

CGA Energy Nexus & Annual Technical Conference 2024

Fuelling the Future

Hydrogen From Production to Utilization ATCO Gas' Work Beyond the Pipeline

Justin Pullukatt, Director, Hydrogen Projects and Technology Development

Michael Leung, Engineer, Technology Development



ATCO GAS: AN ATCO ENERGY SYSTEMS COMPANY



INNOVATION AND ESG

proven track record



100 YEARS

of safe and reliable clean energy

9,000 KM

of transmission pipeline



41,000 KM

of distribution pipeline



800 GWH

salt cavern storage

1.3 MILLION
Customers

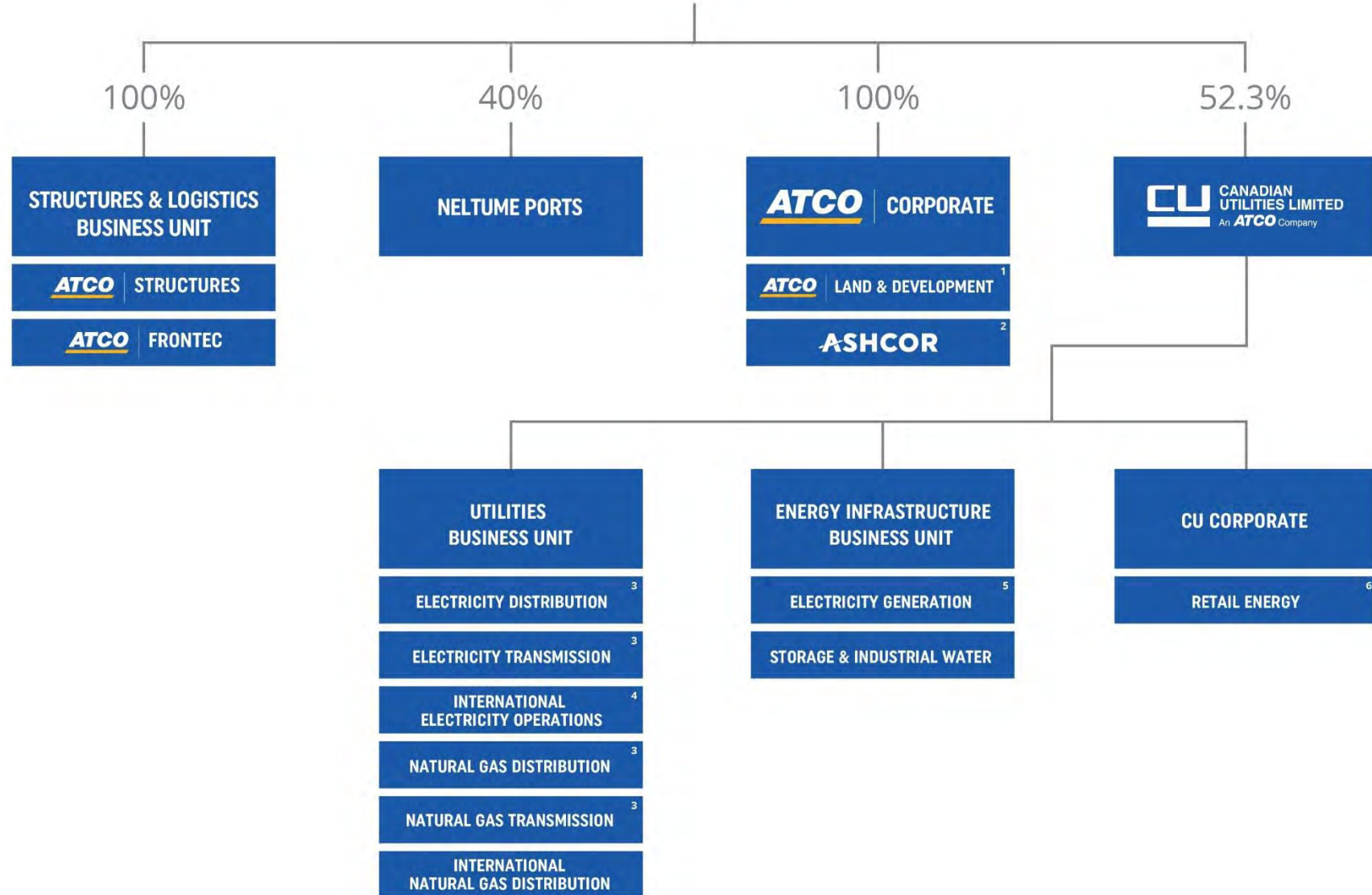
300
Communities



50 GW
peak delivery

45%
of provincial
total





FUEL FOR THOUGHT – OUR ESG TARGETS FOR 2030

ATCO is building on its **long track record of sustainability leadership** by announcing our strategic environmental, social and governance targets for 2030 and commitment to achieve **net zero greenhouse gas (GHG)** emissions by 2050.

OUR ESG TARGETS INCLUDE:



Reducing net operational GHG emissions to earnings intensity by **30%**



Owning, developing, or managing over **1,000 MW** of renewable energy



Reducing our customers' GHG emissions by **2 million tonnes** through continued participation in renewable energy, clean fuels, energy efficiency, and energy infrastructure projects



Deriving **20%** of revenues from transitional product categories (e.g., renewable natural gas and **hydrogen**)



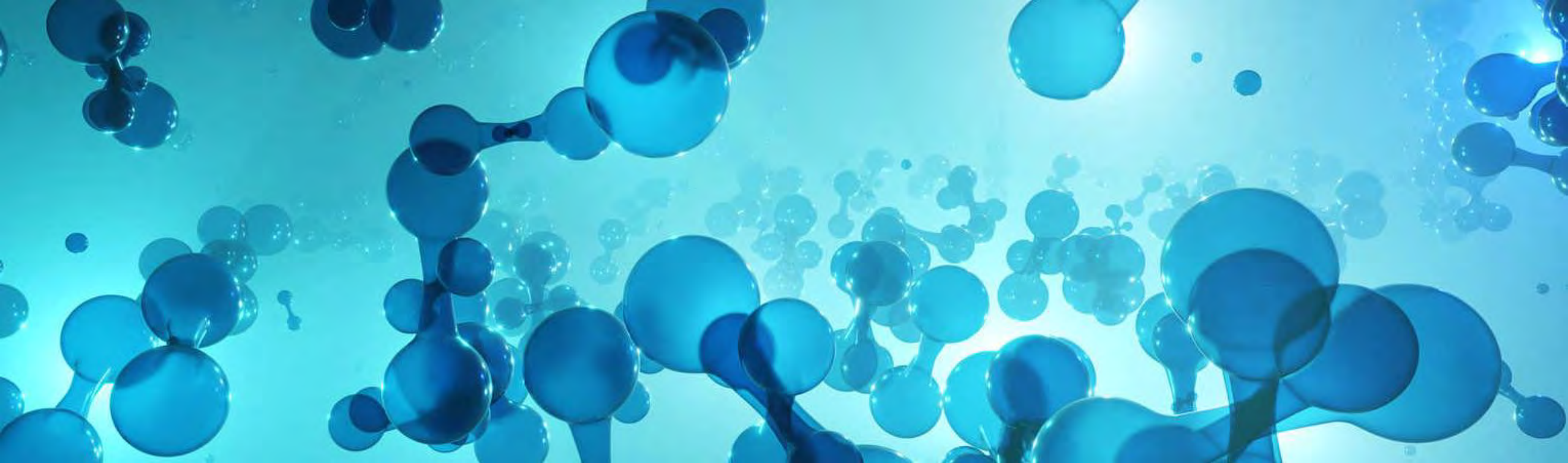
Increasing net economic benefits to our Indigenous partners by **40%**



Promoting **diversity, equity, and inclusion** in the workplace




Maintaining **leading health and safety practices** and performance



WHY HYDROGEN?

EVOLVING THE GAS SYSTEM IS NECESSARY



ALBERTA'S ENERGY POTENTIAL:

CONTINUE AS WORLD LEADERS

- Abundant supply of natural gas
- Existing skills, trades, workforce
- Lowest cost hydrogen production & existing carbon capture assets

