Canadian Hydrogen Association | Association Canadienne de L'hydrogène

Canadian Hydrogen Sector Profile 2024

Table of Contents

Our Shared Vision and Canada's Hydrogen Opportunity

INTRODUCTION

Canada is uniquely positioned to lead the global transition to a sustainable future through the advancement of hydrogen technologies, thanks to our abundant natural resources, advanced research capabilities, and strong government support.

The CHA Sector Profile 2024 highlights significant progress and potential within the sector.

We're grateful to the more than 140 organizations that offered their time and insights to produce CHA Sector Profile 2024.

Notably, 90.2% of respondents believe hydrogen will play a pivotal role in Canada's roadmap to a decarbonized future. This overwhelming confidence underscores the transformative impact hydrogen can have on our energy landscape.

Our respondents identified opportunities to spur sector growth, including incentives to encourage private investment and the creation of awareness campaigns about hydrogen safety and benefits. Importantly, the emergence of the hydrogen economy is also an opportunity for Indigenous leadership and economic reconciliation.

The Profile revealed that the majority of hydrogen production and employment is concentrated in Western Canada, highlighting the region's role as a national hub for hydrogen activity. As we look forward, CHA believes it's essential to double down and leverage this growth, while also harnessing the unique natural resources strengths, technological expertise, and supportive policy environments in other regions of Canada.

The CHA's aim is to ensure that the hydrogen sector contributes to an inclusive economy with new investments in clean technology and infrastructure in all provinces and territories. By focusing on strategic opportunities such as infrastructure development, supportive policies, and innovation funding, Canada can overcome existing challenges and accelerate sector growth. Together, with continued collaboration and investment, we can solidify Canada's position as a global leader in the hydrogen sector.

Ivette Vera-Perez

Ivette Vera-Perez
CHA CEO and President

The Canadian Hydrogen Association Sector Profile 2024

The Canadian Hydrogen Association (CHA) is dedicated to advancing the hydrogen sector in Canada. The CHA is the national voice of the sector and aims to position Canada as a global leader in the hydrogen economy by promoting the development, commercialization, and adoption of hydrogen and hydrogen technologies.

Biennially, the CHA publishes the Sector Profile to provide an overview of the hydrogen sector in Canada. The report reveals the status of the industry as defined by revenue, employment, research and development, and the perceived opportunities and challenges necessary to grow the sector in Canada and globally. The Profile is created based on surveying CHA members and stakeholders. Through these regular updates, the CHA aims to support informed decision-making and strategic planning, fostering the sector's growth and integration into Canada's energy landscape.

CHA engaged iTOTEM Analytics, an Indigenous-affiliated data science and communications firm based in Vancouver, BC and Houston, TX, to complete the Profile.*

The CHA Sector Profile 2024 study received funding from the Government of Canada.

Objectives

1. **Capture Trends and Growth:** Identify and document emerging trends, growth, and notable achievements within the sector.
2. **Assess the Current State:** Offer insights into the status of the sector, including economic, employment, and technological developments.
3. **Inform Stakeholders:** Provide valuable information to policymakers, investors, and other stakeholders to support decision-making and strategic planning.
4. **Identify Opportunities and Challenges:** Highlight the opportunities for growth and the challenges that need to be addressed to advance the sector.
5. **Support Policy Development:** Aid in the development of supportive policies and regulations that can foster the sector's growth and integration into Canada's energy landscape.

*For more information about iTOTEM Analytics, refer to Appendix D

Canadian Hydrogen Sector Insights

This section summarizes the reported figures for annual production, revenue, employment, and research, development, and demonstration activities for 2023 from Sector Profile respondents.

Additionally, the confidence levels and factors for attracting investment as identified by the respondent groups are revealed.

Canadian Hydrogen Production Reported

Out of our sample size of respondents alone, **21.9%** reported producing a total of **234,500 tonnes** of hydrogen in 2023, with estimated production across Canada being as high as **3 million tonnes.** For the majority **(60.9%)** of respondents, steam methane reforming without carbon capture was the primary method of hydrogen production.

21.9% of respondents reported **producing hydrogen**

Industry was the most reported **end-use** for hydrogen production

SMR

(Steam Methane Reform)

was the source for **60.9%** of the reported hydrogen produced in Canada

A sample size of Sector Profile respondents alone produced **234.5K tonnes**, with estimated production across Canada being as high as **3 million tonnes** in 2023.

Source: Estimated production across Canada is sourced from NrCan's "Hydrogen Strategy for Canada" 2020 report

2023 Revenue Reported

Survey respondents reported **$180.5 million** in revenues generated in 2023. A total of **$166.1 million** in revenue was generated from Western Canada. The reported Canadian revenues from respondents experienced a significant **increase of 69.6%** between 2021 and 2023.

$180.5M was the reported **revenue** generated in **Canada**.

Western Canada reported the highest revenue among respondents, with a total of **$166.1M** generated.

Sector Profile respondents reported a **69.6%** increase in the total **Canadian revenue** from 2021 to 2023.

Note: Not all respondents provided information for every question.

Canadian Hydrogen Industry Spotlight

As one of the world's largest and most advanced green hydrogen projects, Bear Head is developing an industrial scale green hydrogen and ammonia production, storage, and loading facility located on the Strait of Canso. Backed by a leading midstream company, the project will allow Nova Scotia to export its abundant wind energy resources.

Bear Head Energy

What do you consider the key building blocks to Canada's hydrogen sector?

Development of hydrogen projects is complex and fast-moving. Consideration must be given to not only the hydrogen production design but also access to power, land, water, transmission, distribution, and environmental regulations.

WSP is uniquely positioned to support our clients in understanding and assessing hydrogen opportunities as they relate to their specific needs. Our engineering and advisory teams encompass experts from all these specialized areas to determine project viability and associated risks and opportunities.

We design and deliver lasting solutions in the Make it, Move it, and Use it spaces.

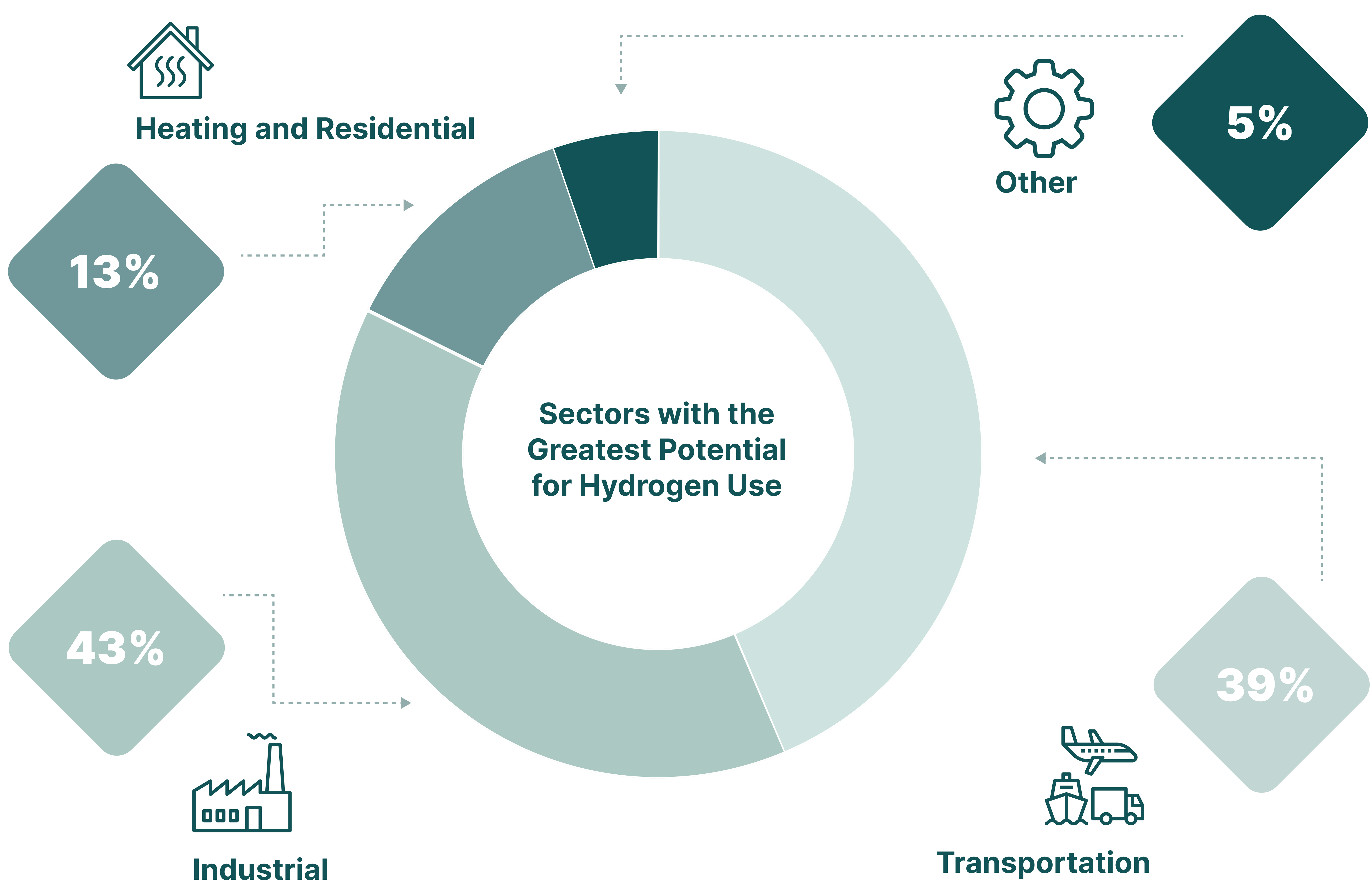
wsp

First End-Use Market Opportunities for Hydrogen

Decarbonizing industry is seen as the earliest market opportunity in Canada by **43%** of survey respondents. Transportation **(39%)** and heating and residential applications **(13%)** were the next most reported as the earliest end-use market opportunity for hydrogen.

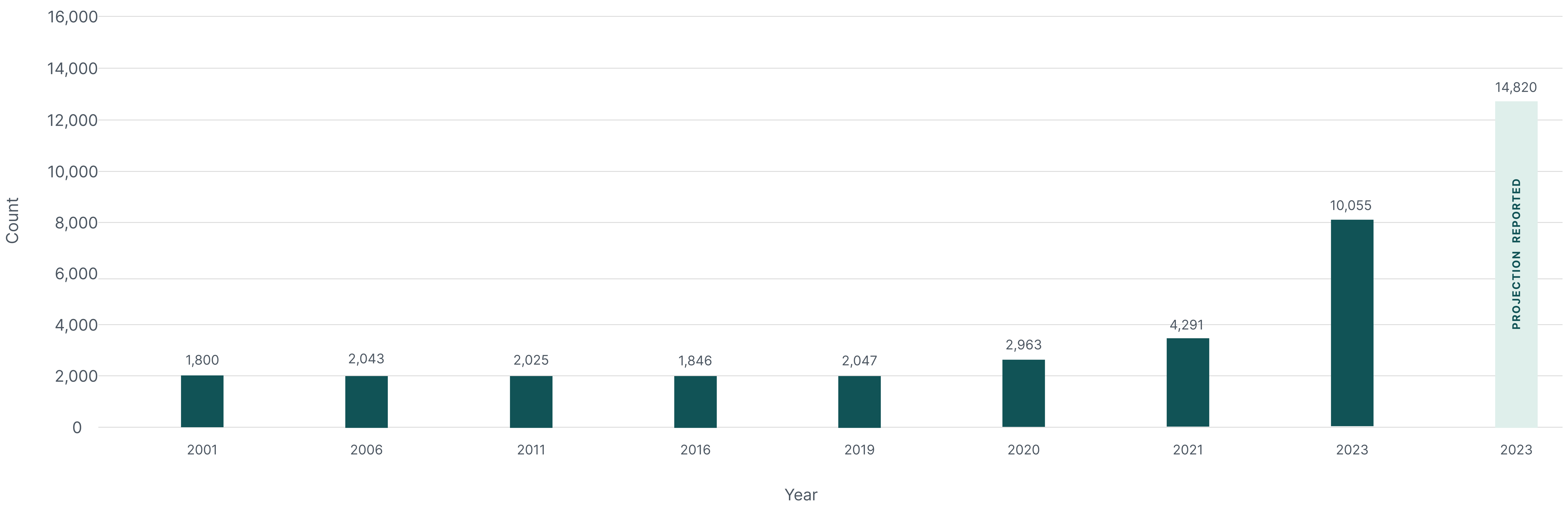
43% of respondents reported that **decarbonization of industry** is the most likely initial application of hydrogen adoption in **Canada.**

Degree of Confidence in Earliest End-Use Market Opportunity for Hydrogen



2023 Employment Reported

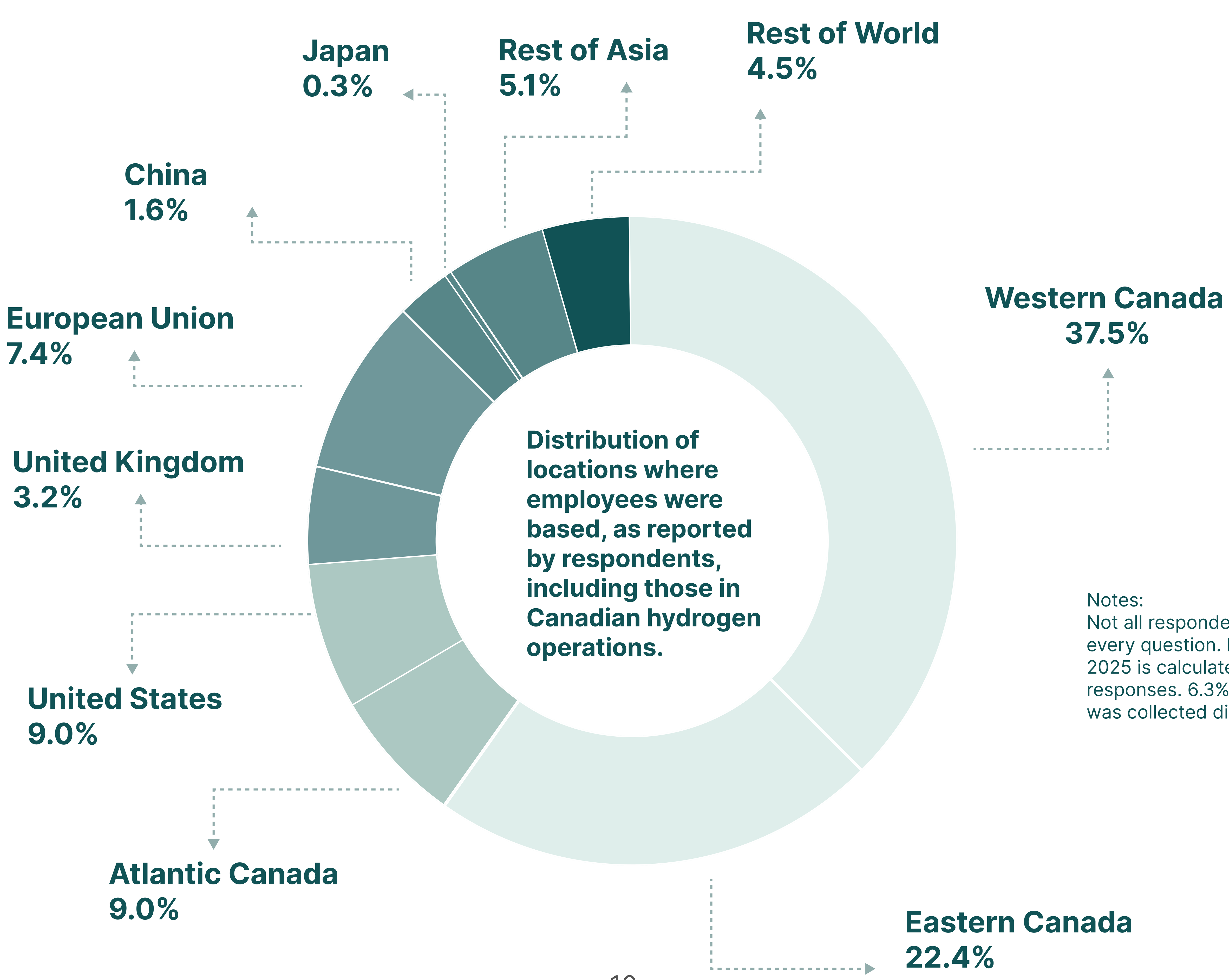
Global Hydrogen Employment Count Reported



Note: Historical global hydrogen employment count data is sourced from the Canadian Hydrogen and Fuel Cell Sector Profile report published in 2022. Historical global hydrogen employment count data from 2019 onwards was assumed to be consistent with 2023 response and was used to estimate 2025 global hydrogen employment count figures using linear regression.

81% of respondents plan to increase their hydrogen **workforce** globally, including in Canada, over the next two years.

Respondents projected their **global hydrogen employment** count will increase by **47.4%** from 2023 to 2025.



Notes:
Not all respondents provided information for every question. Projected employment in 2025 is calculated based on reported responses. 6.3% of the employment data was collected directly by the CHA.

