently described hydrogen adoption in Ontario as a phased and incremental process rather than a rapid, system-wide transition. Early progress is expected in applications where hydrogen already provides clear operational advantages, particularly in high-utilization and heavy-duty fleets.

As supply, infrastructure, and workforce skills continue to develop, Ontario can expand hydrogen use into additional sectors, including goods movement, municipal fleets, off-grid industrial operations, and eventually rail and marine applications. Over the longer term, the combination of clean electricity, improved carbon-capture options, and advancing technology can support the integration of hydrogen into a broader clean-energy system. This will enhance system flexibility, reduce emissions, and create new opportunities for sector development.

5. Glossary

CCUS	Carbon Capture, Utilization, and Storage
CO_2	Carbon Dioxide
EV	Electric Vehicle
FCEV	Fuel Cell Electric Vehicle
GTHA	Greater Toronto and Hamilton Area
H_2-ICE	Hydrogen Internal Combustion Engine
IEA	International Energy Agency
ITC	Investment Tax Credit
JIVE	Joint Initiative for hydrogen Vehicles across Europe
LCFS	Low-Carbon Fuel Standard
MW	Megawatt
OEM	Original Equipment Manufacturer
OPG	Ontario Power Generation
OVIN	Ontario Vehicle Innovation Network
PEM	Proton Exchange Membrane
RCS	Regulations, Codes, and Standards
SMR	Steam Methane Reforming
TCO	Total cost of ownership

6. OVIN Team

Information on OVIN team members and relevant contacts for outreach is available on OVIN's website at: https://www.ovinhub.ca/connect/team/

7. Disclaimers

This report was commissioned by the Ontario Centre of Innovation (OCI) through a Request for Proposals titled "Ontario Vehicle Innovation Network (OVIN) – Annual Comprehensive Sector Report & Quarterly Specialized Reports," dated September 26, 2025, and has been prepared by MNP LLP. It is one of five reports covering an analysis of Ontario's automotive technology, electric vehicle and smart mobility landscape while incorporating implications for the sector's skills and talent landscape.

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