



International Partnership
for Hydrogen and Fuel Cells
in the Economy

IPHE Hydrogen Skills Task Force

Advancing Canada's Hydrogen Workforce – Overview of Education, Skills and Training Initiatives

November 22, 2023

The Hydrogen Strategy for Canada (released 2020)

Opportunities for low-carbon Canadian hydrogen:

- Essential to **energy security**, the **clean energy transition** and broader **net zero by 2050 goals** (domestic and global)
- Offers means to reduce emissions **where electrification is not possible**
- **Flexible end-uses** as a clean fuel, feedstock, and energy storage medium
- **Creates a new market** for Canada's conventional oil and gas sector, positioning it to remain competitive in a low carbon future
- **Opportunity for Canada** to be supplier of choice to the world for clean hydrogen and the technologies that use it

In a **transformative net-zero scenario** hydrogen offers significant environmental and economic benefits by 2050

Environmental Benefits

- **30% of Canada's energy mix in 2050**
- **up to 190 Mt CO₂e reduction in 2050**
- **Emissions reductions** primarily in heavy-industry like freight, mining, steel, manufacturing, and oil and gas

Economic Benefits

- **~350,000 hydrogen sector jobs**
- **>\$50 billion in domestic revenue**
- **> \$50B in exports** in a multi-billion dollar global market
- **>5 million fuel-cell electric vehicles** (e.g., cars, trucks, and buses)

Hydrogen's Emissions Reduction Potential

Modelling in the transformational scenario of the Strategy identifies potential emissions reductions in key areas of the economy:

Totals			
Year	Hydrogen Demand (Mt-H ₂ /year)	% of Delivered Energy	GHG Abatement (Mt-CO ₂ e/year)
2030	4.0	6	45.1
2050	20.5	30	189.8

Blending in Natural Gas	
Year	GHG Abatement
2030	1.7
2050	57.4

Oil and Gas	
Year	GHG Abatement
2030	25
2050	22.3

Industrial Processes	
Year	GHG Abatement
2030	3.3
2050	24.4

Transportation	
Year	GHG Abatement
2030	14.8
2050	61.5

Low Carbon Fuels	
Year	GHG Abatement
2030	0.2
2050	24.4

\$7- \$9B of total public/ private investment needed in next 5- 10 years, with more in the longer term



- Training of skilled workers is an imminent requirement for successful scale-up of Canada's H2 economy, for both the fossil fuel-derived and clean H2 subsectors.
- To train and recruit talent skilled at the design, manufacture, installation, operation and maintenance of H2 infrastructure, equipment and vehicles, Canada plans to:
 - Transition many of the core technical (e.g., STEM) occupations, qualifications and accreditations required for H2 from within the existing labour market;
 - Leverage its education sector to attract youth to the clean energy industry including low-carbon H2;
 - Build deeper talent pools by enhancing diversity and equity considerations across the education and energy sectors; and
 - Draw on its well-established international training, credentialing and equivalency programs to enhance mobility of workers capable of working effectively and safely with H2.





Hydrogen Workforce Assessment Report and Tool (Transition Accelerator, an extra-governmental expert body) – Released 2022

This work recognized the differentiation of hydrogen value chains in Canada into regional HUBs, which in turn demonstrate different occupational and talent needs.

Current Supply

- CCS expertise: concentrated in Canada's O&NG system, in production and infrastructure-related work.
- Electrolyzer experience/expertise: those who work with energy sector renewables – this is an area of strength and talent, but prospects for green H₂ & NH₃ will necessitate growth.
- Fuel cell industry and manufacturing of H₂-related equipment and technology: is already a strength; a world-leader in the development of FC technology.





Current Gaps

- Geoscience professionals: large-scale storage capacity must increase.
- Transport-linked workforce: expanded need for pipeline-linked employment, rail and marine/ports sector transportation – this will entail both labour to reconfigure/convert existing systems, as well as emergent needs for operations staff.
- On-road transportation sector: passenger vehicles, as well as commercial freight sector, will require vehicle technicians and inspectors; fueling stations, installations and infrastructure will require operations staff.
- Heating and power utility labour forces: potential for increased need of skilled labour in these areas.
- Workforce growth in sectors using H2 as industrial feedstock (e.g., steel, cement, mineral/metal manufacturing): here, initial outlays involve retrofitting or conversion of existing systems, equipment and infrastructure to accommodate fuel-switching, co-combustion and blending of H2 with other fuels where feasible.
- Manufacturing sector employment must increase: to boost domestic production (fabrication and/or assembly) of fuel cells, electrolyzers and H2-fueled vehicles, as well as appliances (components and modules) to include those suitable for H2, compatible with H2 infrastructure.