Canadian Hydrogen Association | Association Canadienne de L'hydrogène

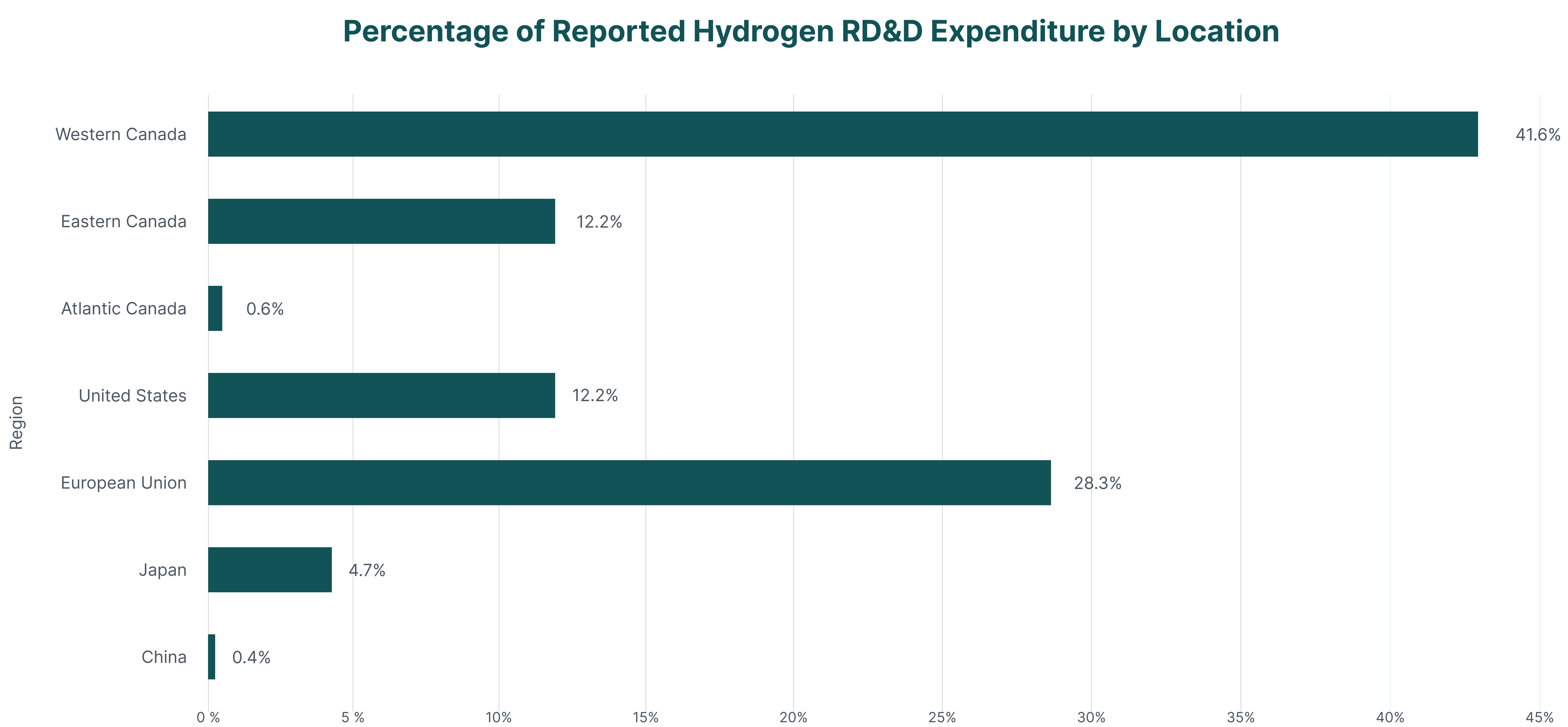
Canadian Hydrogen Industry Spotlight

What product or innovation is your company developing to propel the hydrogen market in Canada?

Toyota believes hydrogen will play an important role in a multi-technology approach to carbon reduction in Canada. In 2019, we became the first automaker to bring hydrogen fuel cell electric vehicles – or "FCEVs" - to Canada en masse. But light-duty vehicles like the Mirai are only part of our hydrogen plan. We believe hydrogen fuel cell technology could be a zero-emission solution across a broad spectrum of vehicle types, from heavy-duty, to medium-duty to light-duty, and we're proud to be part of Canada's growing hydrogen community.

TOYOTA

2023 RD&D Investments Reported



54.4% of respondents' **RD&D** expenditures were in Canada. Within **Canada**, Western Canada accounted for the highest percentage of RD&D expenditures at 41.6%.

23.6% of the reported RD&D focus areas were focused on **hydrogen infrastructure**, making it the top RD&D focus area.

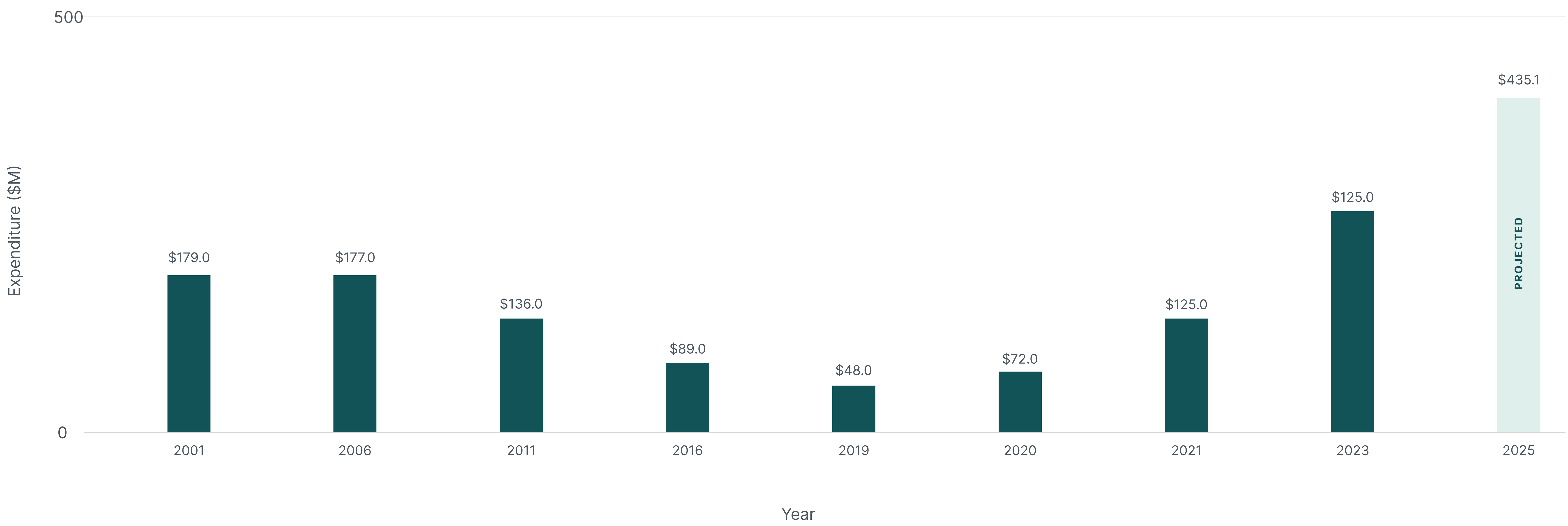
Note: Not all respondents provided information for every question.

RD&D Expenditure Reported

$317M

was reported as the total RD&D expenditure for the hydrogen sector in 2023, according to respondents. If consistent with the historical data and the reported RD&D expenditure in 2023, the projected RD&D expenditure is expected to **increase** by **37.3%** from 2023 to **2025.**

Global Hydrogen RD&D Expenditure Trend



$317 million was reported as the total RD&D expenditure for the hydrogen sector in 2023, according to respondents. If consistent with the historical data and the reported RD&D expenditure in 2023, the projected RD&D expenditure is expected to increase by **37.3%** from 2023 to 2025.

Canada accounted for **54.4%** of the total RD&D expenditures reported by the respondents. Among the regions in Canada, Western Canada accounted for the largest portion of RD&D expenditures with **41.6%**, while Eastern Canada accounted for **12.2%** and Atlantic Canada accounted for **0.6%.**

Note: Historical RD&D expenditure data is sourced from the Canadian Hydrogen and Fuel Cell Sector Profile report published in 2022. Historical RD&D expenditure from 2019 onwards was assumed to be consistent with 2023 response and was used to estimate 2025 RD&D expenditure figures using linear regression.

Canadian Hydrogen Association | Association Canadienne de L'hydrogène

Canadian Hydrogen Industry Spotlight

Powertech Labs: The Power of Trust. The Future of Energy.
Shaping the Hydrogen Infrastructure Future.

Powertech leads Canada's hydrogen fuelling technology sector, with dominant presence in over 90% of the installed stations in Canada and 28 stations globally, including the US. Since the early 2000s, we've developed innovative, safe and reliable hydrogen fuelling solutions at 350-Bar and 700-Bar for light duty and heavy- duty applications covering storage, compression, cooling, dispenser and point-of-sale. With thirty years of hydrogen testing experience, Powertech is a leader in building the future of hydrogen infrastructure.

Innovative History

It all started two decades ago, when Powertech built the world's first 700-bar hydrogen fast-fill fueling station. Today, Powertech is the only North American company that offer fully integrated solutions from the outlet of hydrogen production to the inlet of hydrogen vehicle. Headquartered in the greater Vancouver area with a US subsidiary in Boston, MA, we support our customers coast to coast, in their hydrogen journey.

Five Year Vision

Powertech aims to connect hydrogen producers and consumers over the next five years. Drawing on our decades of experience, our mission is to accelerate the global energy transition with advanced, safe and reliable hydrogen infrastructure solutions.

Our vision is supported by several strategic initiatives:

1. Expand Hydrogen Infrastructure: Powertech offers a range of hydrogen products from stationary to semi- permanent (containerized), to mobile solutions, cater to both light and heavy-duty applications. Emphasizing safety and reliability, these solutions support the growing demand across various mobility solutions across various sectors with the focus on heavy duty.

2. Offer Class Leading High-Capacity/ High-Pressure Tube Trailer: These units are designed for up to 1360 kg at 550 Bar, are smart and automated for the lowest cost per kg hydrogen transportation. With safety and reliability at their core, each trailer includes Type 4 tubes minimising connection points and maximising flow rates fill rates and offload time of 3 hours. and full communication between the export system to the tube trailer and to fuelling station. Our trailer utilises 100% of our hydrogen load enhancing distribution efficiency, reliability and cost of transportation per kg of hydrogen

3. Engineering Excellence: to best support of customers, our experienced team provides full range of engineering services such as Pre-FEED, FEED, System Integration, proprietary Techno-Economic Studies, Codes and Standards, and bench marking product support with cloud base system monitoring and diagnosis

4. Focus on Reliability and Safety: Reliability and safety are core to Powertech, underscored by our extensive and largest hydrogen system and component testing lab. This unique capability enables Powertech to test and verify the quality, safety and reliability of every component that integrated into our designs and solutions. With an independently verified average yearly system availability of over 94%*, we exceed customer expectations, while maintaining rigorous safety standards

5. Testing with Hydrogen: Leveraging three decades of hydrogen expertise with active involvement in hydrogen standard committees, Powertech conducts specialized pressure testing, including factory acceptance tests (FAT) with 100% green hydrogen to ensure 0% system leak. This rigorous testing ensures system integrity, enhances safety, accelerates commissioning timelines, and lowers costs a unique advantage in the market.

6. Widen our market reach and technical expertise with Powertech USA: Established in 2023, our Boston-based subsidiary expands our product lines and market reach across North America. We grew our team to best support our North American customers with very experienced hydrogen engineers. This uniquely position Powertech to best serve our customers with fully certified and regulation compliant transportation and fueling solutions.

Hydrogen-Powered Future

The next five years will be critical for the development of the hydrogen industry. By expanding our offerings, providing high reliability, and delivering industry leading services, we support the energy transition and the global decarbonization efforts.

Powertech is a trusted leader in the hydrogen infrastructure market. With innovative solutions and a focus on sustainability, we are shaping the future of clean energy and advancing a hydrogen-powered world.

Canadian Hydrogen Industry Spotlight

Powertech Labs: The Power of Trust. The Future of Energy.
Shaping the Hydrogen Infrastructure Future.

Since the early 1990s, Powertech has been a global leader of hydrogen equipment test services. In those formative years, Powertech worked with emerging manufacturers to develop test protocols that have since evolved in modern industry standards. Today, Powertech's Hydrogen Industry Technology and Testing team continues to lead the industry with our commitment to true green power and hydrogen. Our engineers serve on several standards committees, offering our customers cutting-edge expertise in testing cylinders, components and fuel systems. Our laboratory operates under ISO 17025:2017 quality system covering wide range of testing standards. Our customers come to us for our accredited expertise and state-of-the-art testing facilities and capabilities. Powertech is recognised as the trusted proving ground for current and next generation technology.

Cylinder Testing

The Cylinder Test Lab offers high pressure cylinder testing to meet EC/ECE, ANSI/CSA, KHK, ISO, SAE, and EN standards. Powertech has high hydrogen storage to allow testing for on-board vehicle (both heavy and light duty), stationary storage, tube trailer, transportable, and portable cylinders. Powertech is also equipped to test to the latest UN GTR No. 13, ECE R134, and SAE J2579 test specifications for hydrogen cylinder durability.

Component Testing

The Component Testing Lab offers services to EC/ECE, UN GTR, ANSI/CSA, KHK, and ISO standards. The component tested includes solenoid valves, regulators, pressure-relief devices, check valves, manual valves, nozzle/receptacles, hoses, fittings, and sensors. The lab features a self-contained, customizable test stations with a high-pressure hydrogen (950 bar) and nitrogen supply. Test services include operating cycle, durability/endurance cycle, hysteresis, internal/external leakage, and high flow pre-cooled tests in environments from -70°C to +170°C.

Advanced Fuel System Testing

The Fuel Systems Testing Lab performs a range of tests including simulated hydrogen fueling tests, hydrogen gas pressure-cycling, static and dynamic hydrogen leakage testing, and drive cycle simulation. The lab also conducts the expected service and localized fire testing required by the UN GTR No. 13, ECE R134, and SAE J2579 test standards. Custom test apparatuses are developed to meet specific vehicle OEM test protocols, including water spray, dust ingress, thermal shock, vibration resistance, mechanical shock or impact, electrical operation, and other specialized tests.