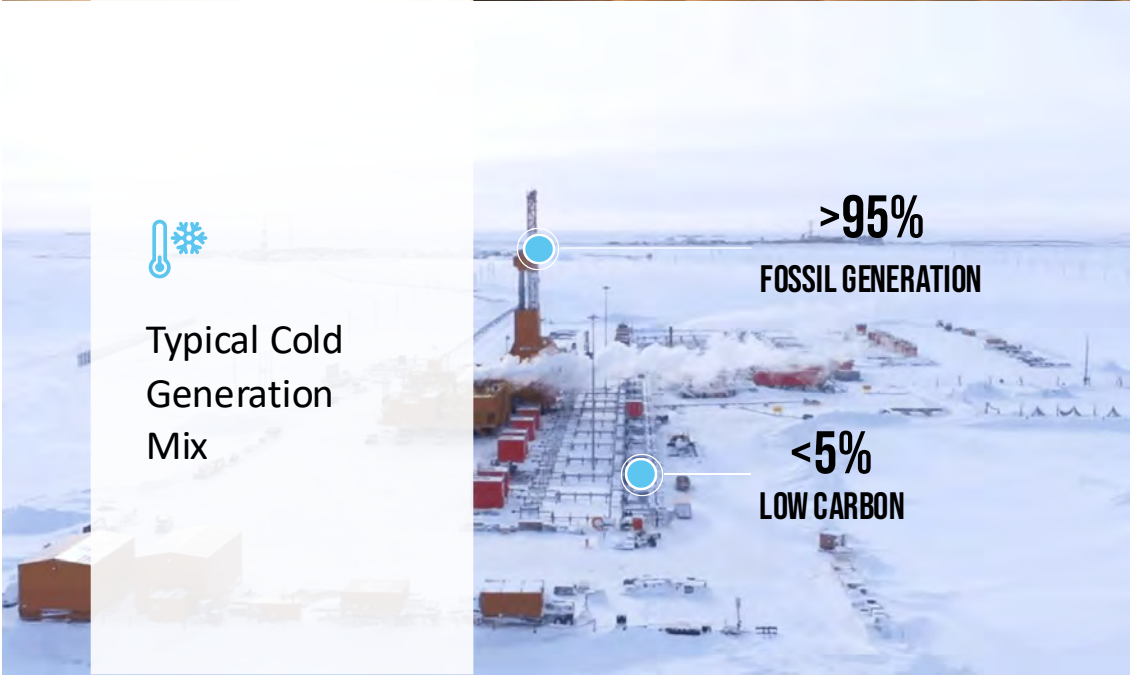
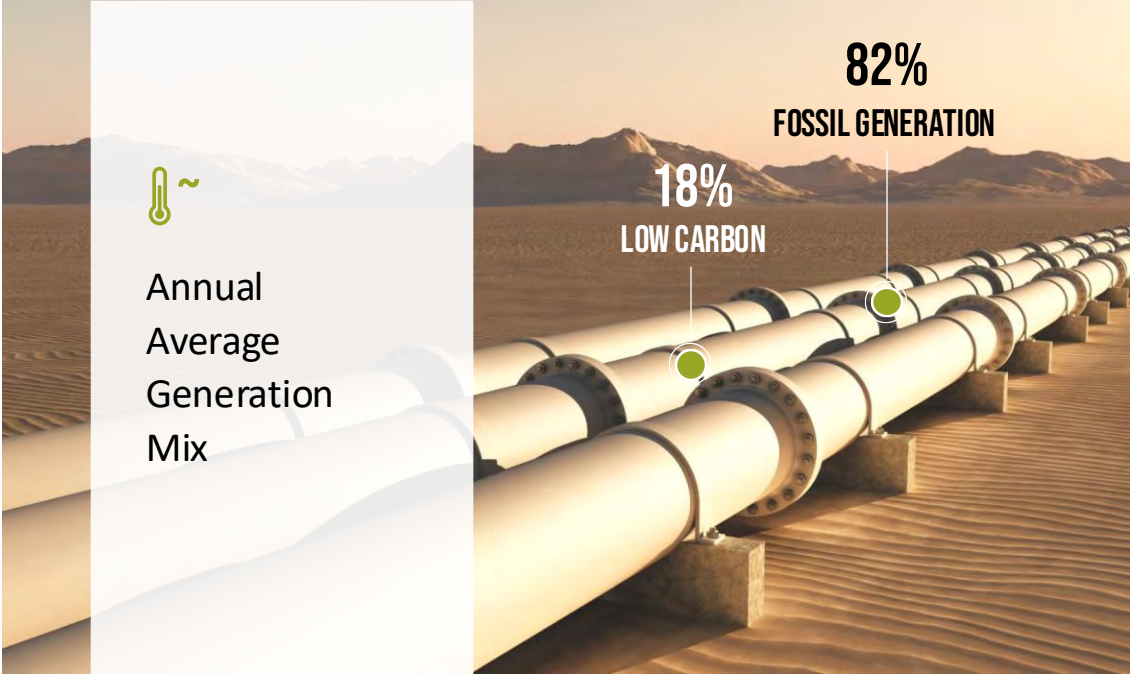
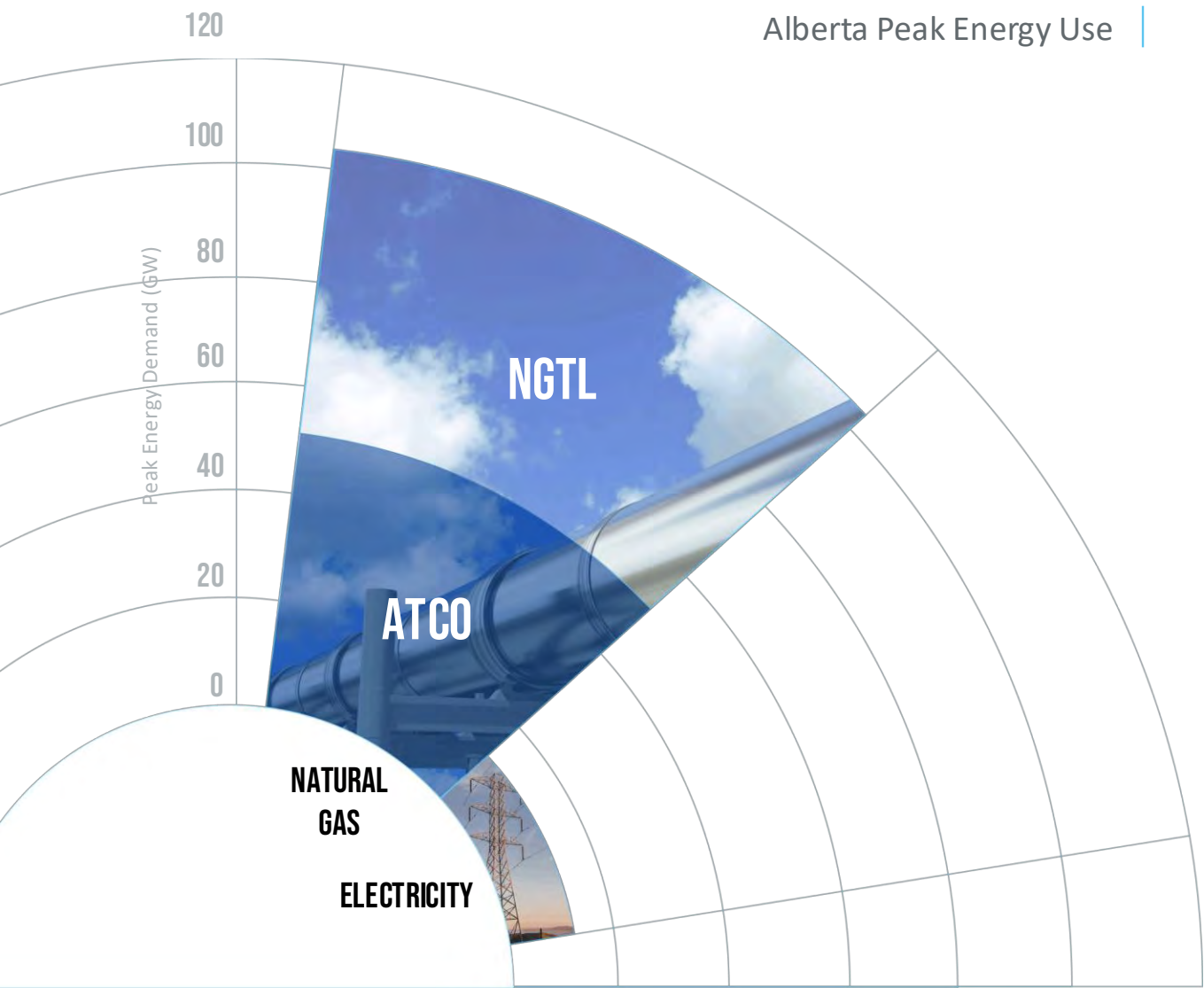
DISRUPTIVE FORCES:

- Carbon tax
- Municipal climate emergencies
- Gas bans

LEGISLATIVE CHANGE: LOW CARBON HEATING SOLUTIONS

- Doing nothing is not an option
- Hydrogen provides a pathway to a prosperous low-carbon future for Alberta and Canada!
- Balance affordability, pace of decarbonization with emission reductions

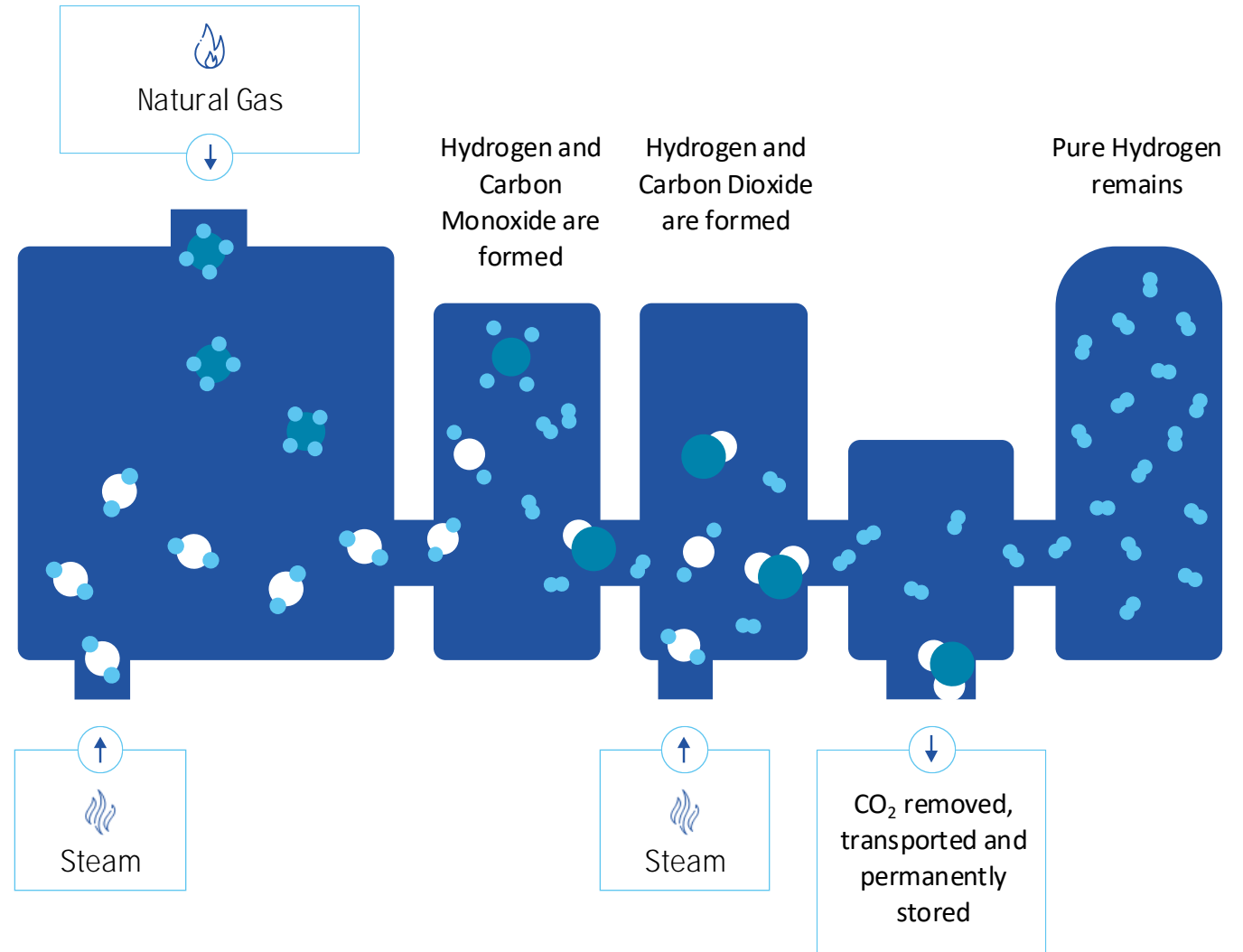
INFRASTRUCTURE CAPACITY - ALBERTA



BLUE HYDROGEN




Blue H₂ facts:

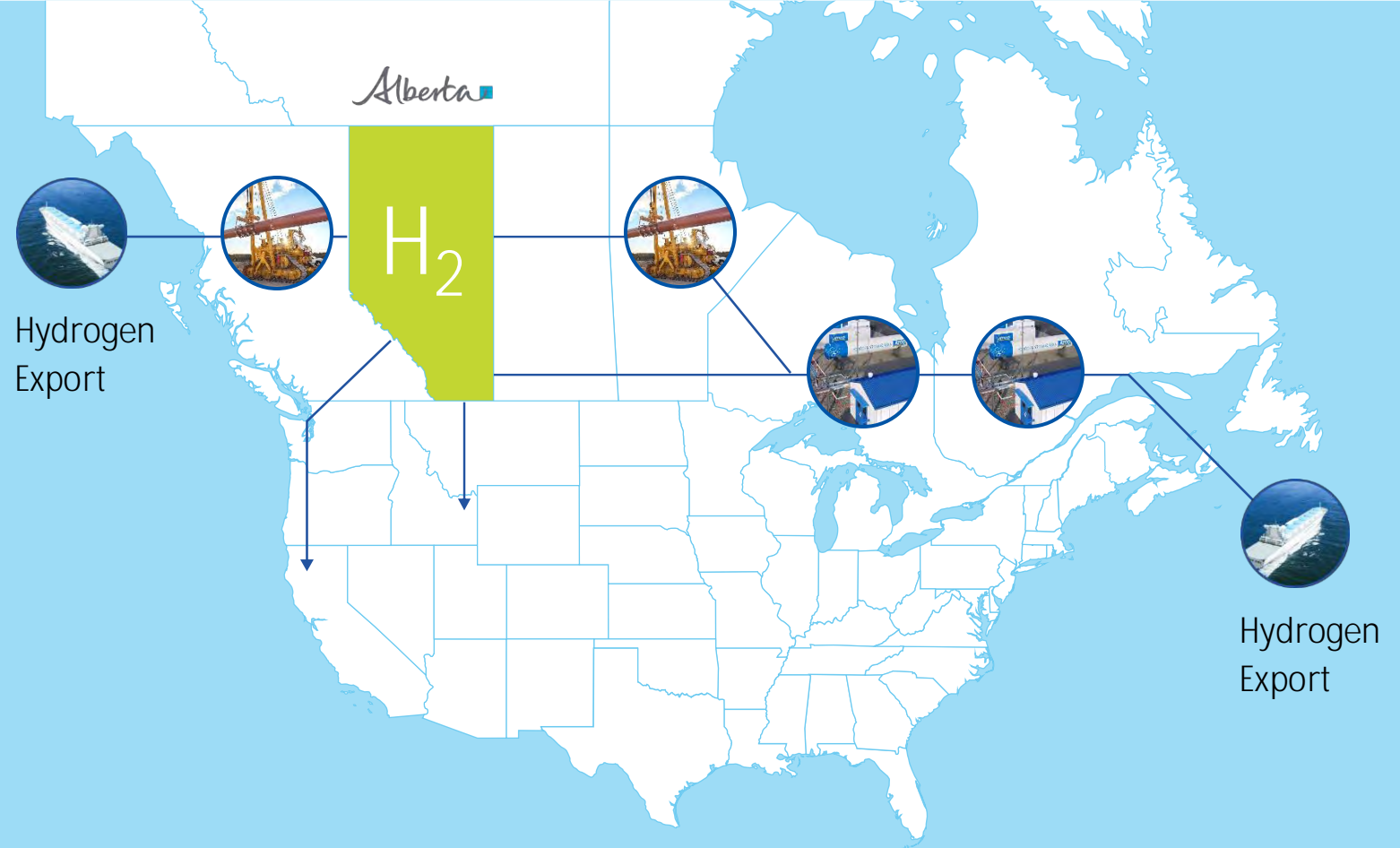
- **When used with CCUS**, blue hydrogen produces nearly zero emissions
- Alberta has the infrastructure to produce blue hydrogen **cheaper than any other jurisdiction** in the world



ALBERTA'S ADVANTAGE

Alberta is a logical hydrogen hub in Canada:

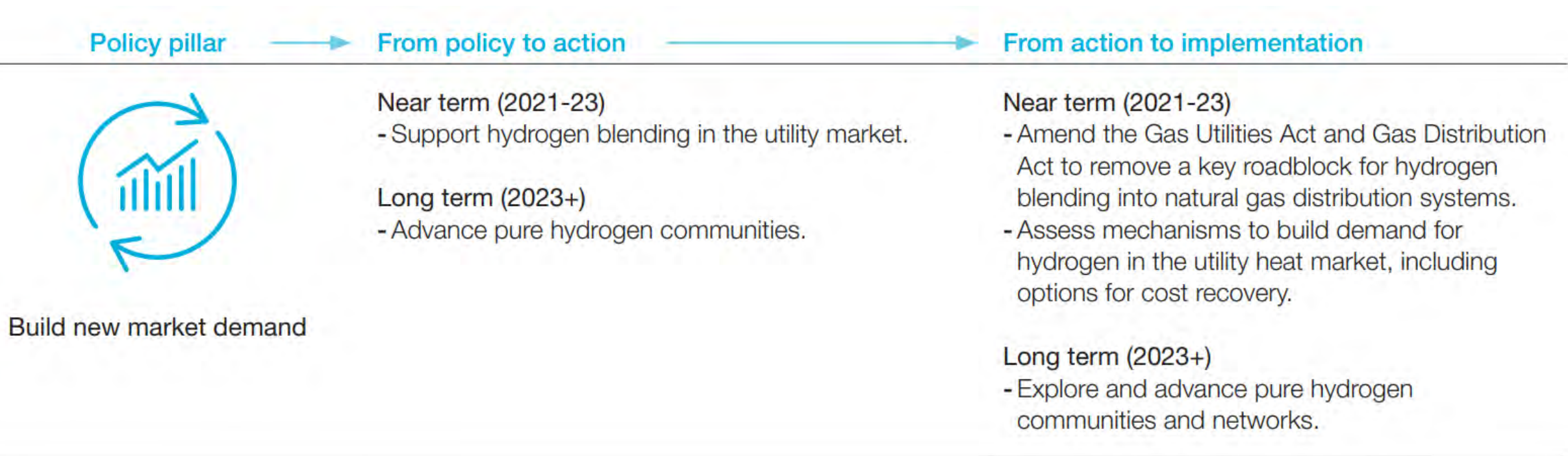
-  Lowest cost hydrogen production and carbon capture assets
-  Abundant supply of natural gas
-  Large industrial demand



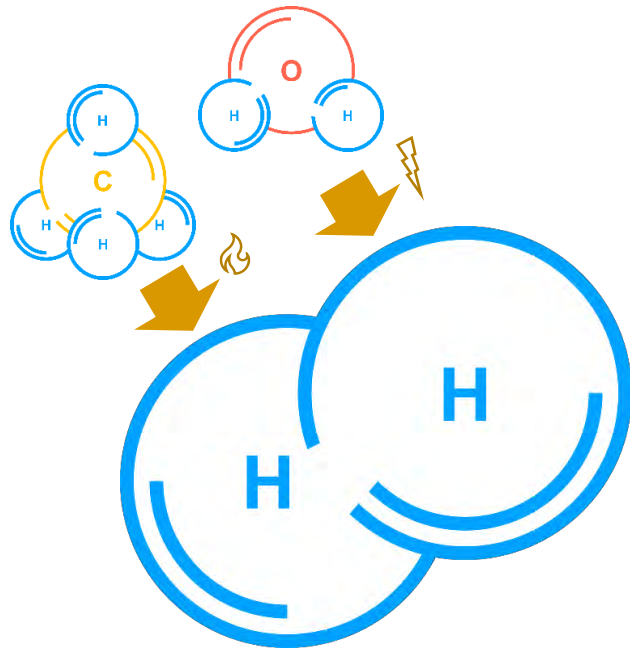
Hydrogen provides a pathway to a **prosperous low-carbon future** for Alberta and Canada!

ALBERTA HYDROGEN ROADMAP

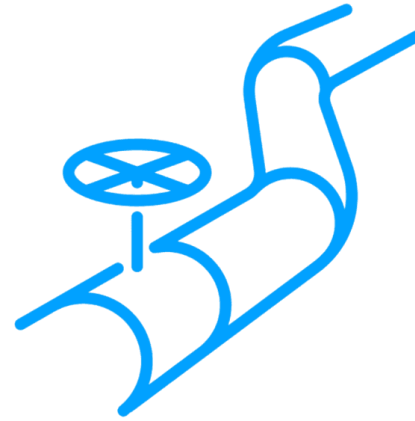
Alberta's 2021 Hydrogen Roadmap both supports hydrogen blending in the utility market and provides new market demand



HYDROGEN PROJECTS



H₂ Production

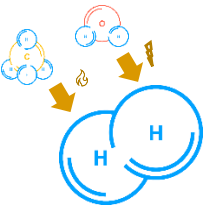


H₂ Delivery

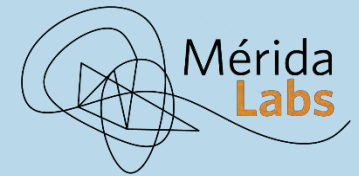


H₂ Utilization

PYROLYSIS PRODUCTION PARTNERSHIPS



ATCO is partnered with several organizations to conduct **pilot demonstrations** of **novel, early TRL**, or otherwise **pre-commercial** pyrolysis technologies to advance hydrogen deployment



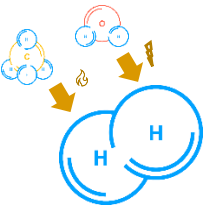
Methane \longrightarrow Carbon Black + Hydrogen



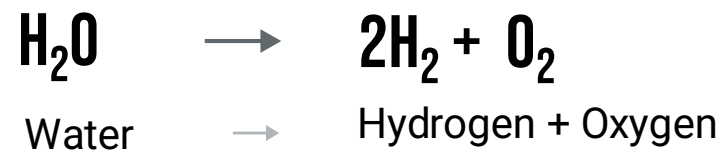
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ELECTROLYSIS



H2 Blending Facility



WINTER DEMONSTRATIONS



Edmonton Home Pilot Projects

Up to
22%

hydrogen blend



January - September 2022

EDMONTON CONVENTION CENTRE



EDMONTON
CONVENTION
CENTRE

The Edmonton Convention Centre ran off a 20% hydrogen blend for the Canadian Hydrogen Convention making it the first convention in North America to be fueled by hydrogen.