Regional HUBs and Labour Market Considerations

Example: Western Canada – Edmonton Regional H2 Hub – Fossil-based H2 from O&NG system w/ CCUS, H2 Transport to market

- Engineers: Chemical, Electrical & instrumentation, Electrochemical, Facility, Manufacturing, Mechanical, Mechatronics, Petroleum, Pipeline, Process, Process Control, Process Safety, Product, Production
- Skilled Trades: Electricians, Gasfitter, FCEV mechanic, Heavy-duty mechanic, HVAC, Industrial mechanic (Millwright), Instrumentation technician, Pipefitter/Steamfitter, Welder
- Technologists & Technicians: Assembly workers, Lab tech, Locomotive technician, Logistics, Pipeline, Sampling & analysis, Utility
- Plant and control room operators
- H2, FC and H2DR (H2/diesel dual fuel) vehicle mechanics
- Truck drivers (Class 1 & 3)
- Geoscience professionals
- Drilling, energy services and seismic crews
- Specialists: Compression, Corrosion, Hydrogen integration, Materials, Measurement, QA/QC





Example: Atlantic Canada – Electrolytic H2 from offshore wind (OSW); Port initiatives for H2 offtake for H2 trade via Canada’s agreements and MOUs with other countries

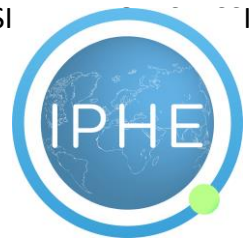
- College of the North Atlantic (CAN) has launched 1- year wind turbine technician program (Stephenville campus, NFLD/Labrador) and 2-year H2 technician diploma (Corner Brook, NFLD/Labrador) campus
- Increasing availability of scholarships and bursaries, incentives to industry to hire since many electrolytic H2 projects in ATL Canada will have decades-long lifespans
- Atlantica Centre for Energy - energy literacy project to raise awareness of opportunities in the clean fuels sector including H2; targets post-secondary students and First Nations’ youth in all four Atlantic provinces
- Fuel 4 the Future (F4F) project - interactive learning website on clean hydrogen, biofuels and renewable natural gas (RNG) jobs through in-class activities and presentations, virtual events, awareness surveys, and jobs fairs





- Private vocational institutes offering H2-linked bootcamps and micro-credentials to update skills to assimilate H2, including workers looking to get out of the oil and gas industry
- Work traditionally associated with the blue (maritime and port) economy will figure importantly in H2 scale-up – e.g., drayage transport, construction including carpentry, welding, electrical and roofing
- Demographic factors may influence skills training and credentialing outcomes:
 - Current students/recent graduates may have better awareness of the sustainability concerns attached to Canada's clean energy transition
 - Younger workers may demonstrate more non-traditional skills and educational achievements including microcredentials
 - Experienced workers, on the other hand, may have high-value/high-demand transitional skills capable of easier passporting
- Role for OEMs, codes and standards organizations who also offer safety training





Government of Canada Commitments to Develop the H2 Workforce

No current government initiatives are targeted specifically to grow and sustain the H2 workforce.

However, since the 2016 Pan-Canadian Framework on Clean Growth and Climate Change ('PCF'), the Government has increased its commitments to fund skills development in a low-carbon economy.

Initiatives since 2022:

- Canada's Emissions Reduction Plan to 2030 committed the Government to investing in skills and training, and creating opportunities for under-represented people to join the clean energy workforce. Actions include:
- **Establishment of a Sustainable Jobs Training Centre**
- **'Futures funds' in Alberta, Saskatchewan, and Newfoundland/ Labrador (i.e., provinces with significant fossil fuel development). To date roughly \$2 billion in federal money has been allocated to these funds to help workers upgrade or gain new skills**





Interim Sustainable Jobs Plan

- CDN \$250 million over five years (starting in 2023–24) to implement support for new energy sector job programming, developed through consultations with Canada's Provincial/Territorial governments and labour organizations
- The primary production of clean fuels (including H₂) is a priority subsector to be addressed by this type of programming. Others include zero-emission public transit, electric vehicle infrastructure, carbon capture use and storage ('CCUS'), and scale-up of the green building industry





- **A full *Sustainable Jobs Plan* is set for release by 2025; under the interim plan, recommendations have been made for 10 priority actions:**
 - **Establish a Sustainable Jobs Secretariat**
 - **Create a Sustainable Jobs Partnership Council**
 - **Develop economic strategies through the Regional Energy and Resource Tables (RERTs) at Energy and Natural Resources Canada (NRCan)**
 - **Introduce a sustainable jobs stream under the Union Training and Innovation Program (UTIP), an initiative of Economic and Social Development Canada (ESDC)**
 - **Advance funding for skills development toward sustainable jobs**
 - **Promote Indigenous-led solutions and a National Benefits-Sharing Framework**
 - **Improve labour market data collection, tracking and analysis**
 - **Motivate investors and draw in industry leadership to support workers**
 - **Collaborate and lead on the global stage**
 - **Establish legislation that ensures ongoing engagement and accountability including publication of action plans and progress reporting**



International Participation

- Multilateral engagement addressed to diversity and inclusion, in order to help drive skills and talent development during the clean energy transition and directly support the uptake of H2 into our national energy mix
- Canada participates in the IPHE's H2 Skills and Training Task Force
- Canada co-leads the Clean Energy Education and Empowerment (C3E) International Initiative, a collaboration between the Clean Energy Ministerial (CEM) and the International Energy Agency (IEA), which aims to advance gender equality in the energy sector globally
- Under C3E, Canada also leads the Equal by 30 Campaign which encourages voluntary commitments from public and private organizations to advance equal pay, leadership and opportunities for women in the energy sector by 2030



Thank you



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