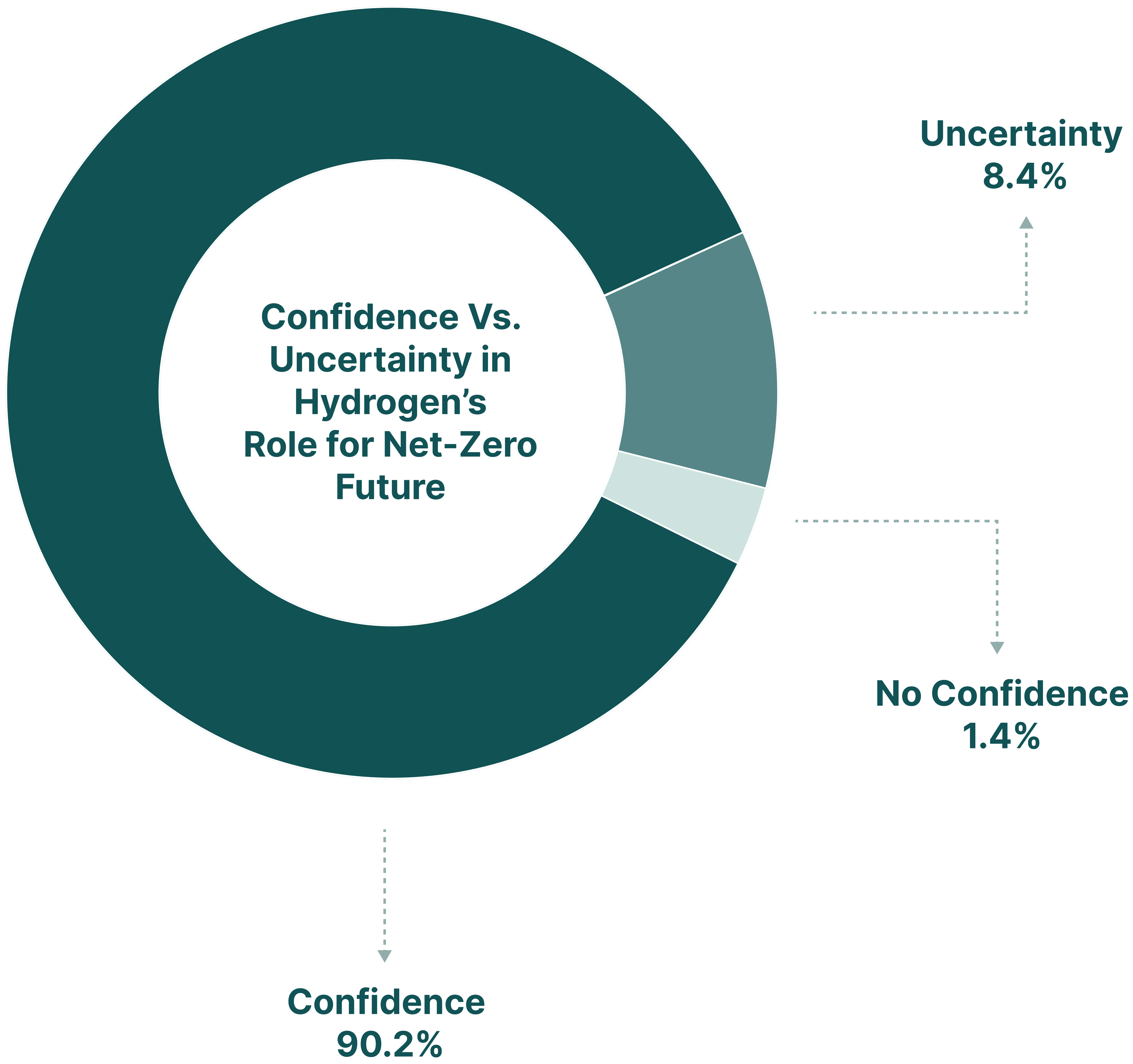
Driving Hydrogen-Powered Future

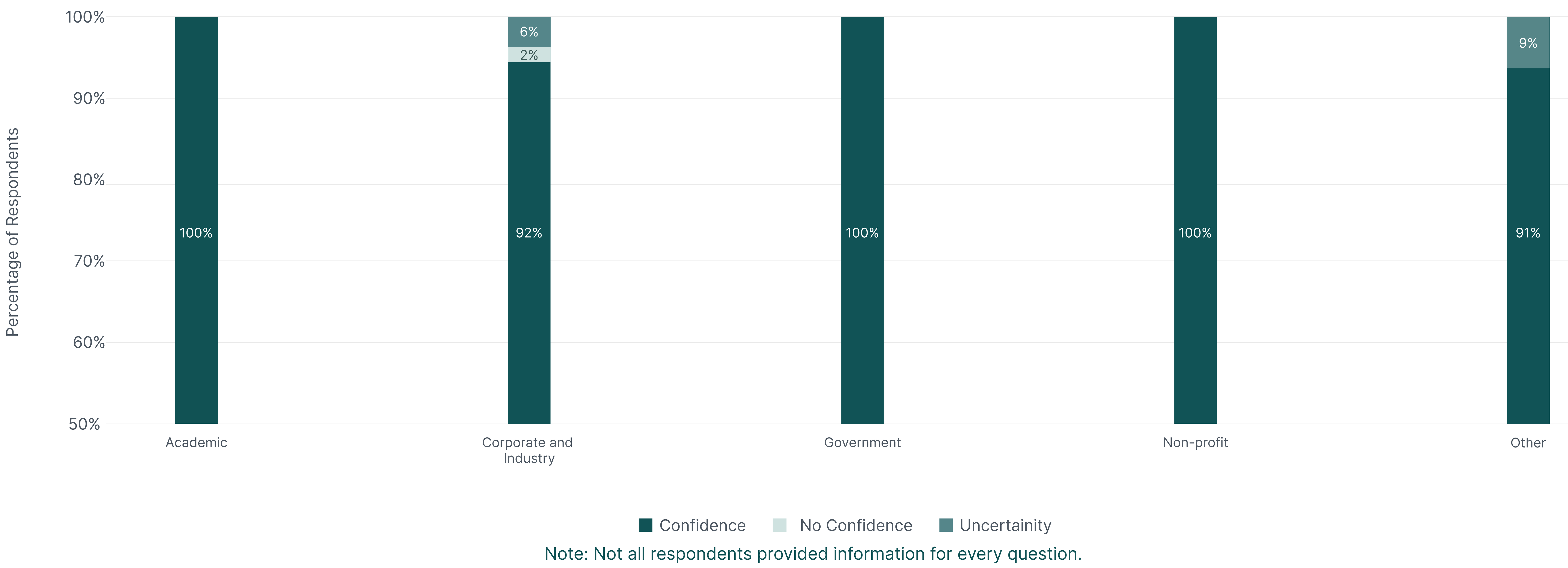
The next five years are critical for the development of the hydrogen industry. Powertech's Hydrogen Industry Technology & Testing team offers our global clients a trusted service to support the energy transition and the global decarbonization efforts. With the commitment to safety, reliability and innovation, Powertech is at the forefront of building a sustainable hydrogen future.

Hydrogen is Seen as Key to Canada's Net-Zero Ambitions

A large majority of respondents **(90.2%)** believe that hydrogen will play a crucial role in Canada's efforts to achieve a net-zero future. A smaller percentage **(8.4%)** expressed uncertainty about this role, while an even smaller percentage **(1.4%)** indicated a lack of confidence in hydrogen's potential.

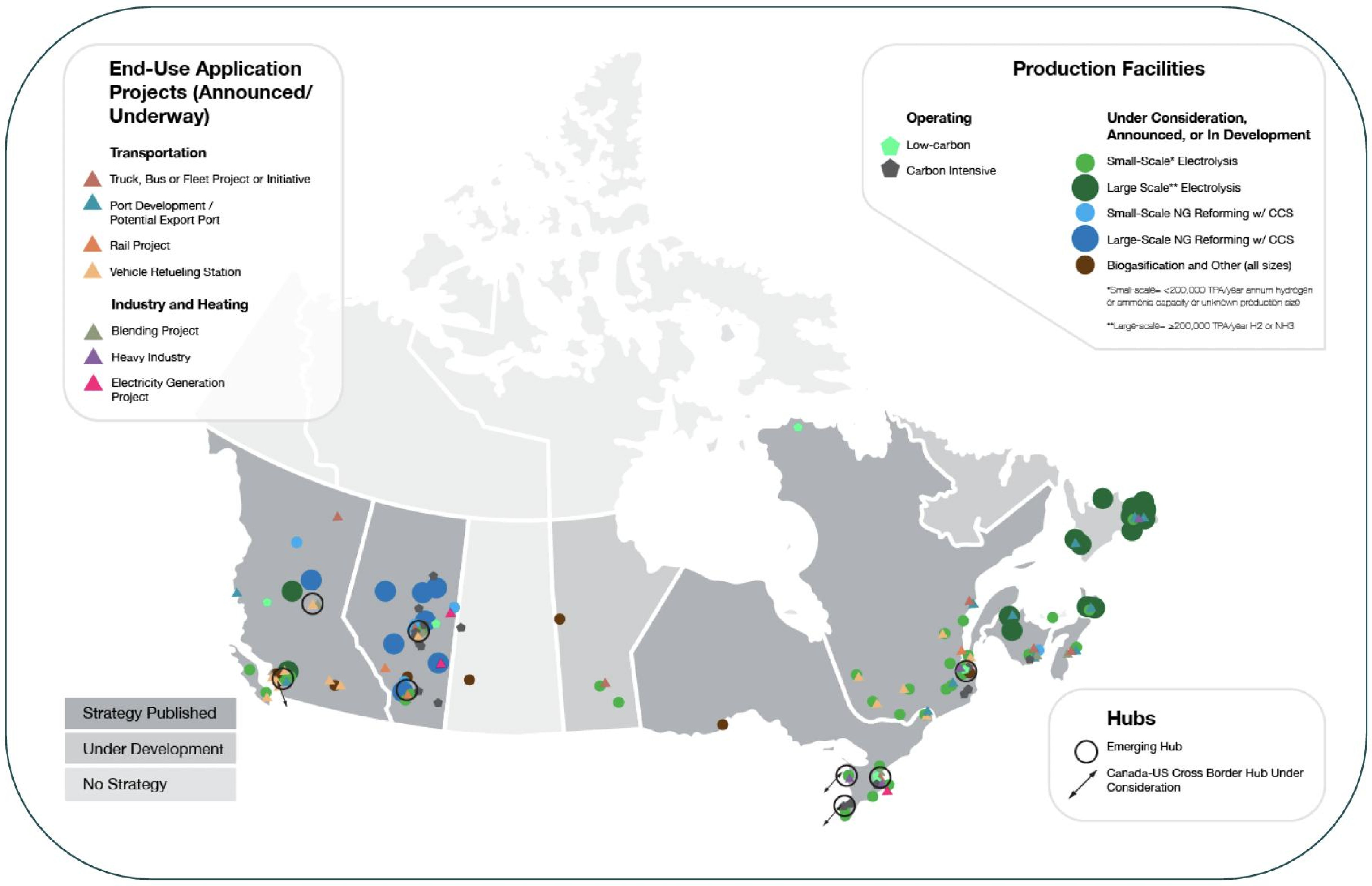
Another important factor is the level of confidence that various respondent groups have in hydrogen for Canada's net-zero ambition. Three respondent groups – academic, government, and non-profit – each have complete confidence **(100%)** in the significance of hydrogen for a net-zero future. Industry and corporate respondents overwhelmingly believe in hydrogen's potential to play a major role in Canada's net-zero future, with **92%** expressing confidence. Only a small percentage, **6%** and **2%** respectively, reported uncertainty or lack of confidence in hydrogen for Canada's net-zero ambitions.





Note: Not all respondents provided information for every question.

Hydrogen Sector Infrastructure in Canada



Source: NRCan: Hydrogen Strategy for Canada Progress Report - April 2024

Current Hydrogen Production Infrastructure

A total of 13 hydrogen production facilities operating in Canada:

- **6** Electrolytic facilities
- **7** Steam-Methane reforming with carbon capture

Future Hydrogen Production Infrastructure

Expression of interest of ~ 80 low carbon hydrogen production projects representing over $100 billion in potential investment across Canada to produce ~5Mt/annum H2.

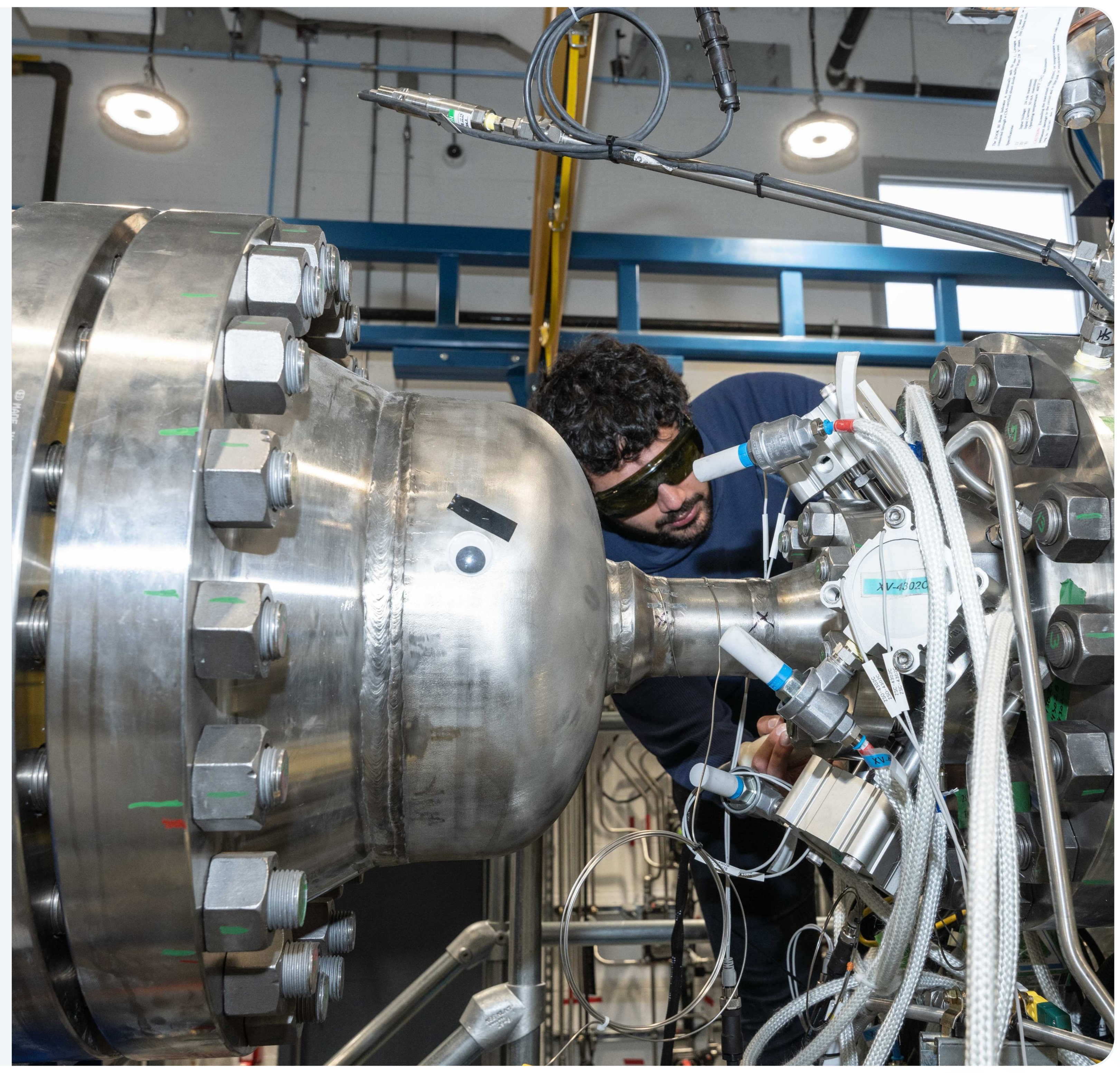
- Under Construction - **6**
- Approval and Preparatory Work - **8**
- Feasibility/FEED/Pre-FEED - **59**

Government Support and Initiatives

- Tax credit programs
- Clean Fuel Regulations (CFR) Credits for H2 use and production
- Provincial Hydrogen Strategies developed and announced for British Columbia, Alberta, Ontario, Quebec, Nova Scotia and New Brunswick
- Newfoundland and Manitoba are developing their provincial H2 strategy
- **8** hydrogen hubs are formed or are being formed across Canada

Canadian Hydrogen Industry Spotlight

We believe collaboration is critical – among industry, academia, governments, and others. Let's stimulate Canada's long history of sector innovation with creative approaches to grants and funding programs, sparking new ideas, inventions, and made-in-Canada solutions. And let's incentivize the adoption of hydrogen alternatives, inspiring and driving market demand to keep us competitive globally.



How is CNL Contributing to Canada's Net-Zero Future?

Canadian Nuclear Laboratories (CNL) is a global leader in researching and supporting today's clean energy technologies and those of the future.

CNL is accelerating the transition to a hydrogen economy with advanced hydrogen production and energy storage technologies. Our partnerships with industry, academic institutions, national and global organizations demonstrate our commitment to innovation and exemplary quality assurance. CNL is a recognized world leader in niche catalyst production for nuclear and non-nuclear applications with significant capacity to support tritium-related technology needs and new product development towards clean energy generation.

Small modular reactors will challenge your assumptions about nuclear power. They are safe, more efficient, and more flexible than the reactors of the past. And they make more than electricity. Heat for your homes and businesses. Steam for industrial processes. And clean, reliable power in places that need it. Companies from around the world are coming to CNL to bring these technologies to life through our research programs, our siting invitation, and through access to CNL's laboratories and expertise.

We support nuclear utilities, the nuclear supply chain, and industry research through operations and maintenance practices that improve reactor operations and respond to emergent issues; life extension initiatives that enable long-term operations; and innovation that develops technologies to support reactor modernization and efficiencies.

To support long-term reliability of existing reactors and the development of advanced reactors, advanced nuclear fuel concepts are being developed worldwide. These advanced fuels offer improved performance, failure tolerance, safety, proliferation resistance, and accident tolerance; and are recycled or recyclable.

Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

Canadian Hydrogen Association | Association Canadienne de L'hydrogène

Canada in the Global Context

This section highlights the estimated global impact of hydrogen operations reported, including contributions from Canadian-based activities.

Canada is Part of an Emerging Global Hydrogen Economy

Total global revenue of **$612.7M** reported by the respondents

16.3% increase in global revenue reported from respondents in 2021

~80% of this revenue was reported to be generated from product sales

$118.4M of the revenue reported was from the provision of services, research and development contracts and other sources

10,055 full-time hydrogen dedicated employees globally reported by respondents

Research, development and demonstration expenditures reported of **$317.0M** representing a **153.2%** increase from 2021 to 2023.

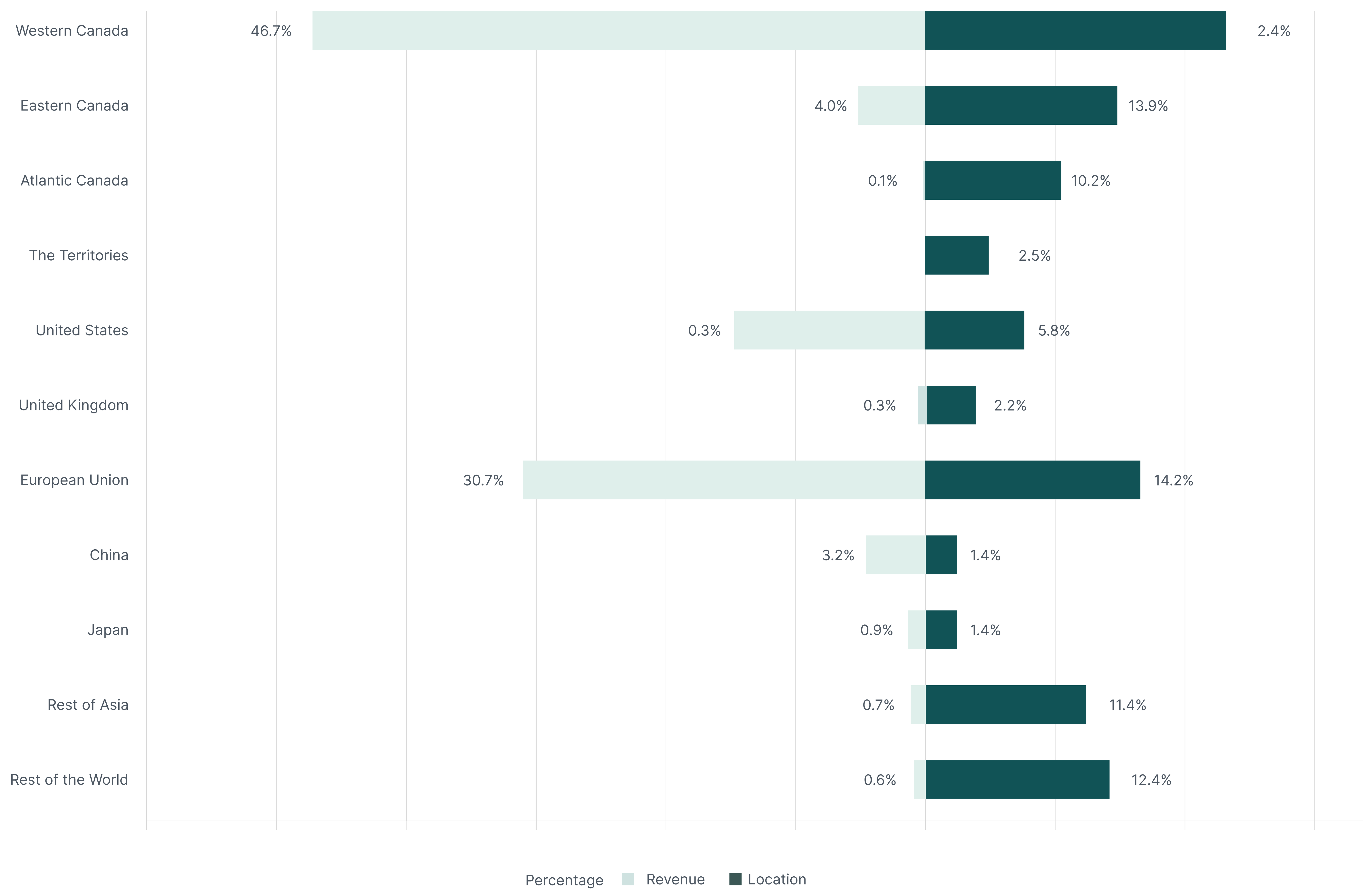
The respondents reported a total global revenue of **$612.7 million** 2023, which signifies a **16.3% rise** in global revenue compared to the figures reported by respondents in 2021. The largest portion of the total revenue, amounting to **80%**, was generated through product sales. **$118.4 million** of the revenue reported was generated through services, research and development contracts, and other means.