FORT SASKATCHEWAN HYDROGEN BLENDING

IN FALL 2022

2,100 ATCO customers became
the first in Alberta to use a **5%**
hydrogen/natural gas blend



Mostly
residential
homes



Some small
businesses



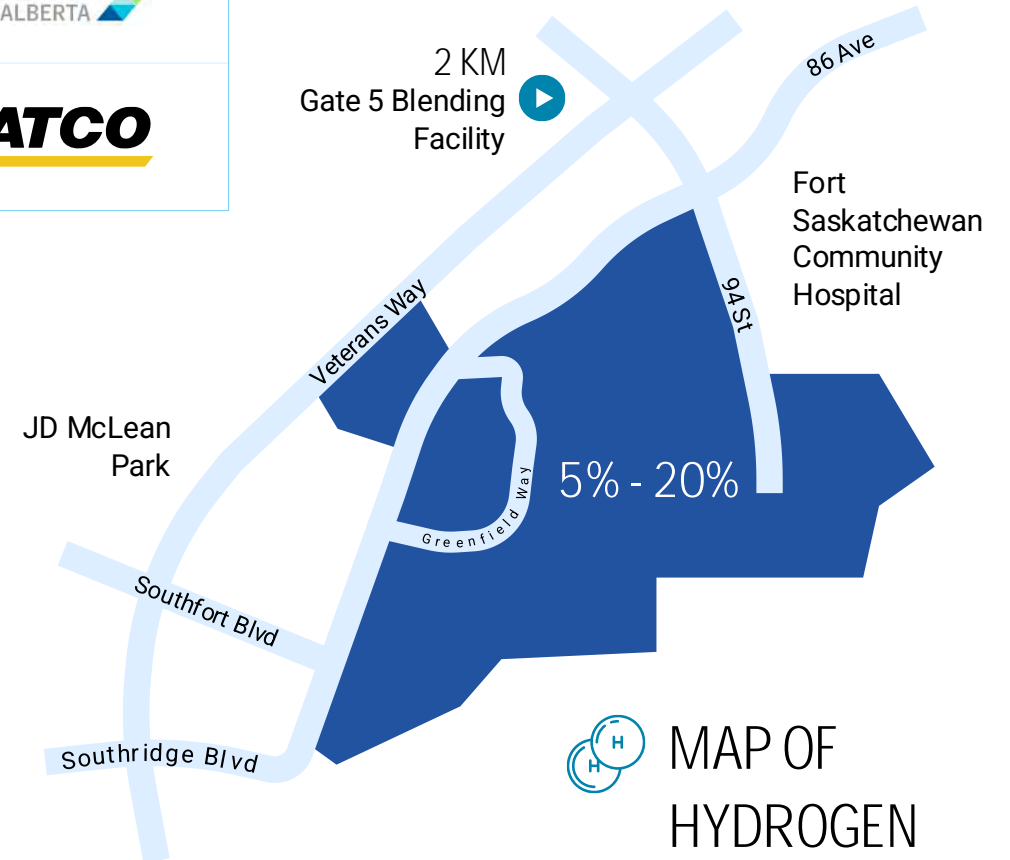
One school

PROJECT OVERVIEW



EMISSIONS
REDUCTION
ALBERTA

ATCO



 **MAP OF
HYDROGEN
BLENDING PROJECT**

EDUCATION & ENGAGEMENT

ATCO has engaged and pursued education of the public and customers through:



Hydrogen Blending Home Inspection (HBHI) Program



SME to develop Clean Fuel Operations Program with NAIT



Assisted SAIT in development of Hydrogen Massive Open Online Course (MOOC)



Collaboration with LAHJ, fire departments, industry associations, local and provincial govt's, regulators, etc.



Open houses and community events



Over 85% inspection rate for private homes in HBHI program

Almost 1,800 customers

Over 5,800 appliances inspected

ORGANIZATIONAL CHANGE MANAGEMENT (OCM)



Pipes



People



Processes



Organizational Change Management

- Modifications to existing practices & procedures, or
- Confirmation something doesn't need to change
- New tools, equipment, training
- Customer engagement & education programs

HOME ONE



In partnership with Qualico, ATCO has successfully commissioned a 100% hydrogen heated showhome in Alberta.

ALBERTA
INNOVATES



Natural Resources
Canada

Ressources naturelles
Canada

Canada

QUALICO®



CODES AND STANDARDS

20% and Pure H₂ Regulations, Codes and Technical Milestones for Utilities

CODES/STANDARDS

✓ ALREADY EXIST

H₂ Distribution: CSA Z662

End User: CSA B149.1 (20%) and BNQ 1784 (Pure H₂)

EXISTING REGULATIONS

⚠ REQUIRES UPDATING

H₂ Distribution: Gas Utility Act;
Gas Distribution Act

End User: Safety Codes Act and
Gas Code Regulation

TECHNICAL MILESTONES

🔧 IN PROGRESS

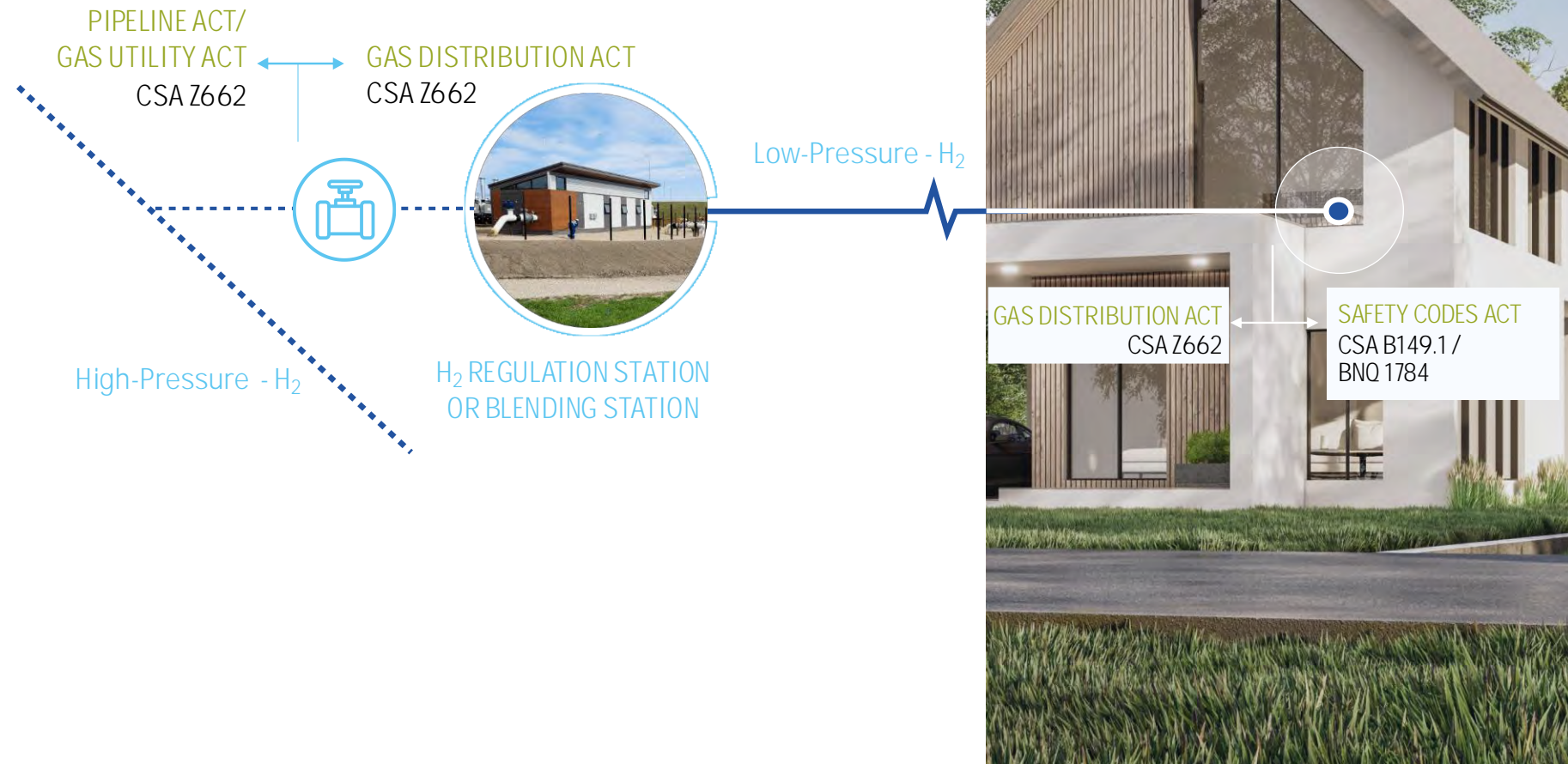
H₂ Transmission and Distribution:

Engineering /Risk Assessment

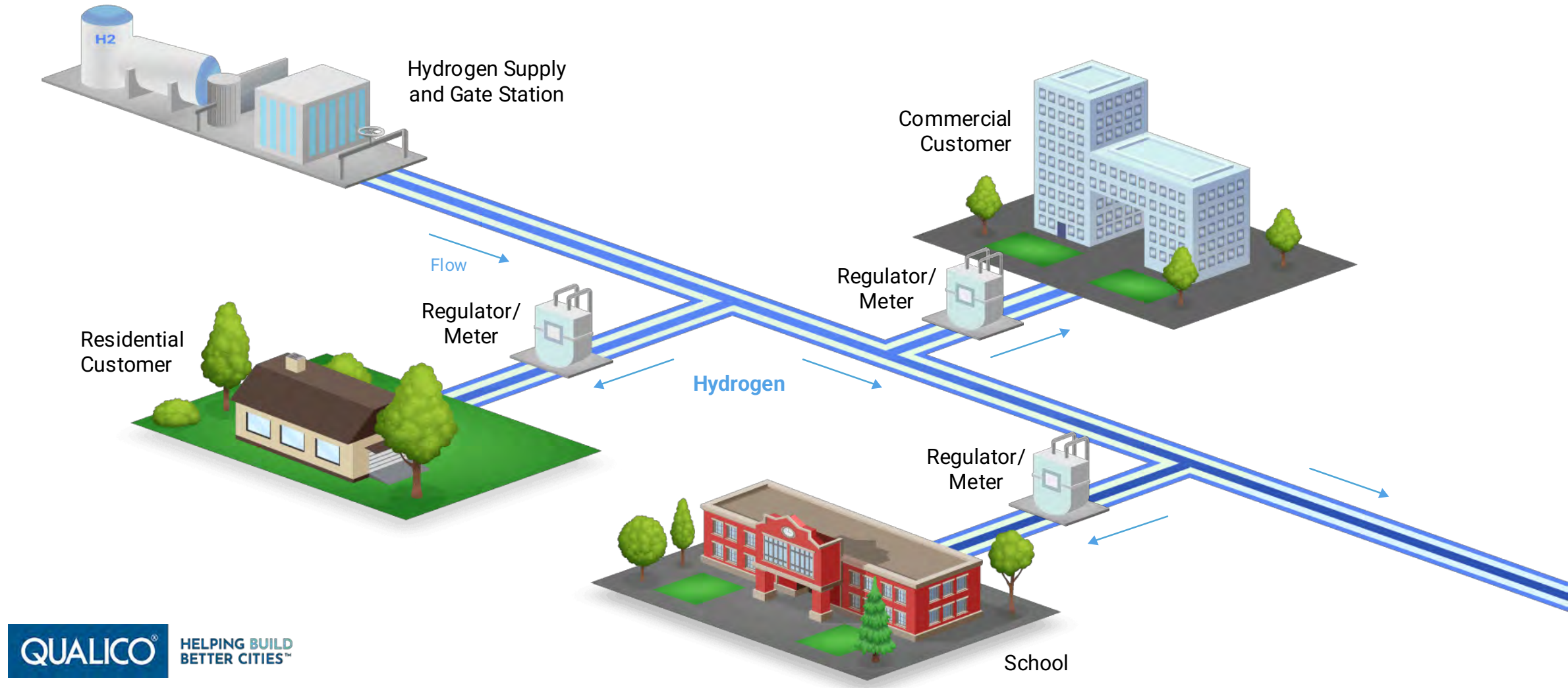
End User:

Engineering/Risk Assessment

Appliance testing/certification standards



100% HYDROGEN COMMUNITY



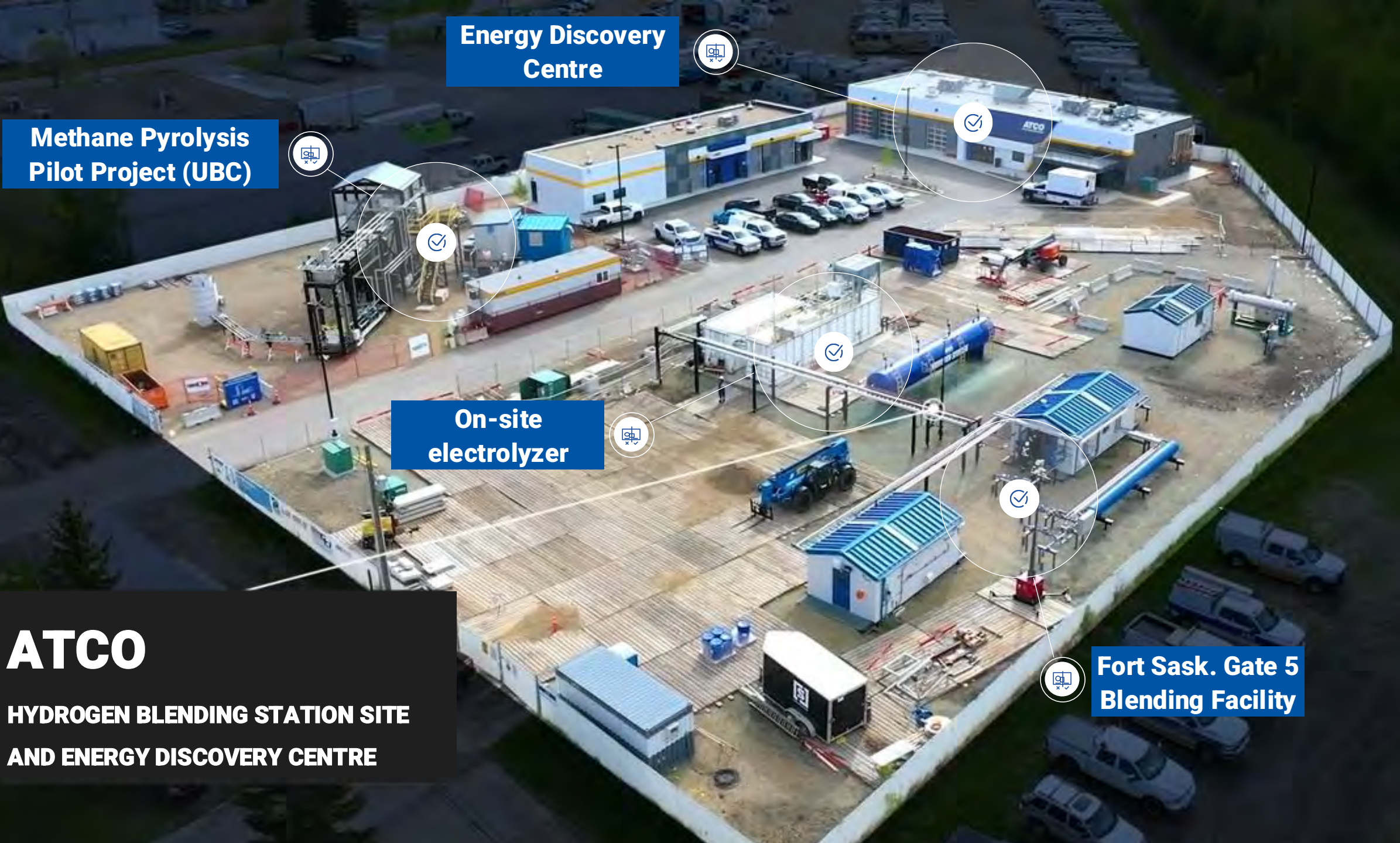
ATCO
HYDROGEN BLENDING STATION SITE
AND ENERGY DISCOVERY CENTRE

**Methane Pyrolysis
Pilot Project (UBC)**

**Energy Discovery
Centre**

**On-site
electrolyzer**

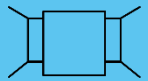
**Fort Sask. Gate 5
Blending Facility**



DEMONSTRATION SPACE



Novel Technologies



Multiple Bays



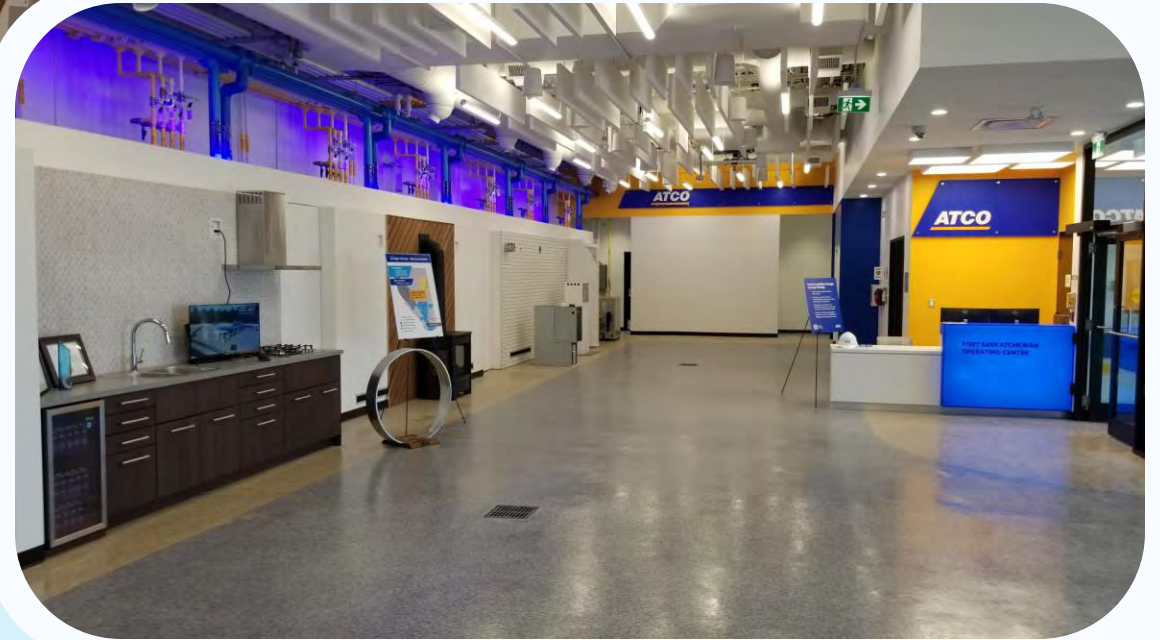
Four Energy Lines



Common Space – No PPE



DEMONSTRATION SPACE



DEMONSTRATION SPACE - INTERIOR



Building Management System



100% H₂ Blend and Natural Gas Piping



DEMONSTRATION BAY



Tech Panel



Service Lines to Each Bay

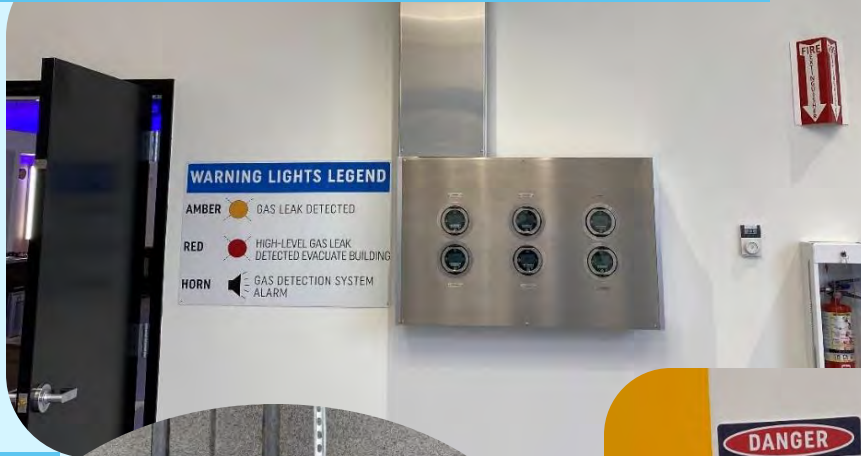


Venting



GAS SAFETY

Hydrogen and NG Detection



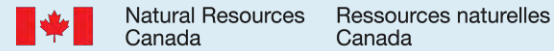
Emergency Shut Down System



Purge and Regulator Vent Lines



ENGAGEMENT



Canada



Rinnai



AISIN

NON-UTILITY PROJECTS



ATCO H₂ Production and Storage

World-scale: up to 300,000 tonnes H₂ & 95% carbon capture



Atlas Carbon Sequestration Hub

Provide open access to carbon capture facilities to emitters in Alberta



CPKC Rail Hydrogen Locomotive

ATCO to design, construct and operate hydrogen refueling infrastructure in Edmonton and Calgary



THE PATH TO NET-ZERO

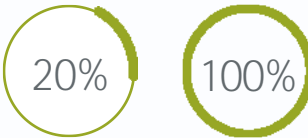


- ✓ In home H₂ blend demonstration
- ✓ Pure H₂ appliance development
- ✓ Community H₂ blending pilot in Fort Saskatchewan
 - H₂ public policy
 - 100% H₂ building(s)

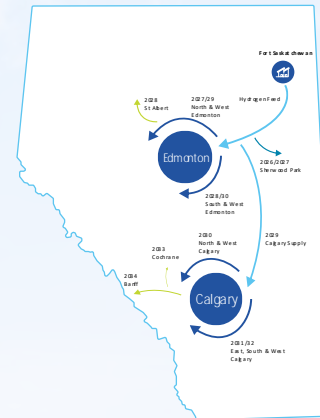
2021-2023



H₂ communities



2024-2026



H₂ blending in
Edmonton and
Calgary H₂ supply
lines



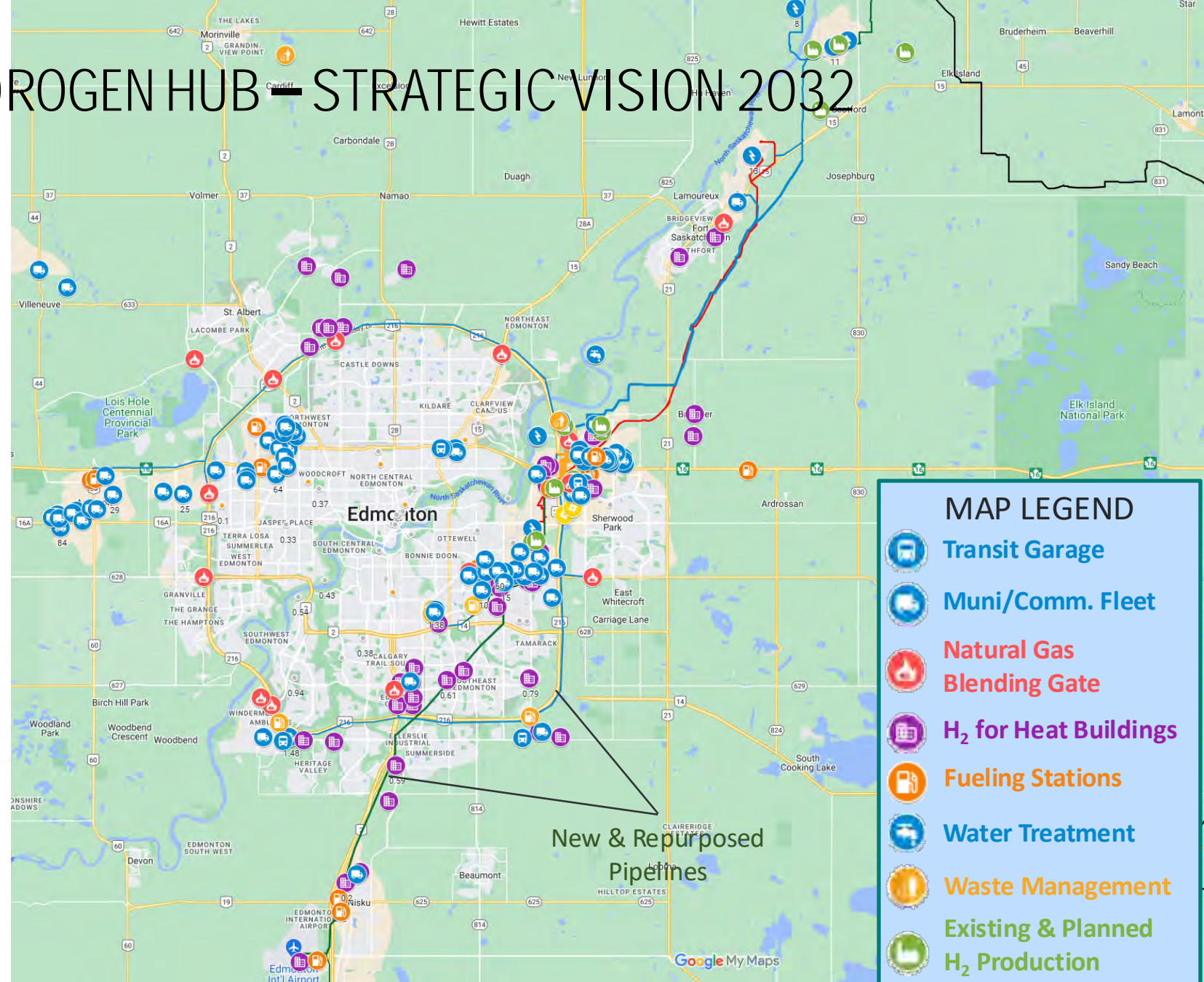
2027-2029

Widespread blending, RNG
and pure H₂ communities



BEYOND

EDMONTON REGION HYDROGEN HUB – STRATEGIC VISION 2032



MAP LEGEND

-  Transit Garage
-  Muni/Comm. Fleet
-  Natural Gas Blending Gate
-  H₂ for Heat Buildings
-  Fueling Stations
-  Water Treatment
-  Waste Management
-  Existing & Planned H₂ Production

Our Partners



CGA Energy Nexus & Annual Technical Conference 2024

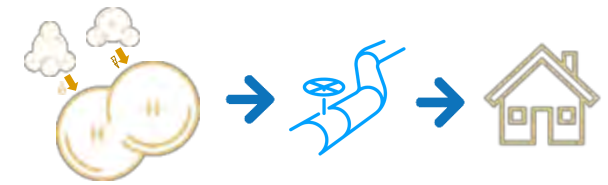
Fuelling the Future

Thank You!



- Justin Pullukatt, Director, H₂ Projects & Technology Development
- Michael Leung, Engineer, Technology Development
- [H₂@ATCO.com](mailto:H2@ATCO.com)

HYDROGEN TRANSPORTATION



H₂ Blending Station



Transmission Asset Conversion



END USE APPLIANCES



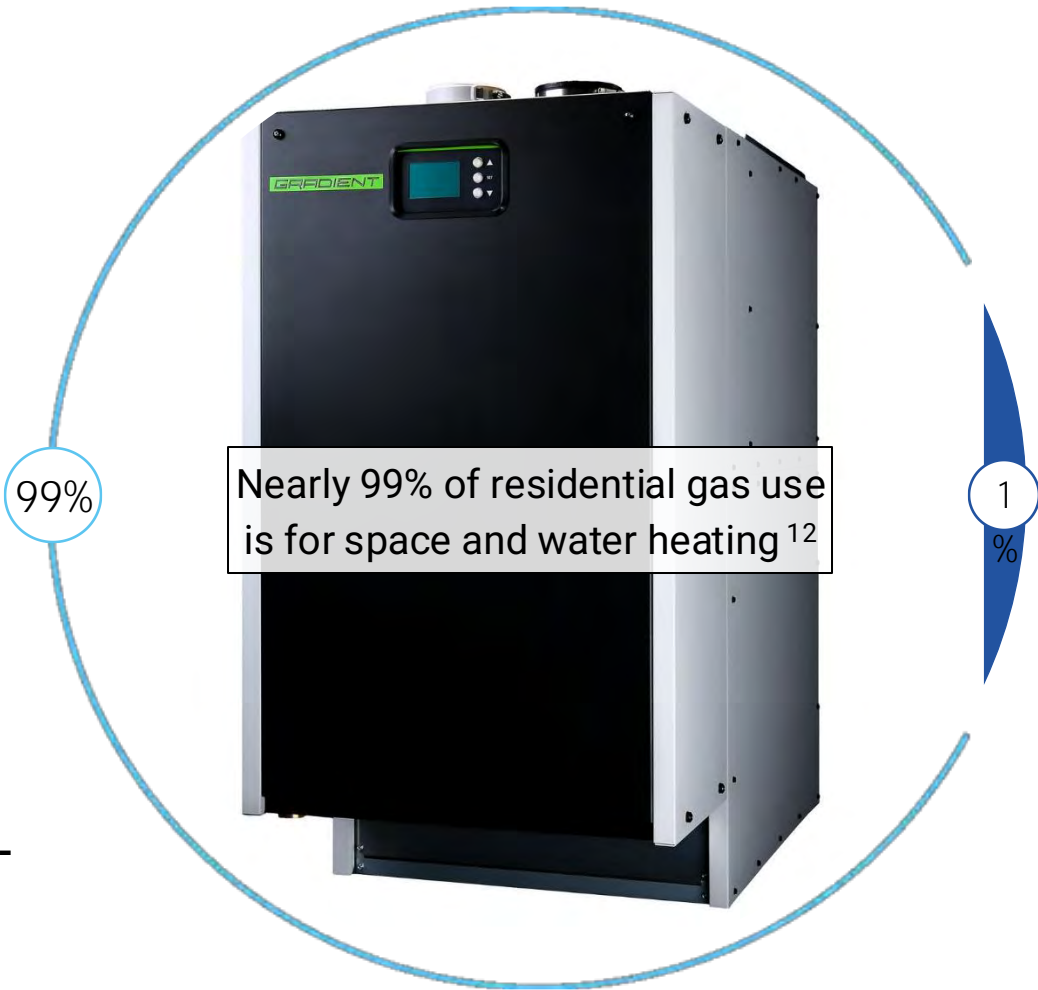
ATCO is working with Gradient Thermal, DNV and Enefen to design, manufacture and certify a 100% hydrogen forced air furnace and hot water heater.