In terms of employment, respondents reported **10,055 full-time employees worldwide** who are dedicated to hydrogen. RD&D spending was reported at **$317.0 million**, which represents an increase of **153.2%** from 2021 to 2023.

Contributions from Canadian-based Operations to Reported Global Revenue by Location

24.9% of respondents reported hydrogen activities in **Western Canada**, making it the top region for sector activities with the highest percentage of **revenue** among respondents.

51.5% of respondents reported hydrogen activity in Canada. **24.9%** of respondents reported hydrogen activity in Western Canada, making it the top region for sector activities with the highest percentage of revenue among respondents. Eastern Canada had the second highest reported hydrogen activity in Canada at **13.9%**, followed by Atlantic Canada at **10.2%**. Outside of Canada, the European Union had the highest reported activity **(14.2%)** and revenue **(30.7%)**, followed by the United States which contributed **12.9%** of reported revenue but only **5.8%** of hydrogen activity.



Note: survey respondents could select multiple options and the percentages may not add up to 100%

Global Revenue Reported

$612.7M was the reported global revenue for the hydrogen sector in 2023, according to respondents.

Global Hydrogen Revenue Trend Reported

The global hydrogen revenue is projected to **increase** by **28.9%** from 2023 to 2025, if consistent with historical trends.

Note: Historical revenue data is sourced from the Canadian Hydrogen and Fuel Cell Sector Profile report published in 2022. Historical revenue data from 2019 onwards was assumed to be consistent with 2023 response and was used to estimate 2025 revenue figures using linear regression.

Canadian Hydrogen Industry Spotlight

How is the Northern BC Hydrogen Hub Contributing to Canada's Net Zero Future?

Low Carbon Hydrogen Production

Attracting and supporting hydrogen producers through the availability of low-cost industrial land, clean power and water resources, fast clear permitting times and stable business property tax rates. Community leaders have been advocates for clean energy development in the region.

Export Opportunities

The extensive transportation network throughout northern BC can be leveraged to create new export opportunities in the global clean energy market through the Port of Prince Rupert.

Fuel Switching & Decarbonization

Local hard-to-electrify sectors like manufacturing and transportation are incorporating hydrogen into their operations to assist in the decarbonization of Canada. There is significant opportunity for CCUS technology to be applied to industries like natural gas processing and heavy industries to capture and store carbon dioxide emissions in naturally occurring geological formations in the region.

Economic Growth

The region is home to robust natural resources including wind, biomass and natural gas which can contribute to clean alternatives and diversify the economy. Northern BC's industrial clusters create a strong, skilled local workforce with zero emission-specific training, and a test bed for tech and production companies, and could support CCS infrastructure development.

Research & Innovation

The University of Northern BC has expert researchers with a suite of analytical science instrumentation enabling a broad spectrum of accredited analysis and opportunity for partnerships and R&D. Prince George has been home to pilot projects such as hydrogen truck testing and carbon storage, and Prince Rupert is testing hydrogen trucks at its port.

NORTHERN BC HYDROGEN HUB

Barriers and Opportunities for Hydrogen Sector Growth in Canada

This section examines the primary barriers and opportunities influencing the growth of Canada's hydrogen sector. The analysis is presented in three parts: a summary of key factors affecting investment, such as infrastructure development, public awareness, regulatory and policy frameworks, technology, and workforce development; a breakdown of insights by stakeholder group; and a detailed account of barriers and challenges associated with attracting investment, as reported by various stakeholder groups.

Key Barriers to Hydrogen Investment

Respondents were asked to identify key factors impacting investment in hydrogen and hydrogen technologies. Below is a table summarizing the top reported investment barriers by category. **"Significant upfront investment to build hydrogen infrastructure"** was the top investment barrier reported, as reported by **64.5%** of respondents.

Additionally, **38.7%** pointed to **public safety awareness** as a critical issue, underscoring the need for better communication about hydrogen's reliability. **28.4%** cited the **lack of government support** and funding as a major hurdle, highlighting the need for clearer policies and financial incentives. On the technology front, **60.5%** of respondents identified **cost competitiveness** with conventional fuels as a key challenge, stressing the importance of research to reduce costs. Lastly, **52.9%** noted a **shortage of skilled trades workers**, calling for educational programs to support workforce development.

Category	Top Barrier for each Category	Remarks
Infrastructure Development	Significant upfront investment to build hydrogen infrastructure	• Number of barrier options listed in the survey for Infrastructure Development category: **5** • Response rate for the question: **96.5%** • **64.5%** of respondents chose "**Significant upfront investment to build hydrogen infrastructure**" as the top investment barrier in this category.
Public Acceptance and Awareness	Lack of awareness in safety around hydrogen	• Number of barrier options listed in the survey for Public Acceptance and Awareness category: **8** • Response rate for the question: **92.3%** • **38.7%** of respondents chose "**Lack of awareness in safety around hydrogen**" as the top investment barrier in this category.
Regulatory and Policy Environment	Lack of government support in funding	• Number of barrier options listed in the survey for Regulatory and Policy Environment category: **6** • Response rate for the question: **93.7%** • **28.4%** of respondents chose "**Lack of government support in funding**" as the top investment barrier in this category.
Technology and Innovation	Achieving cost competitiveness compared to conventional fuels	• Number of barrier options listed in the survey for Technology and Innovation category: **5** • Response rate for the question: **94.4%** • **60.5%** of respondents chose "**Achieving cost competitiveness compared to conventional fuels**" as the top investment barrier in this category.
Workforce Development	Lack of skilled trades workers	• Number of barrier options listed in the survey for Workforce Development category: **5** • Response rate for the question: **84.6%** • **52.9%** of respondents chose "**Lack of skilled trades workers**" as the top barrier investment barrier in this category.

Note: 94.4% of survey participants responded to three or more questions regarding the conditions necessary to attract investment in Canada's hydrogen sector.

Canadian Hydrogen Industry Spotlight

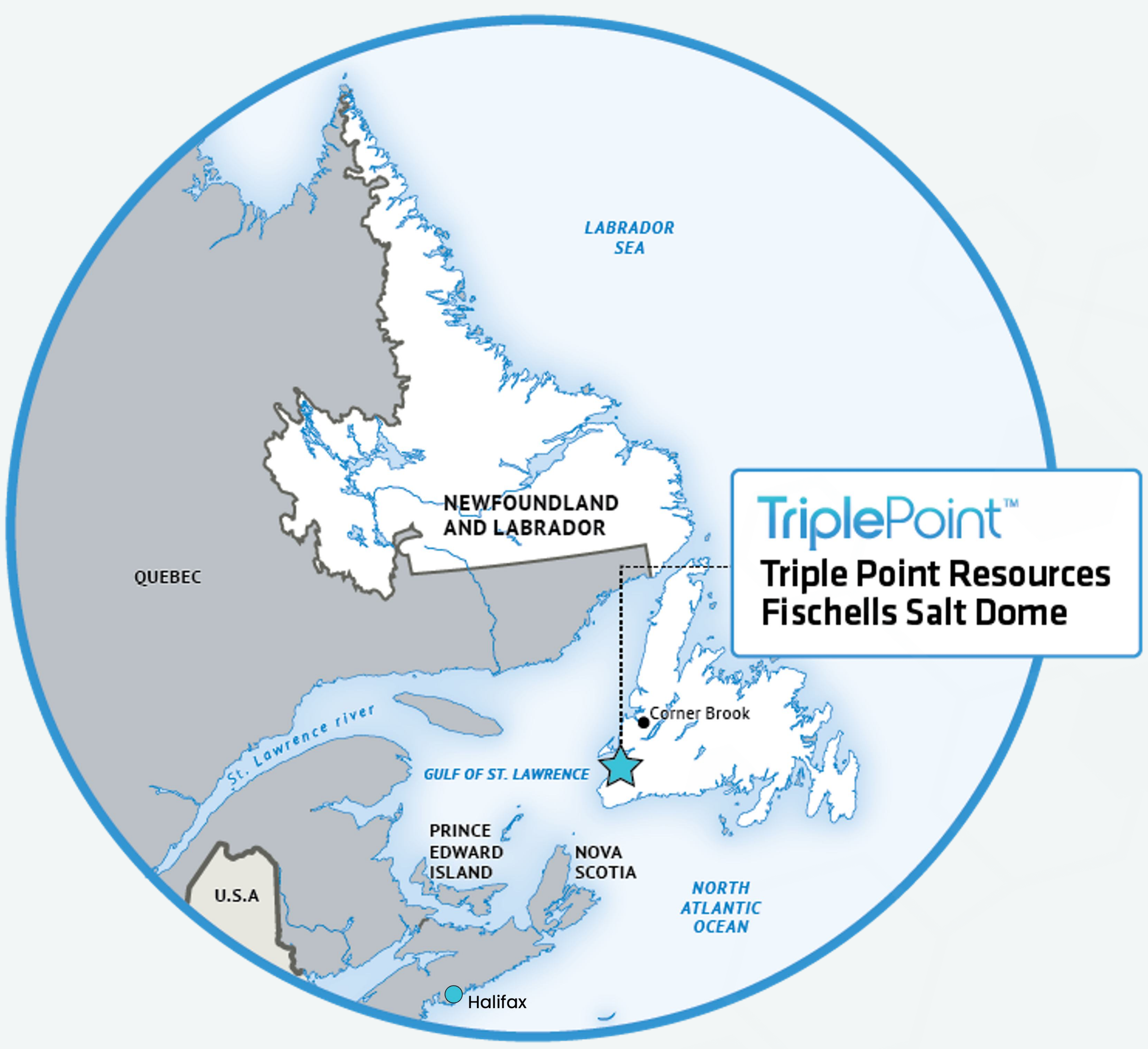
How is the Triple Point Contributing to Canada's Net Zero Future?

Triple Point Resources Ltd. (Triple Point) is transforming Canada's hydrogen sector with the development of its Fischells Salt Dome in Newfoundland and Labrador. This asset is a game changer on North America's East Coast as the only salt dome proven to be able to store hydrogen, which offers the potential to significantly enhance the region's renewable energy infrastructure.

The Fischells Salt Dome is poised to increase the stability of the hydrogen market with a dual purpose for compressed air energy storage (CAES) as well. This opportunity makes the asset more reliable by allowing the local grid to store surplus energy as compressed air and hydrogen, which can be converted back into electricity during periods of peak demand and increase market capacity.

The Fischells Salt Dome has significant storage capabilities with the potential to enhance reliability, stabilize prices and reduce the risks of market fluctuations. These elements are crucial for the affordability of transitioning to a hydrogen-based economy as it encourages commitment to long-term contracts and investments.

Triple Point's efforts align with provincial and federal initiatives to advance clean energy while collaborating with local communities and stakeholders to maximize economic and environmental benefits.



Key Opportunities to Promote Hydrogen Investment

Respondents were asked to identify opportunities to promote investment in hydrogen and hydrogen technologies. Below is a table summarizing the top reported investment attraction opportunities by category. "**Funding for pilot projects**" was the top investment attraction opportunity reported with **46.2%** of respondents prioritizing it.

In the infrastructure development category, **39.7%** emphasized the importance of incentives to encourage private investment in new hydrogen infrastructure. For public acceptance and awareness, **34.7%** pointed to the need for campaigns promoting hydrogen as a viable decarbonization path. Regulatory and policy environment improvements were identified by **33.2%**, with a focus on developing supportive policies. Lastly, **35.2%** of respondents underscored the need for workforce development initiatives, particularly bridge training for workers from other sectors.

Category	Top Opportunity for each Category	Remarks
Infrastructure Development	Incentives to encourage private investment to build new infrastructure to support hydrogen	• Number of investment attraction choices listed in the survey for Infrastructure Development category: **6** • Response rate for the question: **92.3%** • 39.7% of respondents chose "Incentives to encourage private investment to build new infrastructure to support hydrogen" as the top investment attraction opportunity in this category.
Public Acceptance and Awareness	Awareness campaign to promote hydrogen as a viable decarbonization pathway to net zero	• Number of investment attraction choices listed for Public Acceptance and Awareness category: **5** • Response rate for the question: **93%** • **34.7%** of respondents chose "**Awareness campaign to promote hydrogen as a viable decarbonization pathwayto net zero**" as the top investment attraction opportunity in this category.
Regulatory and Policy Environment	Develop supportive policies (e.g., climate policy, mandates, targets)	• Number of investment attraction choices listed in the survey for Regulatory and Policy Environment category: **6** • Response rate for the question: **93%** • **33.2%** of respondents chose "**Develop supportive policies**" as the top investment attraction opportunity for attracting investment in this category.
Technology and Innovation	Funding for pilot projects	• Number of investment attraction choices listed in the survey for Technology and Innovation category: **6** • Response rate for the question: **94.4%** • **46.2%** of respondents chose "**Funding for pilot projects**" as the top investment attraction opportunity in this category.
Workforce Development	Bridge training for workers outside of the sector	• Number of investment attraction choices listed in the survey for Workforce Development category: **6** • Response rate for the question: **85.3%** • **35.2%** of respondents chose "**Bridge training for workers outside of the sector**" as the top investment attraction in this category.

Note: 94.4% of survey participants responded to three or more questions regarding the conditions necessary to attract investment in Canada's hydrogen sector.

Top Barriers Identified by Respondent Group

Respondent groups identified several significant barriers to advancing hydrogen development. For corporate and industry category, the most prominent challenge was reported as the **substantial upfront investment** required to build hydrogen infrastructure. Academic and Non-Profit groups highlighted a **lack of government funding support** as a critical roadblock, while government entities flagged **the need to achieve cost competitiveness** with conventional fuels. Non-Profit respondents also flagged the **insufficient incentives to promote hydrogen**, further stalling progress. These insights underscore the diverse hurdles that stakeholders face in driving the hydrogen sector forward.

Top Reported Barriers to Hydrogen Investment by Respondent Group

Respondent Group	Significant upfront investment to build hydrogen infrastructure	Lack of awareness in safety around hydrogen	Lack of government support in funding	Achieving cost competitiveness compared to conventional fuels	Lack of incentives to promote hydrogen
Academic			✓		
Corporate and Industry	✓				
Government		✓			
Non-Profit				✓	✓
Other					✓

Note: There was a tie between "Achieving cost competitiveness compared to conventional fuels" and "Lack of incentives to promote hydrogen" as the top barrier for the Non-Profit respondent group.

Canadian Hydrogen Association | Association Canadienne de L'hydrogène

Canadian Hydrogen Industry Spotlight

NGen is Canada's Global Innovation Cluster for advanced manufacturing. We are founded on the principle that digital transformation in advanced manufacturing will enrich the lives of Canadians, delivering better products, good jobs, and improved environmental sustainability. We fund innovation projects, lead skills & training programs, and showcase Canada's advanced manufacturing capabilities at flagship manufacturing events around the globe.

NGen is leading a recruitment campaign across the country to showcase Canada's best and brightest hydrogen technology companies to the world. Join team Canada at Hannover Messe 2025 for a unique opportunity to be part of Canada's Partner Country experience. Running from March 31 to April 4th, Hannover Messe is the world's largest showcase of advanced manufacturing and energy solutions.

If your company is export-ready and eager to forge new international partnerships, visit **www.ngen.ca/hannover-messe** to find out how you can become an exhibitor. In partnership with the Goverment of Canada, NGen is offering financial reimbursement packages to support Team Canada at Hannover Messe. Space is limited, exhibitor floor space will be allocated on a first-come, first-served basis. Submit your expression of interest today and help us position Canada as a green supplier to the world.

Top Opportunities Identified by Respondent Group

To spur investment in hydrogen, respondent groups identified key opportunities for growth. Corporate and industry and academic respondents pointed to **funding for pilot projects** as the top opportunity to advance hydrogen technologies. In the government and Non-Profit sectors, **Incentives for private investment in hydrogen infrastructure** were recognized as most vital. **Bridge training for workers transitioning** into the hydrogen sector was also highlighted by government respondents. It is worth noting that awareness campaigns and developing supportive policies, although necessary, were not deemed a top opportunity for any respondent group.

Top Reported Investment Attraction Opportunities to Spur Hydrogen Sector Development by Respondent Group

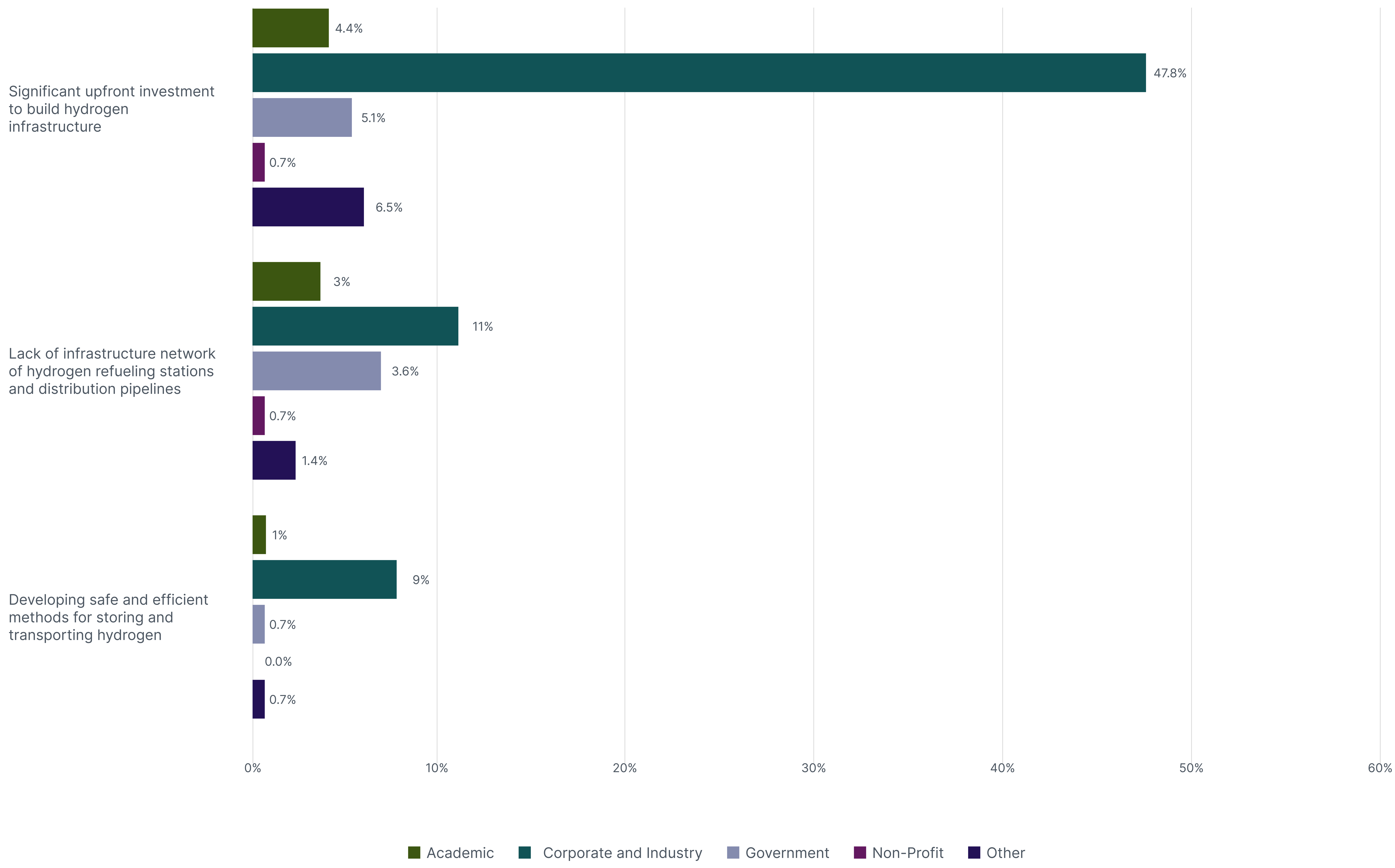
Respondent Group	Incentives for private Investment in hydrogen infrastructure	Funding for pilot projects	Bridge training for workers outside of the sector	Hydrogen awareness campaign for net-zero decarbonization	Develop supportive policies
Academic		✓			
Corporate and Industry		✓			
Government			✓		
Non-Profit	✓				
Other	✓				

Note: Blank rows indicate opportunities that may have been selected by some respondents but were not the top opportunity for any respondent group.

Infrastructure Development Barriers Reported

The most prominent challenge facing hydrogen infrastructure development is the significant upfront investment required, with **64.5%** of respondents citing it as the top barrier. This highlights the critical need for financial backing, both from the public and private sectors, to build the foundational infrastructure necessary for a Canadian hydrogen economy. Additionally, **19.7%** of respondents highlighted the lack of a refueling station network and distribution pipelines as a top barrier, and **11.4%** of respondents stressed the need for safe and efficient methods for hydrogen storage and transport, a technical challenge that must be addressed to ensure hydrogen's scalability as a clean energy source.

Top Three Infrastructure Development Barriers Reported



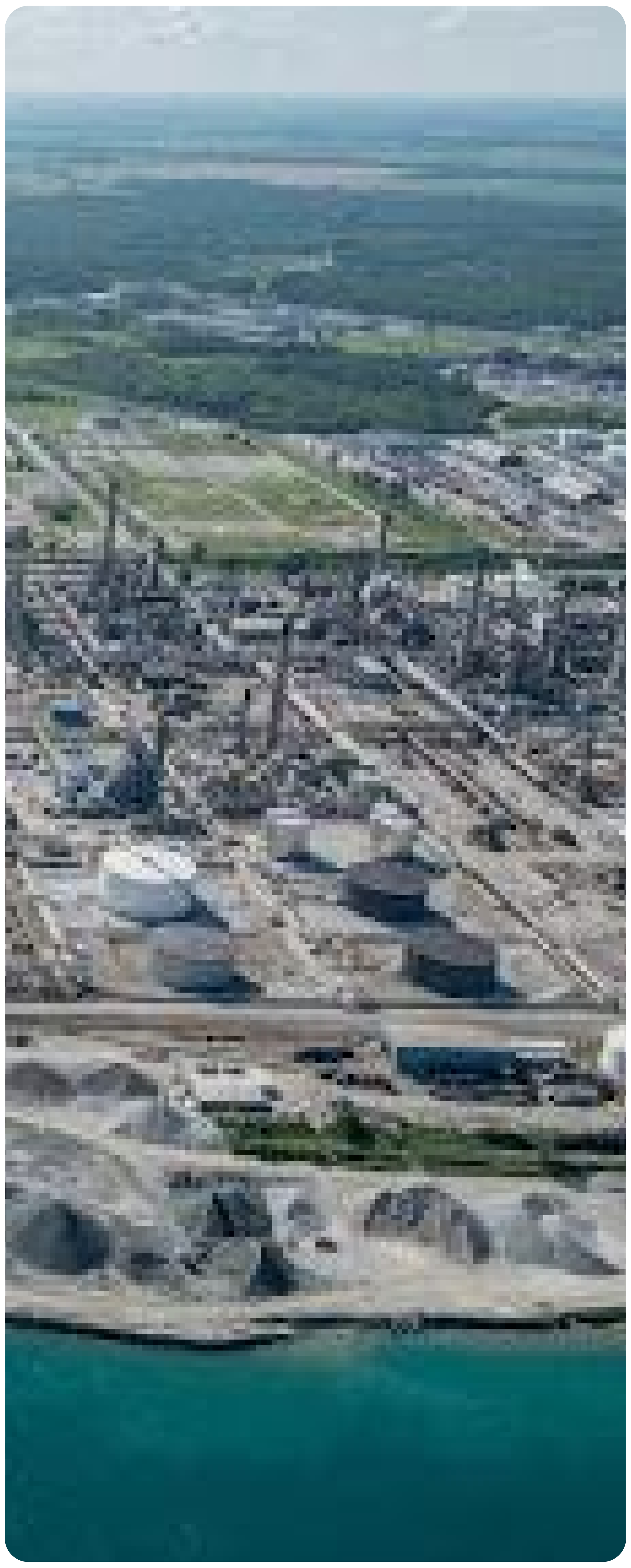
64.5% of respondents across all respondent groups reported **a lack of significant upfront investment to build hydrogen infrastructure** as the greatest challenge to infrastructure development.

Note: Not all respondents provided information for every question.

Canadian Hydrogen Industry Spotlight

How is your Sarnia-Lambton Economic Partnership contributing to Canada's net-zero future?

The Sarnia-Lambton Economic Partnership is dedicated to contributing to Canada's net zero future through sustainable development, innovation, and collaboration, with a focus on key initiatives and sectors that align with the goals of reducing carbon emissions and promoting green technologies. Samia-Lambton is **Ontario's Hydrogen Hub**, at the forefront of the province's large-scale low-carbon hydrogen economy. Our region leads in hydrogen production and usage, with ongoing initiatives to actively transition to low-carbon hydrogen production, supporting the decarbonization of local industries and attracting investment in transformational technologies. With access to connecting infrastructure, geology enabling salt cavern storage and carbon sequestration, export routes, and established R&D excellence, we are committed to leading net-zero technology innovation and commercialization and are attracting new technology pathways to assist local decarbonization efforts, making Sarnia-Lambton a leader in driving net-zero solutions. Through these strategic initiatives, the Samia-Lambton Economic Partnership is actively contributing to Canada's net-zero future by fostering innovation, supporting and attracting sustainable industries, and driving economic growth that aligns with environmental stewardship.
Linked to this, the **Sarnia-Lambton Hybrid Chemistry Cluster** is Canada's premier location for the development of, and investment in, clean, green, and sustainable chemistry technologies. As such, we leverage the expertise of our community partners and other ecosystem organizations, such as the Western Samla-Lambton Research Park, Lambton College, and Bioindustrial Innovation Canada to drive growth in renewable and bio-based chemicals and materials. This not only drives decarbonization but also fosters the development of a circular economy.



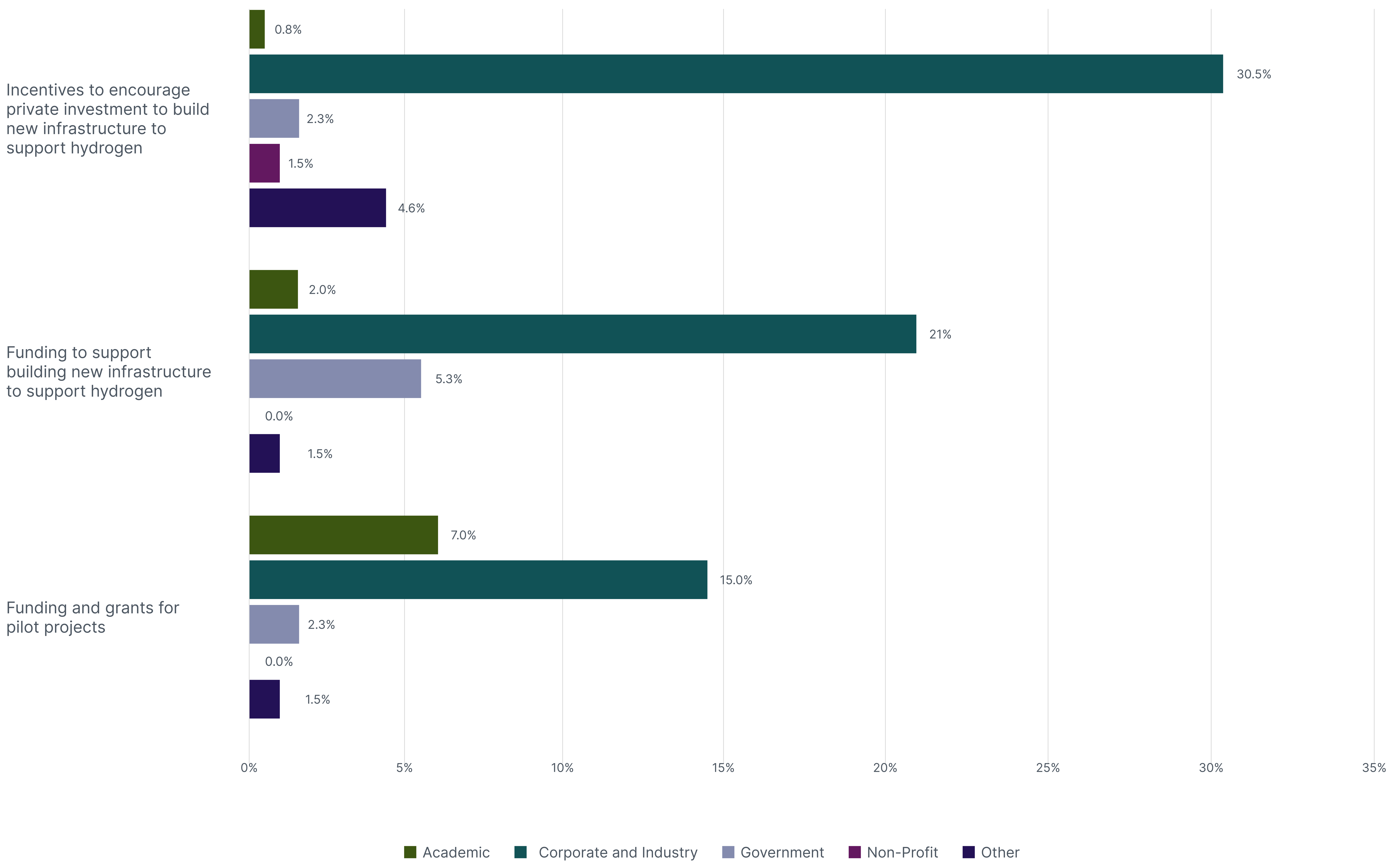
"Samia-Lambton will be one of Canada's premier locations for investment, innovation, decarbonization, and growth in the hydrogen economy. -as Ontario's Hydrogen Hub."

Matthew Slotwinski, Chief Executive Officer

Infrastructure Development Opportunities Reported to Attract Hydrogen Investment

Incentives to encourage private investment in hydrogen infrastructure were seen as the most promising opportunity for sector growth, with **39.7%** of respondents identifying it as a top priority. This highlights the need for government and industry collaboration to create favorable conditions for private sector investment. Following closely, **29.8%** of respondents pointed to funding to support building new infrastructure, emphasizing the importance of financial backing to establish a robust hydrogen network. Additionally, **25.8%** of respondents identified funding for pilot projects as essential to testing and scaling hydrogen technologies. These insights underscore the importance of a comprehensive funding approach—both for infrastructure and innovation—to drive the sector forward.

Top Three Infrastructure Development Opportunities Reported



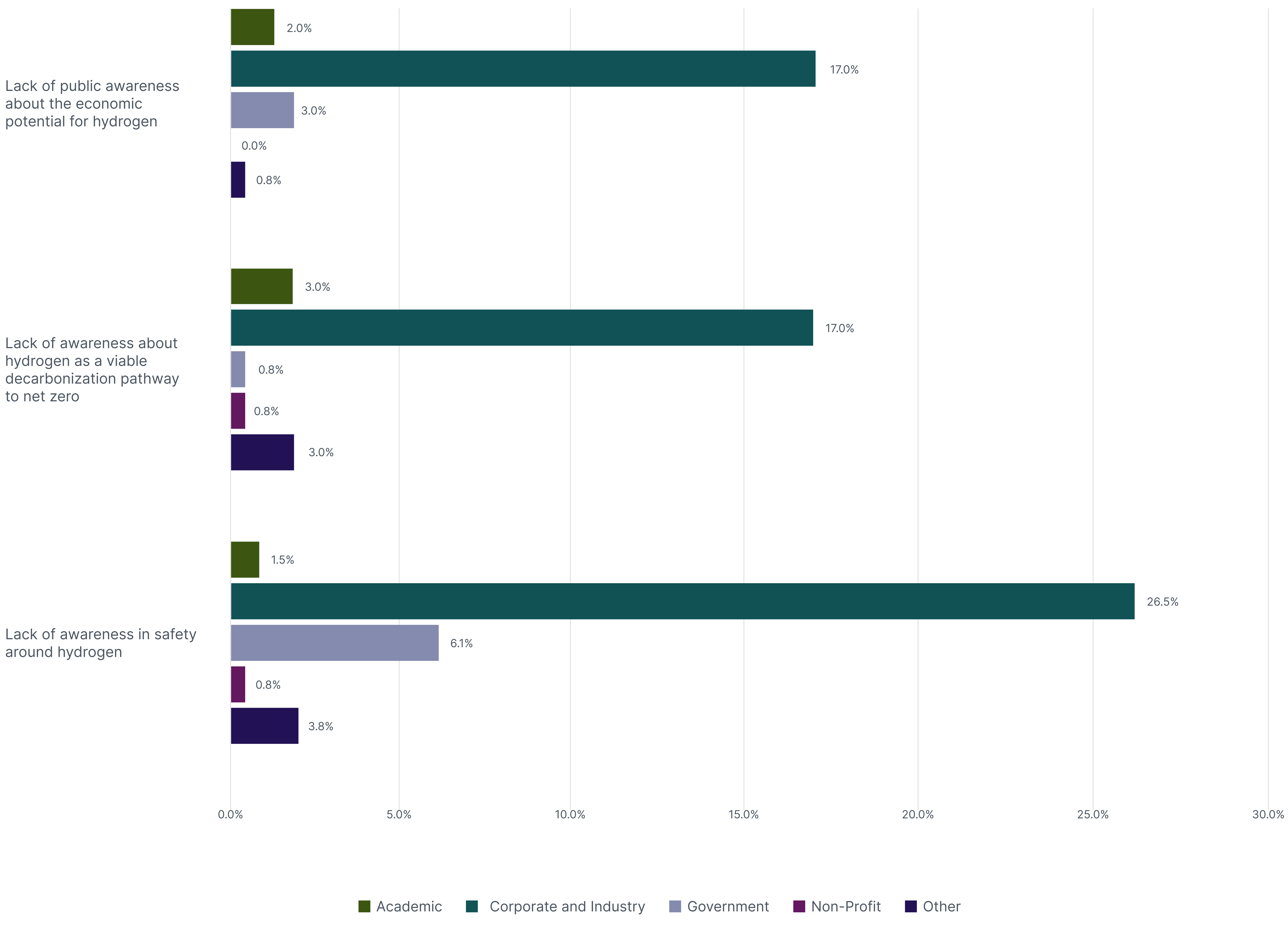
39.7% of respondents across all respondent groups reported **incentives to encourage private investment to build new infrastructure to support hydrogen** as the greatest opportunity to improve infrastructure development.