Successful testing in both Netherlands and Alberta.



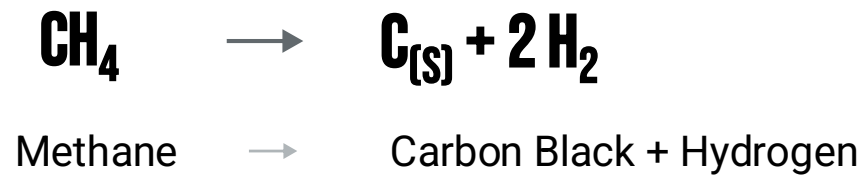
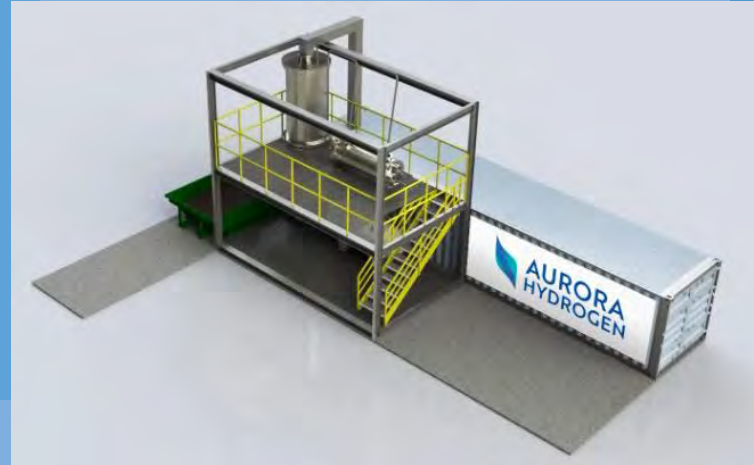
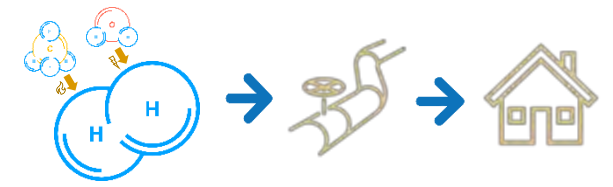
Refinement underway with field-certification planned in 2023.



Other appliances and standards ^{13,14,15} are available outside the Canadian marketplace

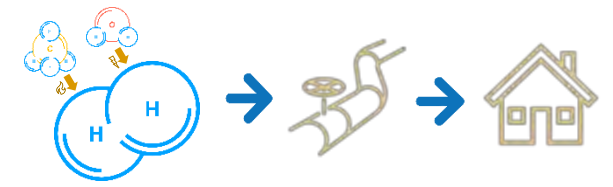
- Barbeque
- Boiler
- Stove/range
- Fireplace

PYROLYSIS



Using energy to break down methane into H_2 and solid carbon, without emitting CO_2

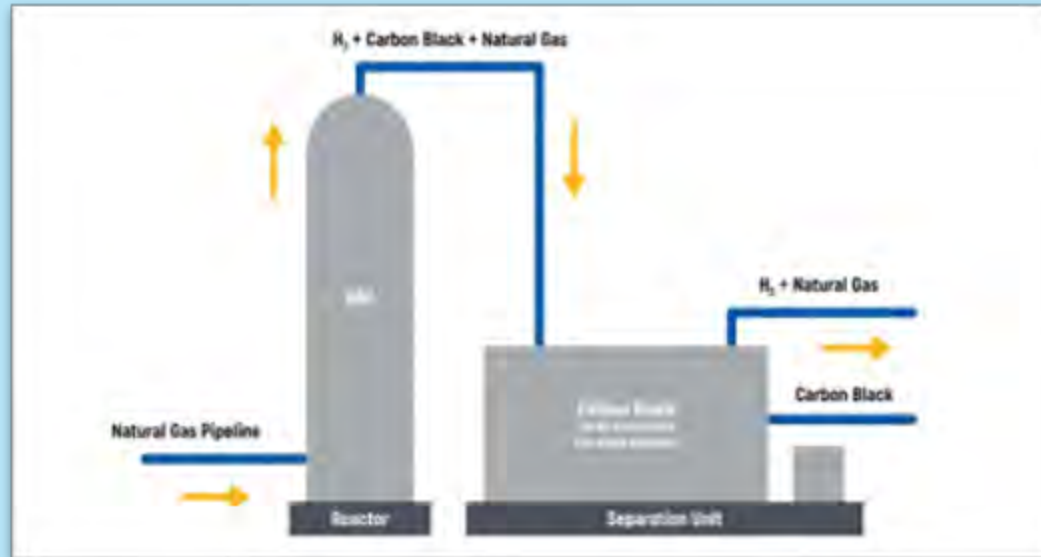
HYDROGEN PRODUCTION



Pyrolysis



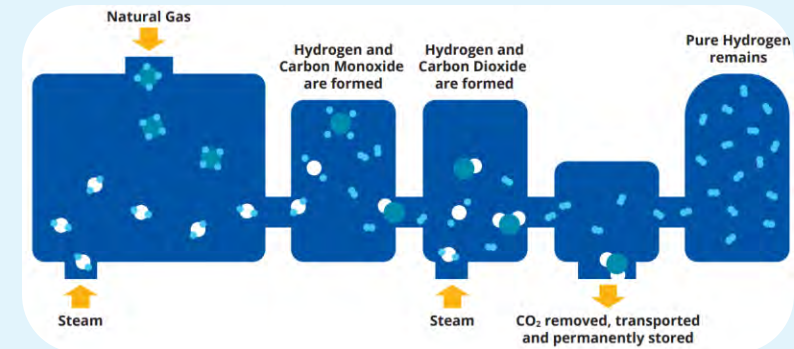
<https://www.cga.ca/energy-magazine-post/low-emission-hydrogen-from-natural-gas/>



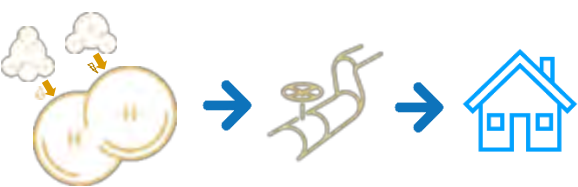
Electrolysis



ATCO Big Blue H₂ Project



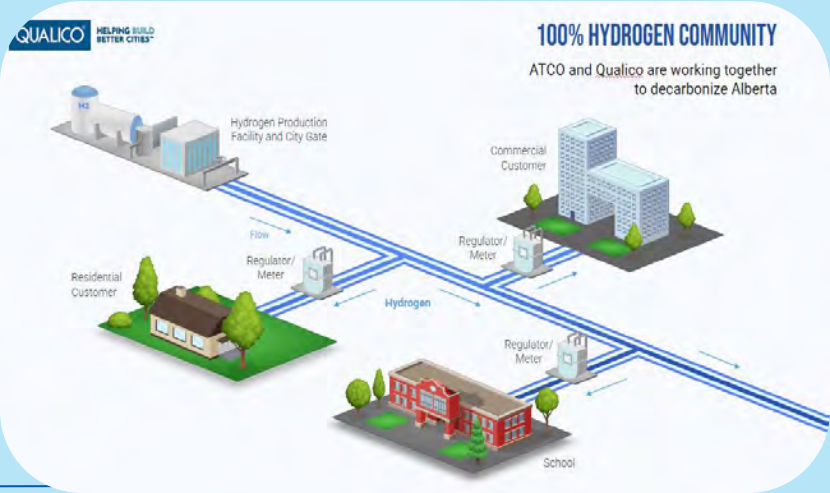
HYDROGEN UTILIZATION



Energy Discovery Centre (EDC)