Note: Not all respondents provided information for every question.

Public Acceptance and Awareness Barriers Reported

The greatest challenge to public acceptance of hydrogen is a lack of awareness around hydrogen safety, with **38.7%** of respondents highlighting this as a key concern. Additionally, **24.6%** of respondents noted a lack of awareness about hydrogen's role as a decarbonization pathway, indicating the need for stronger messaging on hydrogen's potential to help achieve net-zero targets. Similarly, **22.8%** pointed to insufficient awareness about the economic potential of hydrogen, emphasizing the need to demonstrate hydrogen's role in creating jobs and stimulating economic growth. Addressing these awareness gaps is essential to building public confidence and driving adoption of hydrogen as a cornerstone of Canada's clean energy future.

Top Three Public Acceptance and Awareness Barriers Reported



38.7% of respondents across all respondent groups reported **lack of awareness in safety around hydrogen** as the greatest challenge to public acceptance and awareness.

Note: Not all respondents provided information for every question.

Canadian Hydrogen Industry Spotlight

How is your MeridaLabs contributing to Canada's net-zero future?

MéridaLabs is a research and innovation group at the University of British Columbia in Vancouver, Canada. We work on hydrogen technologies, energy systems and solutions for cities and communities.

Our work on hydrogen technologies encompasses the production, storage, distribution and use of hydrogen. We pioneered fuel cell diagnosis via electrochemical impedance spectroscopy, as well as advanced reactor design for high temperature and pressure water electrolysis. Our mission-driven approach to innovation, and our work on pyrolytic hydrogen enabled the launch of our first spin-off company (https://vulcanx.ca).

Our **Smart Hydrogen Energy** District is a city-scale testbed for integrated energy system design. It includes solar energy, fuel cell and electric vehicles, water electrolysis, hydrogen refueling, smart chargers, drones and 5G networks. We are now integrating this work at city-scale, exploring links between energy, transportation, digital technologies and urban design.

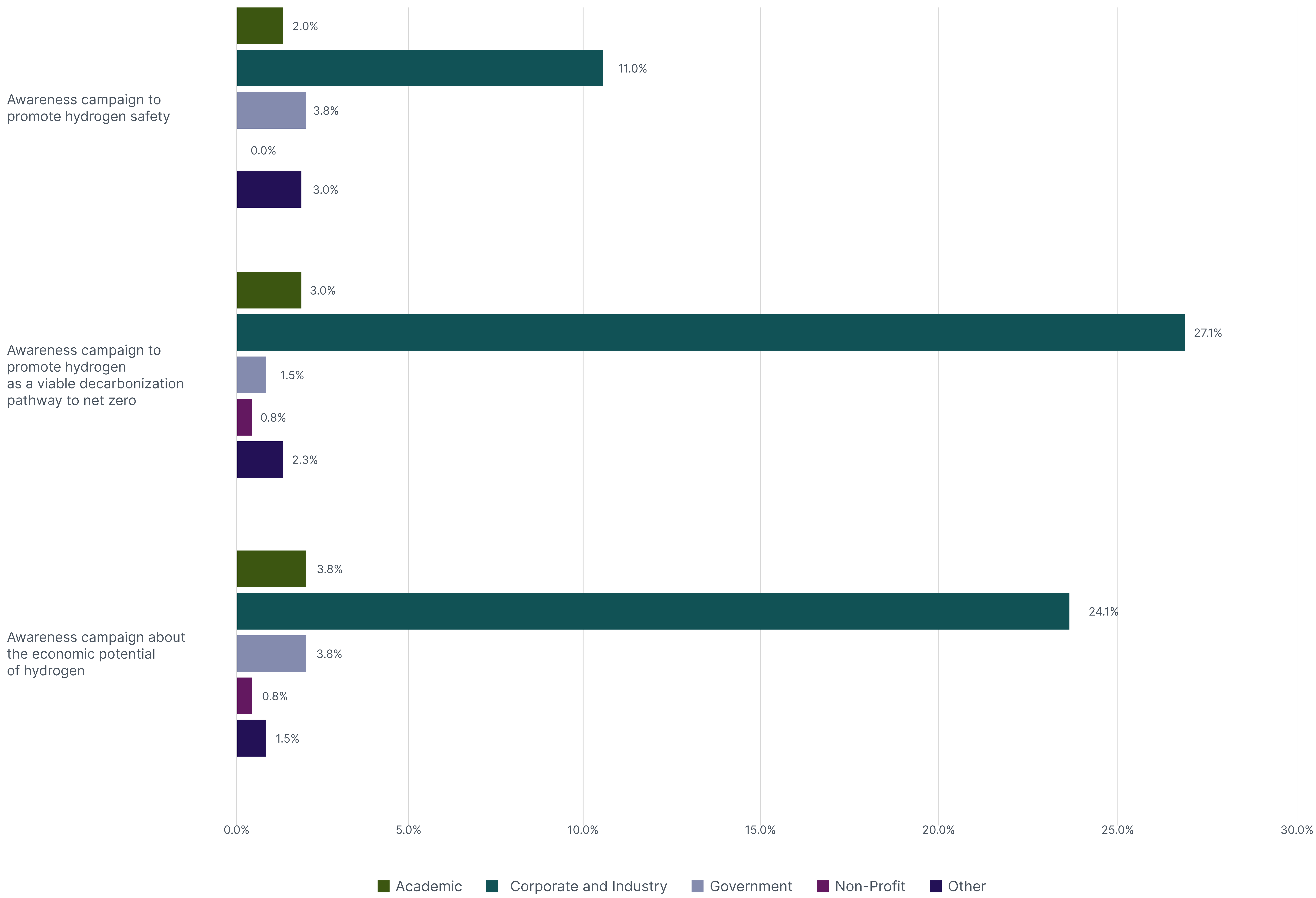
We enable clean growth in a low-carbon economy. In parallel with technological breakthroughs, we develop new business cases, techno-economic models, and engagement mechanisms for climate action. We partner with cities in pilot projects with economic development potential. We work with industry and utilities to deploy mid-scale installations in a risk-tolerant environment. We work with governments to develop evidence-based policies for carbon pricing.

Mérida Labs

Public Acceptance and Awareness Opportunities Reported to Attract Hydrogen Investment

The most promising opportunity to enhance public acceptance of hydrogen was reported to be awareness campaigns to promote hydrogen as a viable decarbonization pathway to net zero, as identified by **34.7%** of respondents. This highlights the critical need for targeted messaging that positions hydrogen as an integral part of Canada's clean energy transition. Furthermore, **34.0%** of respondents highlighted the need to raise awareness about hydrogen's economic potential, which could encourage broader support from industry stakeholders and the public. Additionally, **19.8%** of respondents saw an awareness campaign focused on hydrogen safety as a key opportunity.

Top Three Public Acceptance and Awareness Opportunities Reported



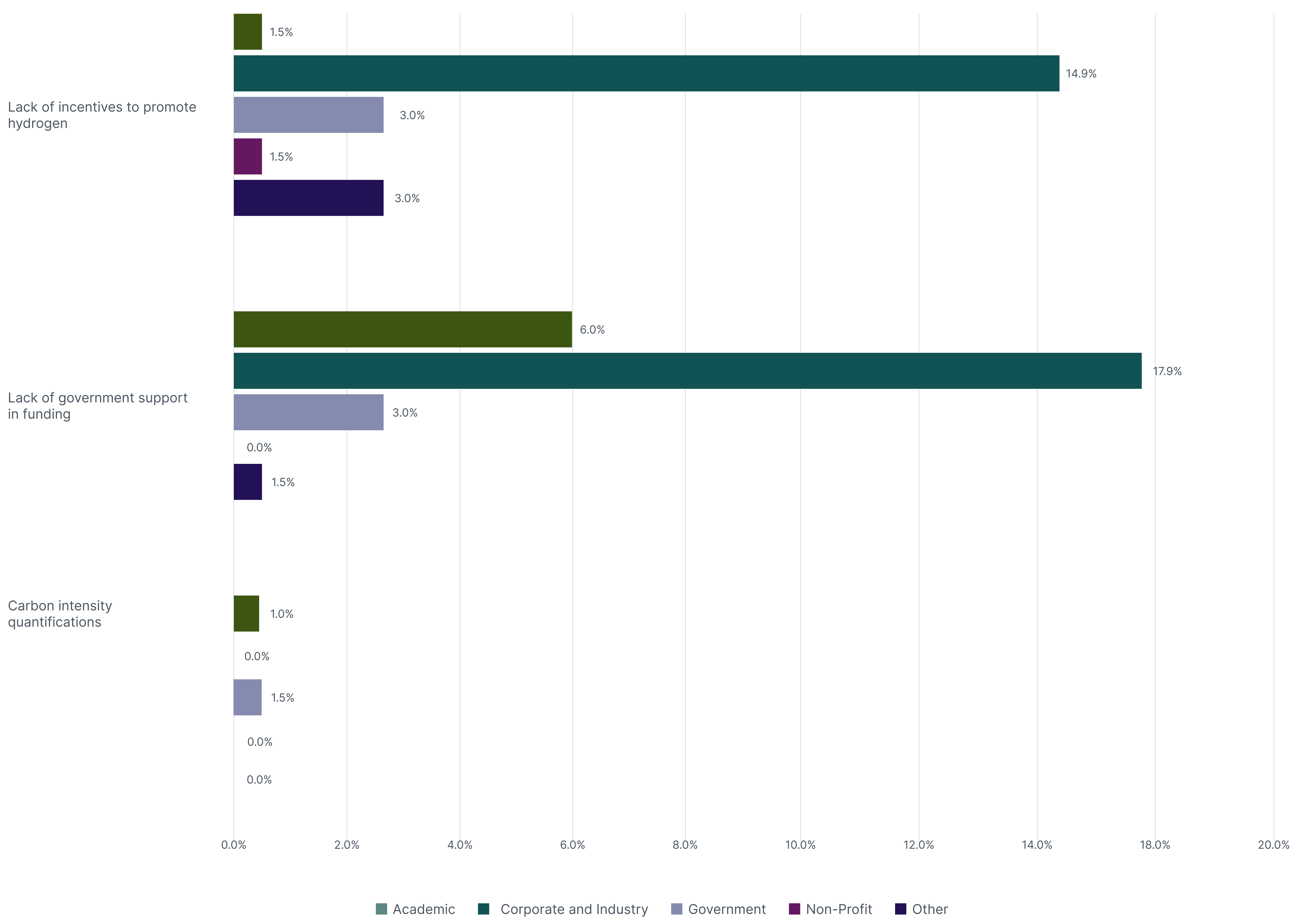
34.7% of respondents across all respondent groups reported **awareness campaign to promote hydrogen as a viable decarbonization pathway to net zero** as the greatest opportunity to improve public acceptance and awareness.

Note: Not all respondents provided information for every question.

Regulatory and Policy Barriers Reported

The largest regulatory barrier to advancing hydrogen investment is the lack of government support in funding, cited by **28.4%** of respondents. This suggests that without stronger financial backing from the government, the sector may struggle to achieve the scale necessary for widespread adoption. Additionally, **23.9%** of respondents pointed to a lack of incentives to promote hydrogen as a top barrier, further highlighting the need for more comprehensive policy frameworks that provide clear incentives for businesses and investors to enter the hydrogen market. Finally, concerns around carbon intensity quantifications were raised by a smaller percentage of **2.5%** respondents, indicating that clearer regulatory guidelines for carbon measurement could aid in standardizing hydrogen production and usage for some respondent groups.

Top Three Regulatory and Policy Barriers Reported



28.4% of respondents across all respondent groups reported **lack of government support in funding** as the greatest challenge in the regulatory and policy environment.

Note: Not all respondents provided information for every question.

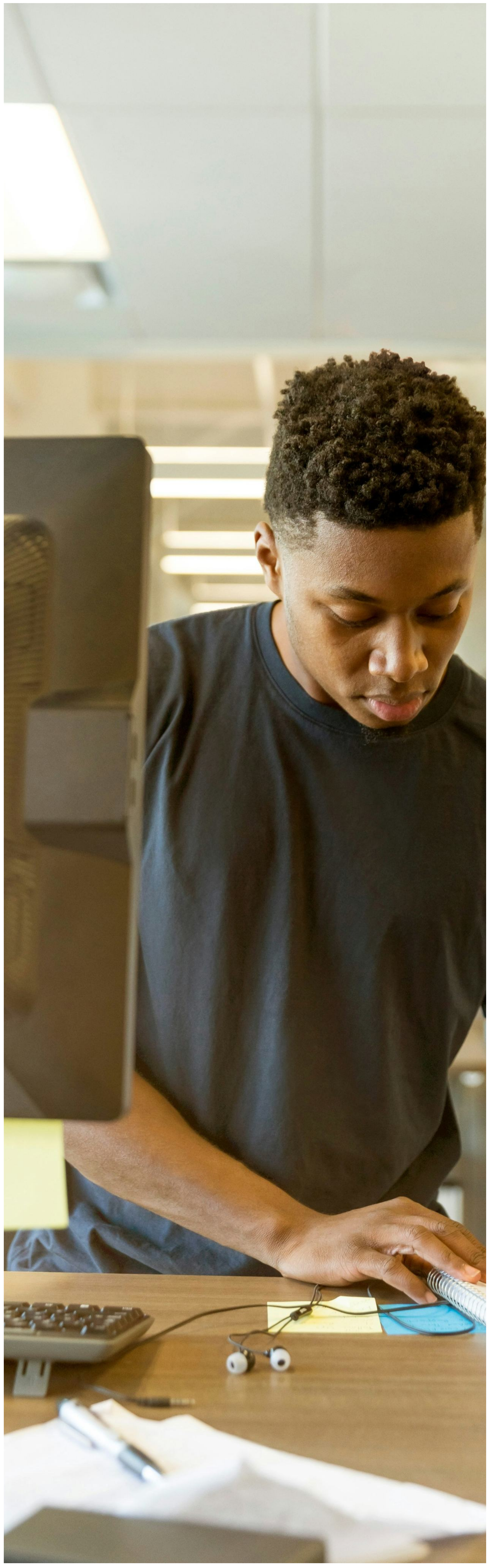
Canadian Hydrogen Industry Spotlight

How is the Northern Alberta Institute of Technology (NAIT) Addressing the Growing Demands of the Hydrogen Sector to Support Canada's Net-Zero Ambitions?

At NAIT, we are dedicated to fostering a skilled workforce that supports the hydrogen sector and contributes to Canada's net-zero ambitions. In collaboration with Palette Skills, we proudly offering the Clean Energy Professional Upskilling Program, a comprehensive 16-week initiative designed to equip students with essential skills in this vital industry. The program features focused modules on upstream hydrogen production, carbon capture, sequestration, and product lifecycle assessment, empowering participants to elevate their careers in clean energy. Graduates receive a certificate of achievement along with nine micro-credentials, ensuring they are well-prepared for the evolving job market. Our last intake for this specific program is November 4, 2024.

Chetan Deep Singh, a recent graduate of the Clean Energy Professional Upskilling Program, shared his transformative experience: "I got to know about the Clean Energy Professional Upskilling Program offered by NAIT late in 2023 and was immediately invested in it. With the significant growth in the Clean Energy sector in Western Canada, I was looking to upskill myself before entering the job market. The program provided not only industry-experienced instructors but also an amazing support staff that guided me through every step. Having completed the program, I was fortunate to secure a full-time role with a startup focused on Clean Hydrogen production. NAIT has been instrumental in my journey, helping me build foundational knowledge and valuable industry connections."

This Fall, NAIT's Corporate and Continuing Education is expanding its offerings with a suite of Clean Fuels courses, covering essential topics in clean fuel technologies and practices. These courses are designed to equip learners with the skills needed to excel as the clean energy sector continues to evolve. Additionally, we are excited to announce two new courses launching in late Fall that will focus on Hydrogen Powered Vehicles, aimed at upskilling technicians and operators. More information on our courses can be found at nait.ca/energy.



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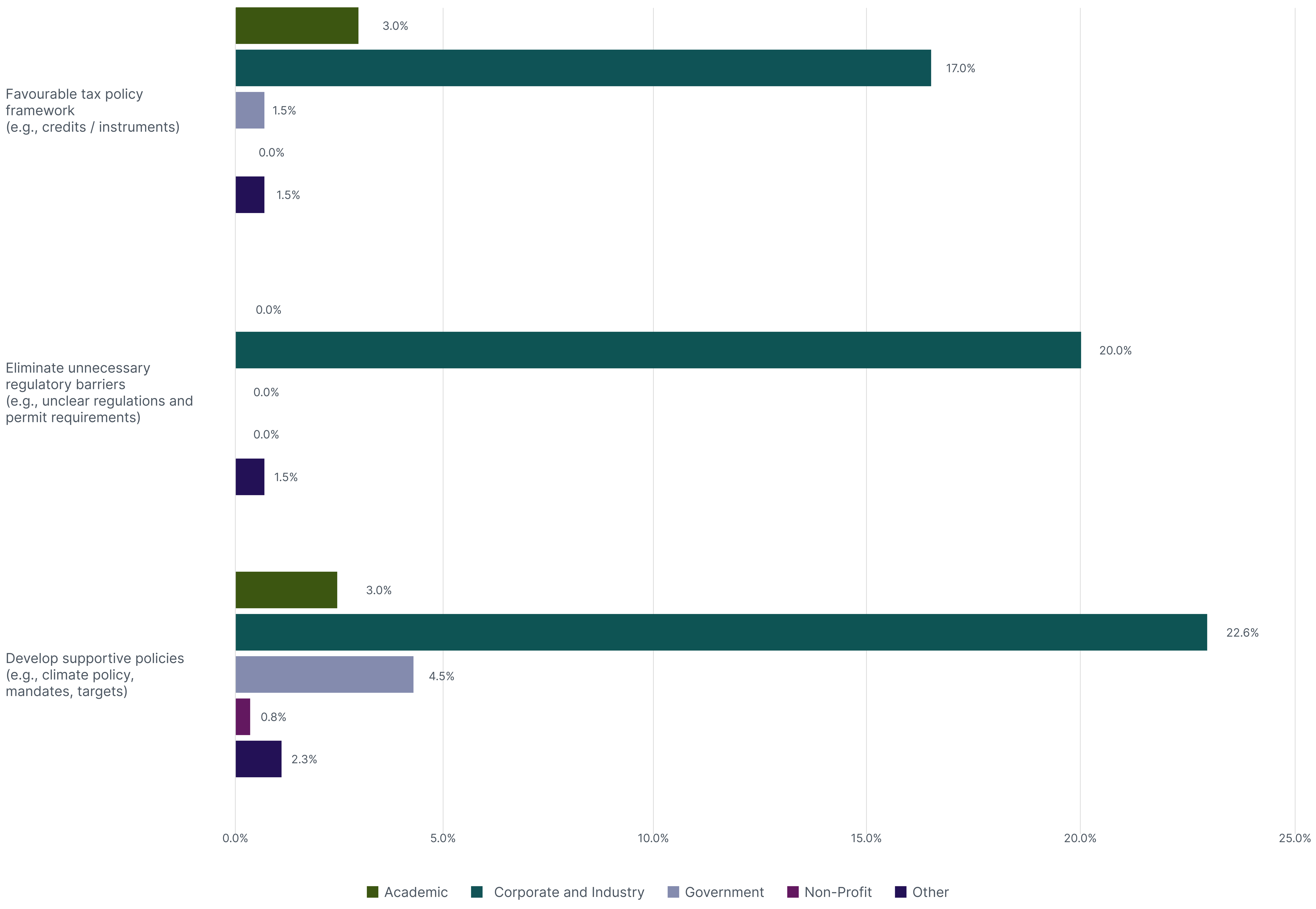
Regulatory and Policy Opportunities Reported to Attract Hydrogen Investment

The most significant opportunity to enhance the regulatory environment for hydrogen is to develop supportive policies, such as climate policies, mandates, and targets, with **33.6%** of respondents identifying this as a critical step. Clear and supportive policies can provide the necessary framework for long-term investment and development in the hydrogen sector. Additionally, **21.5%** of respondents highlighted the need to eliminate unnecessary regulatory barriers, including unclear regulations and complex permit requirements, which currently hinder project development and scaling. Lastly, a favorable tax policy framework, cited by **23.0%** of respondents, was presented as a top opportunity to incentivize investment in hydrogen through mechanisms like tax credits and financial instruments.

Top Three Regulatory and Policy Opportunities Reported



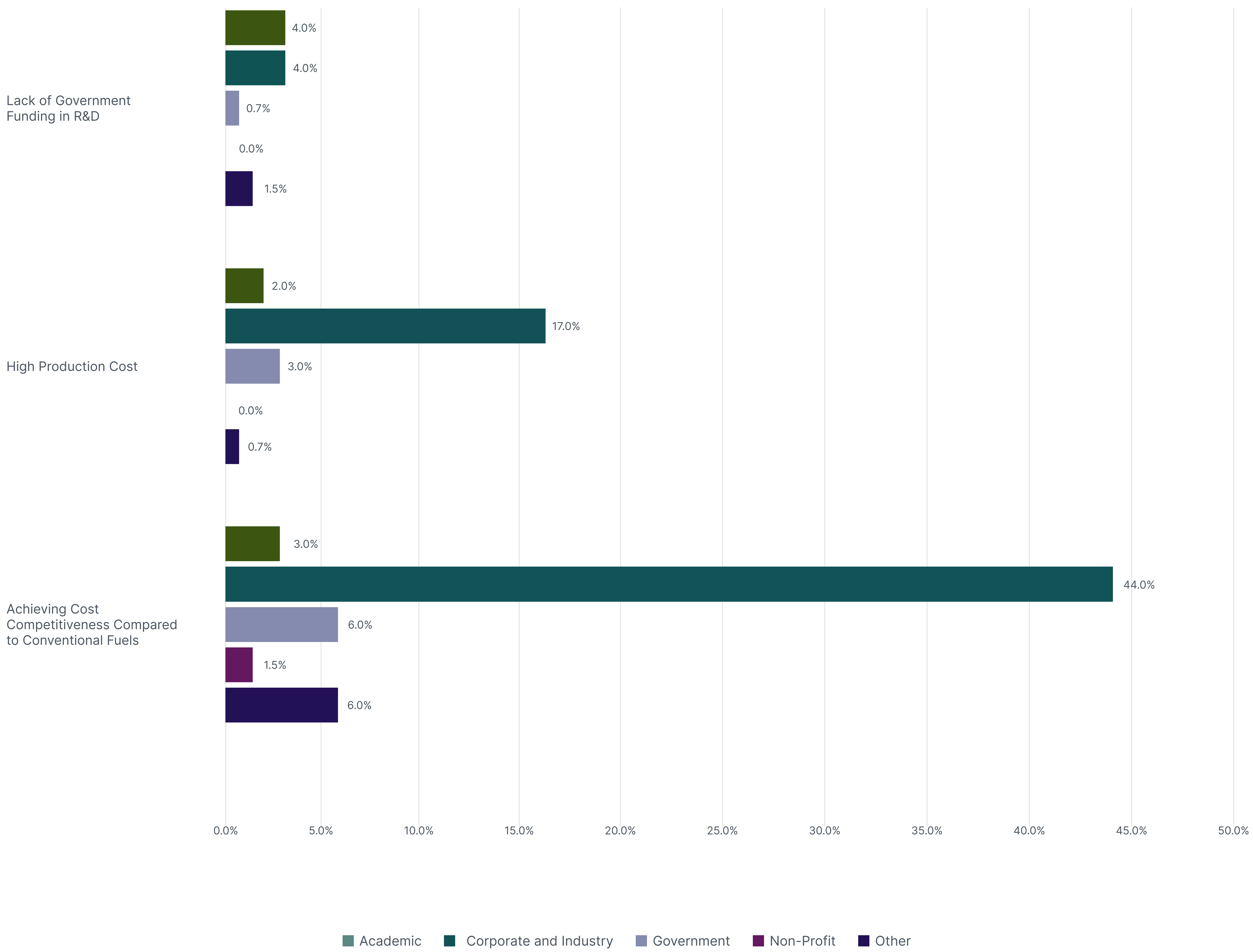
33.2% of respondents across all respondent groups reported **develop supportive policies (e.g., climate policy, mandates, targets)** as the greatest opportunity to improve the regulatory and policy environment.

Note: Not all respondents provided information for every question.

Innovation and Technology Investment Barriers Reported

The most significant challenge to advancing hydrogen technology is achieving cost competitiveness with conventional fuels, as reported by **60.5%** of respondents. Additionally, **22.7%** of respondents identified high production costs as a barrier, which further highlights the importance of technological innovation to lower costs across the hydrogen value chain. A lack of government funding in R&D, noted by **10.2%** as a top barrier, also points to the need for increased public investment in research to drive technological breakthroughs.

Top Three Innovation and Technology Investment Barriers Reported



60.5% of respondents across all respondent groups reported **achieving cost competitiveness compared to conventional fuels** as the greatest challenge to technology and innovation.

Note: Not all respondents provided information for every question.

Canadian Hydrogen Association | Association Canadienne de L'hydrogène

Canadian Hydrogen Industry Spotlight

What product or innovation is your company developing to propel the hydrogen market in Canada?

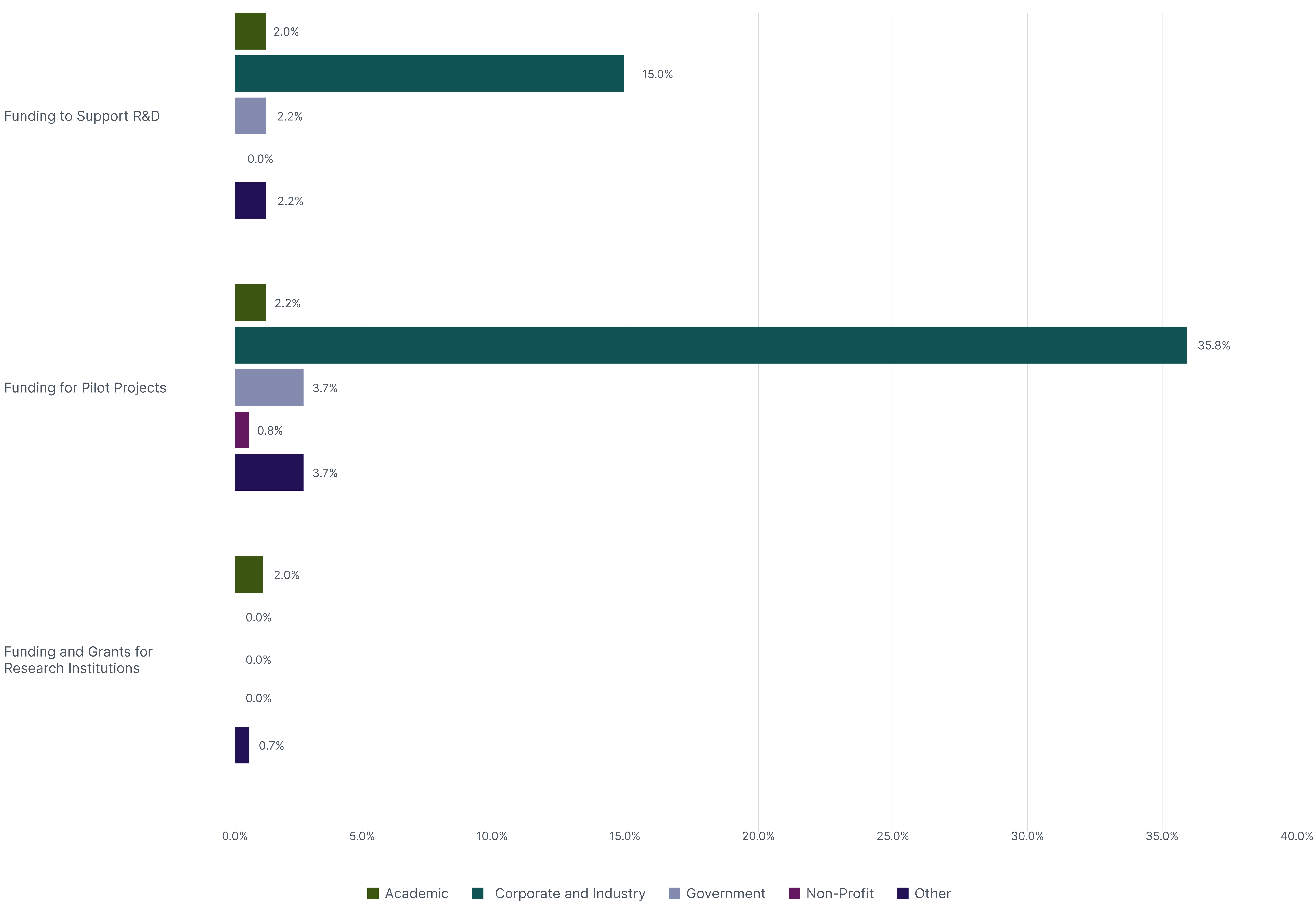
As the largest event in Canada showcasing hydrogen as a key enabler to reach net-zero emissions by 2050, the **Canadian Hydrogen Convention** is the only annual meeting place for energy executives, government officials and Indigenous leaders to convene to build Canada's low-carbon energy future. This must-attend show will offer a unique perspective for the entire Canadian supply chain to discuss innovations and solutions for low-carbon hydrogen production, storage, utilization, and hydrogen's future as a key fuel.

dmg events

Opportunities Reported to Attract Investment in Hydrogen Innovation and Technology

The greatest opportunity to attract investment in hydrogen innovation and technology is through funding for pilot projects, identified by **46.2%** of respondents. Pilot projects are crucial for testing new technologies and demonstrating their commercial viability, which is key to attracting further investment. **21.4%** of respondents also highlighted the importance of funding to support R&D, which is necessary to overcome technical barriers and lower costs in hydrogen production and distribution. Additionally, **2.7%** pointed to funding and grants for research institutions as a way to ensure that academic and non-profit organizations can continue to contribute to technological advancements in the sector.

Top Three Innovation and Technology Investment Opportunities Reported



46.2% of respondents across all groups reported **funding for pilot projects** is the greatest opportunity in technology and innovation.

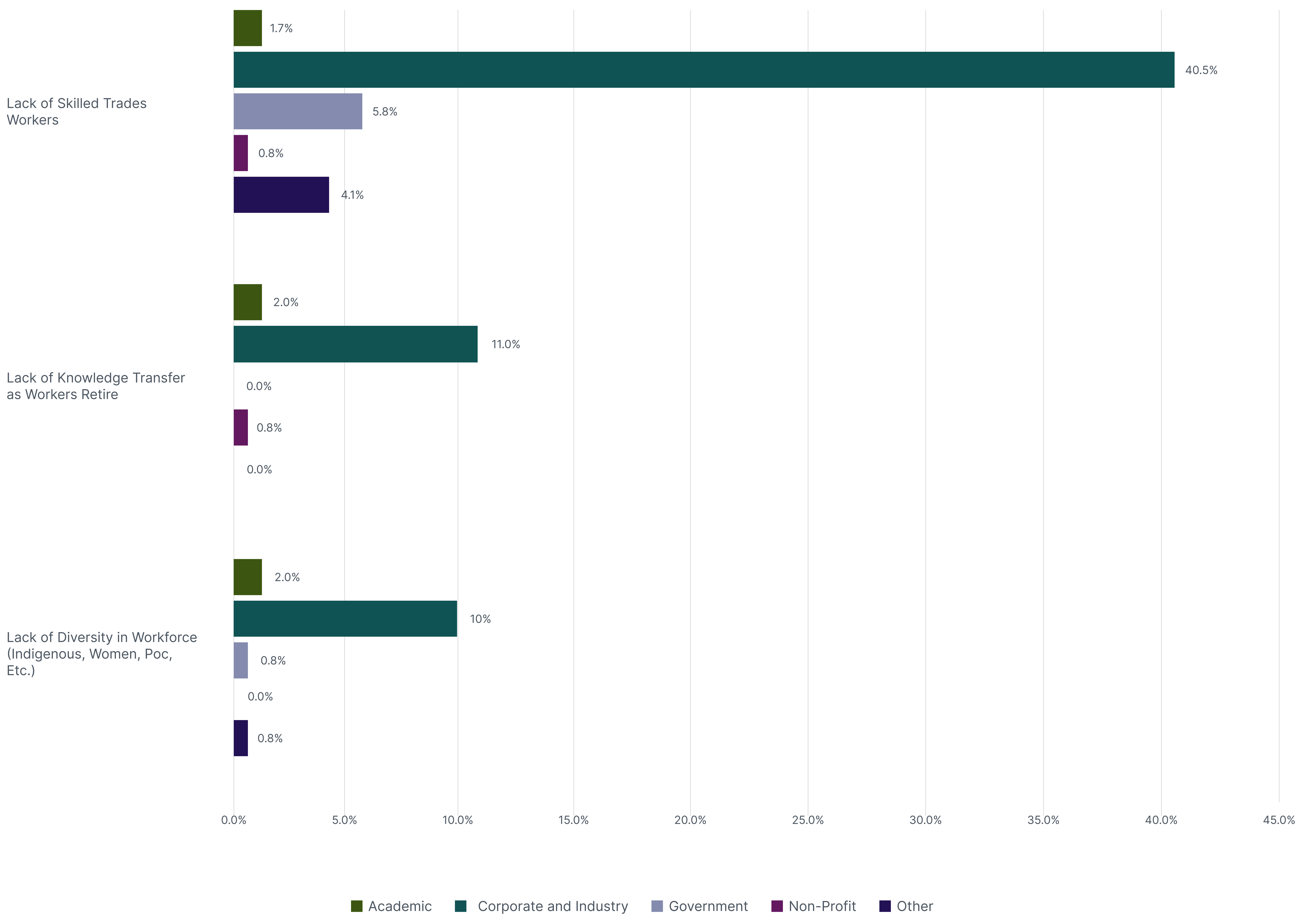
Note: Not all respondents provided information for every question.

Canadian Hydrogen Association | Association Canadienne de L'hydrogène

Workforce Development Barriers Reported

The most critical barrier to workforce development in the Canadian hydrogen sector was reported as a lack of skilled trades workers, with **52.9%** of respondents identifying this as the top challenge. This shortage poses a significant risk to scaling hydrogen projects, as a skilled workforce is essential to meet the growing demands of infrastructure development and maintenance. Additionally, **13.8%** of respondents pointed to the lack of knowledge transfer as workers retire as a top barrier, signaling a gap in succession planning that could further exacerbate the skills shortage. Lastly, a lack of diversity in the workforce, was cited by **10.0%** of respondents as a top barrier, highlighting the need to engage underrepresented groups, including Indigenous peoples, women, and people of colour, to build a more inclusive and resilient hydrogen workforce.

Top Three Workforce Development Barriers Reported



52.9% of respondents across all respondent groups reported **lack of skilled trades workers** as the greatest challenge in the workforce.

Note: Not all respondents provided information for every question.

Canadian Hydrogen Industry Spotlight

How is TES Canada Contributing to Canada's Net Zero Future?

With Project Mauricie, TES Canada is developing a green hydrogen production project that will assist in accelerating the decarbonization of Quebec and contribute to Canada's net zero future.

500 MW	3%	1,000
Green H_2 production Plant	of Quebec's 2030 GHC reduction target	jobs during construction

Hydrogen: a 500 MW green hydrogen production plant powered exclusively by renewable electricity, mostly met by self-generated renewable energy.

Transport / Heavy Industries: producing hydrogen and renewable natural gas intended for Quebec end-users, playing a complementary role to direct electrification, in industrial processes and the heavy transport sectors.

GHG Reduction: representing 3% of the province's 2030 emissions reduction target, by avoiding 800,000 tonnes of GHG annually.

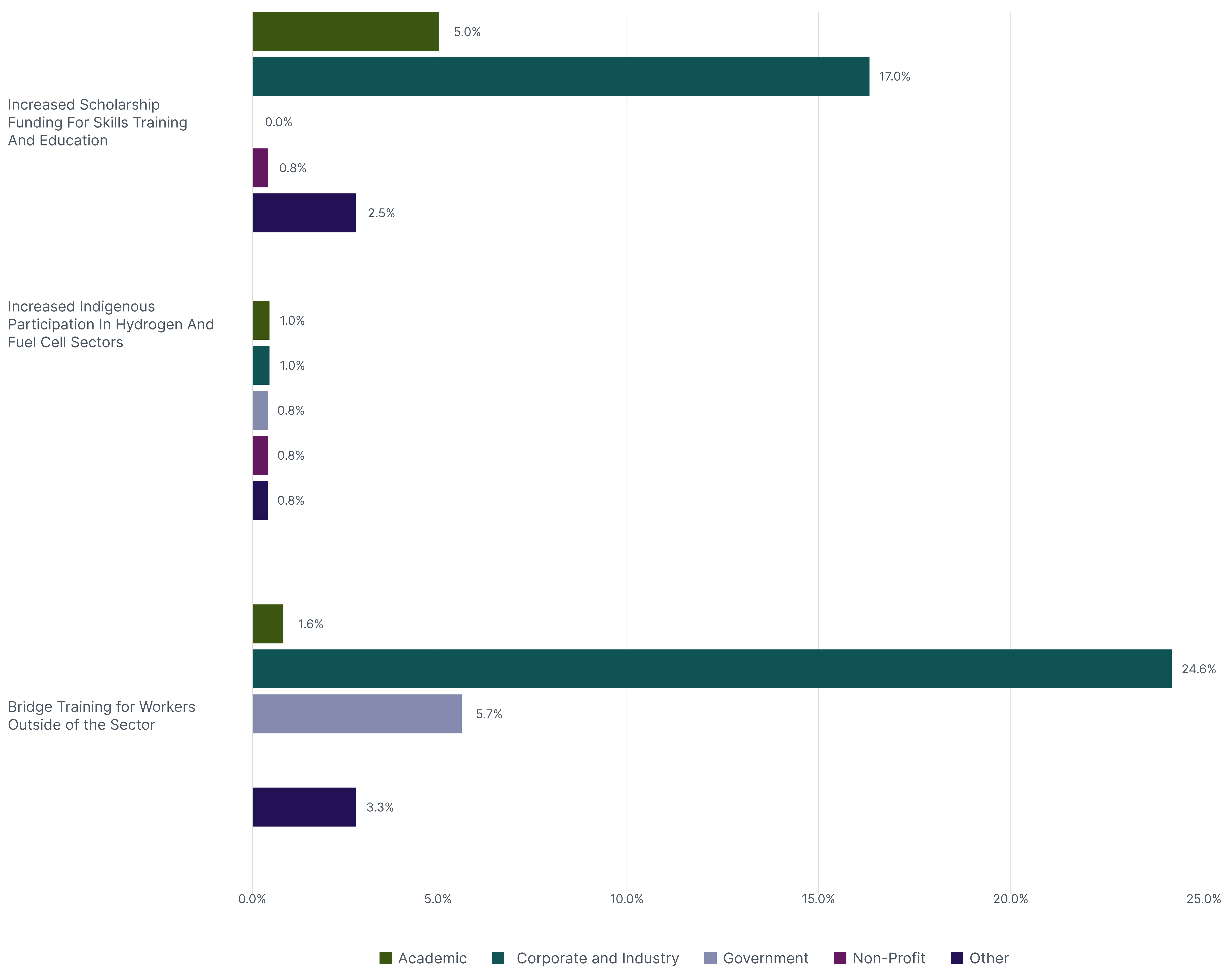
Jobs: creating more than 1,000 jobs durung contruction and over 200 permanent jobs.

Find out more about the project: **en.projectmauricie.ca**
Contact us: **Contact@tes-h2.ca**

Workforce Development Opportunities Reported to Attract Hydrogen Investment

The most significant opportunity for workforce development in the Canadian hydrogen sector was cited as bridge training for workers outside of the sector, with **35.2%** of respondents highlighting this as a key solution to address the skills gap. This training would enable workers from other industries to transition into hydrogen, helping to meet the demand for skilled labor. Additionally, **25.3%** of respondents pointed to increased scholarship funding for skills training and education as an essential opportunity to building a long-term, skilled workforce capable of supporting hydrogen development. Lastly, as identified by **4.4%** of respondents, increased Indigenous participation in the hydrogen sectors, was reported as a top workforce development opportunity.

Top Three Workforce Development Opportunities Reported



35.2% of respondents across all respondent groups reported **bridge training for workers outside of the sector** is the biggest opportunity to grow and improve the workforce.

Note: Not all respondents provided information for every question.

Canadian Hydrogen Association | Association Canadienne de L'hydrogène

Conclusion

Conclusion

The CHA Hydrogen Sector Profile 2024 presents a comprehensive analysis of the current state and future potential of the hydrogen sector in Canada. The key findings highlight the sector's progress, and the critical role hydrogen is poised to play in Canada's decarbonized economy.

Strong Belief in Hydrogen's Role: An overwhelming 90.2% of respondents believe that hydrogen will significantly contribute to Canada's roadmapto a decarbonized future, reflecting strong confidence in its transformative potential.

Regional Concentration: The majority of hydrogen production and employment is concentrated in Western Canada, positioning the region as a hub for hydrogen activity. Leveraging regional strengths while ensuring inclusive growth across all provinces and territories is essential for national success.

Key Barriers and Opportunities: The report identifies significant barriers such as the substantial upfront investment required for infrastructure and the need for increased public awareness about hydrogen's safety and benefits. Conversely, it highlights critical opportunities, including incentives for private investment and awareness campaigns to promote hydrogen as a viable decarbonization pathway.

Investment and Growth Potential: Infrastructure development, supportive policies, and innovation funding are pivotal for overcoming existing challenges and accelerating sector growth. The insights provided by respondents underscore the importance of strategic planning and collaboration to attract investment and drive progress.

Policy and Workforce Development: Developing supportive policies and addressing workforce gaps are crucial for sustaining sector growth. The report emphasizes the need for bridge training programs and increased scholarship funding to build a skilled workforce capable of supporting the hydrogen economy.

Canada holds immense potential to lead in the global hydrogen economy.

By addressing key barriers, leveraging regional strengths, and fostering collaboration, we can accelerate the growth of the hydrogen sector and solidify Canada's leadership on the global stage. Together, we will pave the way for a cleaner, more sustainable future, driven by the power of hydrogen.

Canadian Hydrogen Association | Association Canadienne de L'hydrogène

Appendices

Sector Profile 2024 Framework

1. Participant Representation

The Canadian hydrogen sector is broadly defined to include individuals and groups interested in the industry's future both in Canada and globally

Survey respondents represented a diverse range of fields, including advocacy, education, energy utilities (gas, electric, other), fuel cell development and manufacture, hydrogen distribution, storage, and dispensing, energy project development, technology development and manufacture (production, storage, distribution, dispensing), policy development, program administration, research, safety or training, suppliers until integrators of fuel cells (including OEMs), and transportation.

These bodies were further categorized as **Academic, Corporate and Industry, Government, Non-Profit, or within the Other** category, which includes stakeholders with unique or less common involvement in the hydrogen sector.

More than 140 surveys were received from organizations located in nine different provinces. These groups represent the most active organizations striving to build Canada's hydrogen sector.

2. Survey Structure

The CHA Sector Profile survey was categorized into four primary dimensions.

Dimension	Number of Questions	Average Response Rate
Hydrogen Production and Revenue	44	12.8%
Employment*	6	59.2%
Innovation and Research, Development and Demonstration	24	5.3%
Barriers and Opportunities to Grow the Sector	32	62.6%

3. Timeline and Approach

- The CHA Sector Profile was broadly promoted by CHA through member relations and social media.
- The survey was issued in **March 2024 and remained opened to June 30, 2024.**
- To ensure maximum participation, CHA hosted a webinar outlining the objectives and details on how to participate in the survey.
- When relevant, industry groups of interest were analyzed separately to reveal viewpoints across different backgrounds.
- Analysis techniques included measures of percentiles, response categorization, and cross-tabulation to identify variations in perceptions among various entity groups.

Source: NRCan: Hydrogen Strategy for Canada Progress Report - April 2024

Sector Profile 2024 Methodology and Data Processing

Focus Area	Assumptions
Survey Participation	• 578 CHA members and non-members were invited to participate in the CHA Sector Profile survey through email, phone calls, and social media platforms. There were a total of 143 survey submissions achieving ~25% participation rate. • Not all respondents provided information for every category requested.
Year of Scope	• Respondents reported out on the year 2023.
Limitations and Notes	• iTOTEM relied on the accuracy of the information provided by CHA and CHA Sector Profile respondents regarding their hydrogen production, revenue and employment.
Quality Assurance Data Changes and Exclusions	• A QA process was run to remove duplications, standardize spellings and apply exclusions. • iTOTEM ran a validation process with the CHA and CHA respondents to assure the data veracity.
Rounding	• $ were in CAD and rounded to the nearest million or thousand.

Data Cleaning Steps

- Responses were checked for duplicates.
- Respondents were classified by organization type.
- Responses were standardized, and any unclear answers were clarified through follow-up with respondents.
- The data was processed and cleaned using automated scripts.
- The data was incorporated into the report.

Source: NRCan: Hydrogen Strategy for Canada Progress Report - April 2024

Canadian Hydrogen Association | Association Canadienne de L'hydrogène

Sector Profile 2024 Limitations

1. **Survey Fatigue:** The length of the survey may have led to a lower participation rate in the later sections. As a result, the data collected towards the end may be less comprehensive compared to the data from the earlier sections. Mitigation: To counteract this, the survey was designed with a user-friendly interface and progress indicators to help participants manage their time and expectations.
2. **Participation Rates:** While the survey aimed to encompass a broad range of stakeholders—including regulatory authorities, proponents and operators, suppliers, educators, non-governmental organizations, elected officials, Indigenous peoples, and various demographics—certain areas experienced limited participation. Mitigation: Efforts were made to mitigate this through promotional webinars and direct engagement with representatives of each group to encourage participation. Despite these efforts, participation rates varied, which may affect the representativeness of the insights gathered.
3. **Internal Bias:** Despite efforts to structure questions to minimize internal bias and avoid influencing responses, the design and options provided may have inadvertently guided some answers. This could impact the neutrality of the data. Mitigation: The survey design was peer-reviewed, and pilot testing was conducted. Open-ended questions were included to allow for unbiased responses.
4. **Nascency and Global Nature of the Sector:** The Canadian hydrogen sector is still in its nascent stage and involves a diverse, global ecosystem with entities at various phases of market maturity. Many organizations operate on an international scale, integrating hydrogen production, employment, revenue, and research activities within a global portfolio. Consequently, financial reporting and asset allocation are often consolidated at the corporate level, making it difficult to extract precise data specific to Canada or its sub-regions, such as provinces, territories, or municipalities. This global integration can obscure localized insights and trends, limiting the granularity and specificity of the data presented for the Canadian hydrogen sector. Mitigation: Where possible, efforts were made to disaggregate data to reflect local contexts, and follow-up interviews were conducted to clarify region-specific information.

Source: NRCan: Hydrogen Strategy for Canada Progress Report - April 2024

Government Sources

Government	Sources
NRCan	Hydrogen Strategy for Canada Progress Report - April 2024
NRCan	Hydrogen Strategy for Canada - December 2020

Sector Profile Participants

Sector Profile Participants			
ABO WIND / ABO ENERGY	BRYMARK INSTALLATIONS GROUP	EASTWARD ENERGY	GREEN FUEL SYSTEMS
ACCELERA BY CUMMINS	CANADIAN NUCLEAR LABORATORIES	EDMONTON INTERNATIONAL AIRPORT	GREENLIGHT INNOVATION CORP
AIR LIQUIDE CANADA	CARIBOO CLEAN FUELS INC	EKONA POWER	GREENLYH2
AIR PRODUCTS CANADA LTD	CARON HAWCO GROUP	ELEMENT 1 CORP	HARNOIS ENERGIES
AKS FUEL CELLS	CELLCENTRIC CANADA	ELEMENTAL TRUCKS INC	HATCH
AMTA	CEM ENGINEERING	EMOBILITY ENERGY INC	HEARTLAND GENERATION LTD.
ASSOCIATED PLASTICS	CERTARUS LTD.	ENBRIDGE GAS INC	HTEC
ATCO GAS AND PIPELINES LTD.	CETRI, U OF R	ENERGY INC.	HYCAMITE TCD TECHNOLOGIES LTD
ATURA POWER	CHANGE ENERGY SERVICES	ENERGYLINK INTERNATIONAL	HYDROCOOL
AURORA HYDROGEN	CHAR TECHNOLOGIES LTD	ERM	HYDROGEN CANADA CORP.
AURORA SCIENTIFIC CORP.	CHWG	EVERWIND FUELS	HYDROGEN IN MOTION INC. (H2M)
AVL FUEL CELL CANADA	CITY OF BURNABY	FASKEN	HYDROGEN OPTIMIZED
BALLARD POWER SYSYTEMS	CITY OF COQUITLAM	FAT DOG HOLDINGS	HYDROGEN RESEARCH INSTITUTE / UQTR
BAYOTECH	CITY OF EDMONTON	FORESIGHT CANADA	HYDROGENII CANADA INC.
BC CICE	CITY OF MISSISSAUGA	FORTESCUE	HYDRO-QUÉBEC
BC HYDRO	COLLEGE OF THE NORTH ATLANTIC	FORTISBC ENERGY INC	HYFLUENCE SYSTEMS CORP.
BC RESEARCH INC. (BCRI)	CPKC	FURANO PACIFIC CONSULTING LTD.	ILLUMING POWER
BEAR HEAD ENERGY	CRATOS CAN INC	GEOSCIENCE BC SOCIETY	IMPERIAL
BOSCH CANADA	CROSS RIVER INFRASTRUCTURE PARTNERS	GH POWER	INNOVA HYDROGEN CORP.
BOWMAN CENTRE FOR SUSTAINABLE ENERGY	CUTRIC	GHD	INNOVATION, SCIENCE & ECONOMIC DEVELOPMENT CANADA
BRUCE COUNTY	DAL	GLOBAL AFFAIRS CANADA	INTERTEK
BRUCE POWER	E4 STRATEGIES INC	GREEN CAT HYDROGEN	INVEST VANCOUVER

Sector Profile Participants

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IRVING OIL LIMITED	POWERTECH LABS	TECK RESOURCES	WATERLOO INSTITUTE FOR NANOTECHNOLOGY
LINDE	PRAIRIES ECONOMIC DEVELOPMENT CANADA	TERRESTRIAL ENERGY	WESTPORT FUEL SYSTEMS
MEAGER CREEK DEVELOPMENT CORP.	RED RIVER COLLEGE POLYTECHNIC	TES CANADA	WHEATLAND COUNTY
MEDERU CANADA INC.	REIGNITE CONFERENCE	TESTNET CANADA INC.	WHEATONH2 INC
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UM6P CANADA	NEL HYDROGEN	SIEMENS ENERGY	UNDEFINED
NORTH ATLANTIC	SIMON FRASER UNIVERSITY	UNILIA (CANADA) FUEL CELLS INC.	NORTHERN PETROCHEMICAL CORPORATION
SOLAS ENERGY CONSULTING INC.	UNIVERSAL H2	NOVOHYDROGEN	STURGEON COUNTY
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