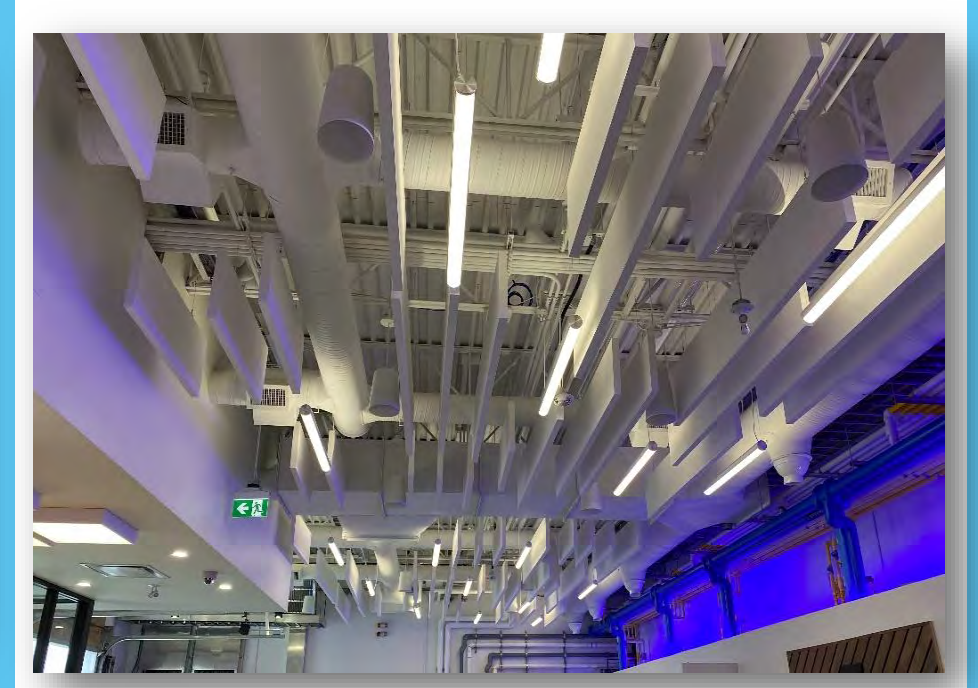
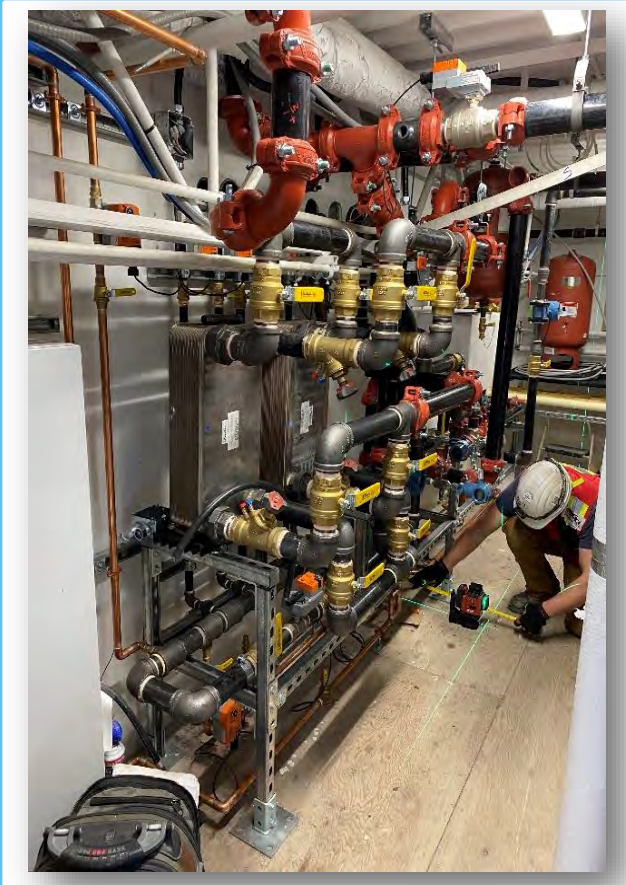
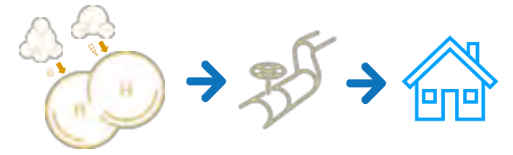
100% H₂ Community



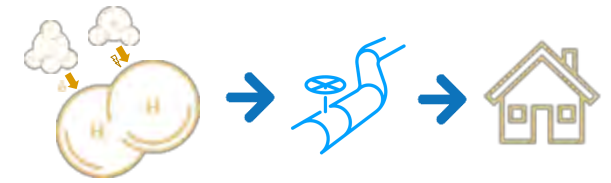
HomeOne – 100% H₂ Showhome



HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)



HYDROGEN TRANSPORTATION



Hyzon



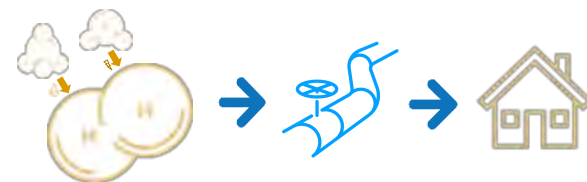
Powered 100% by Fuel Cell

Hydra

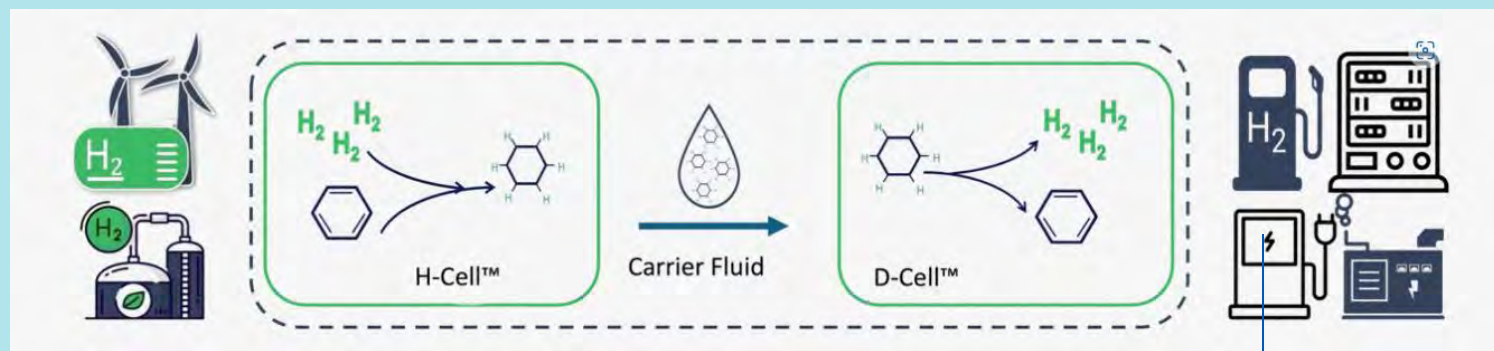


Injection of H₂ into Diesel

HYDROGEN DELIVERY



Ayrton LOHC



Ammonia

NH₃
Ammonia

DECARBONIZING THE GAS SYSTEM

CONTINUOUS IMPROVEMENT

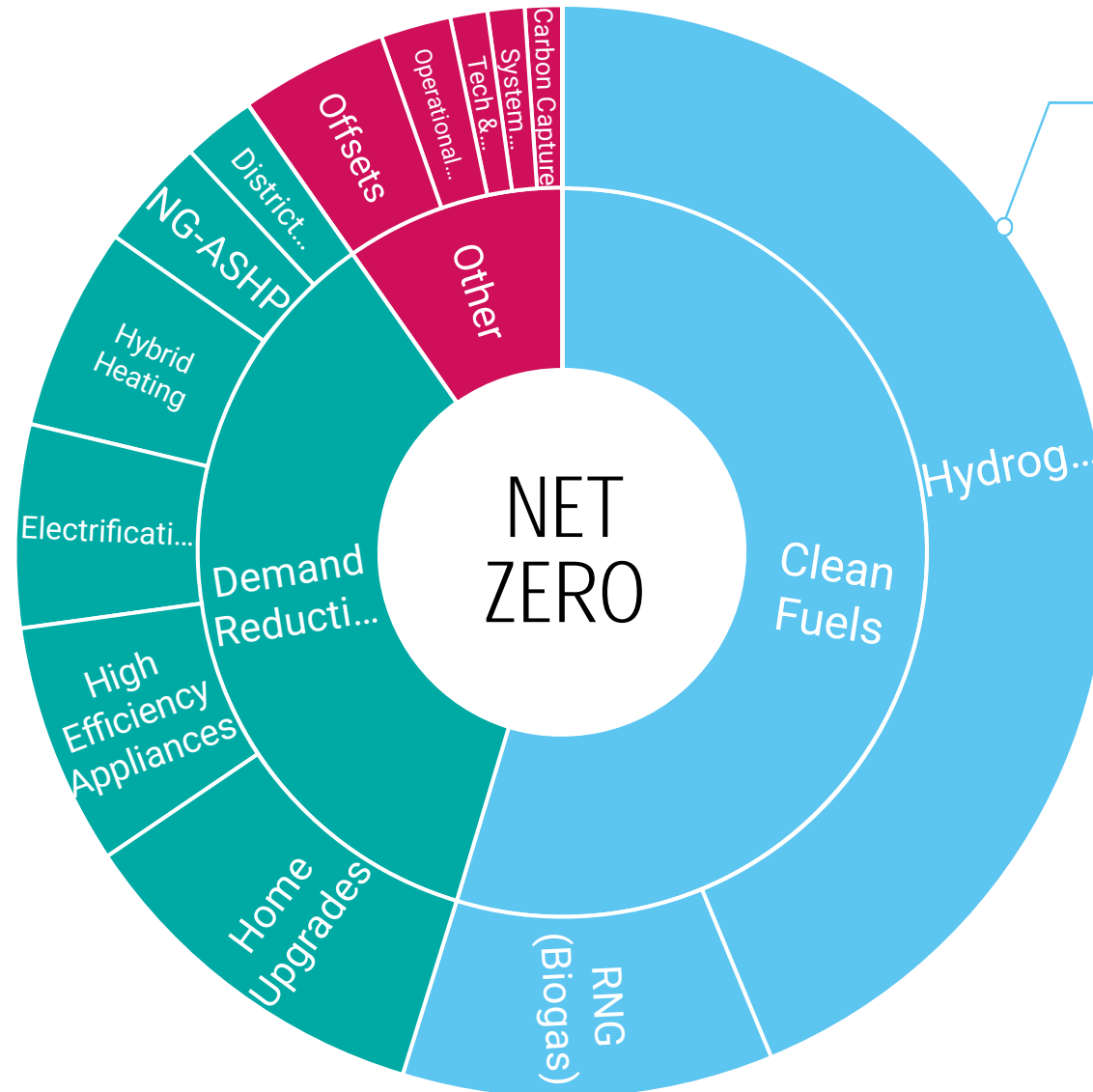


- Operational efficiencies, upstream emissions
- Research and development of technology and innovation

END USER CONTRIBUTIONS



- Improving energy efficiency in homes
- Reduced consumption



MAJOR ROLE IN ALBERTA:

- Abundant supply of natural gas
- Large industrial demand
- Lowest cost hydrogen production and carbon capture assets



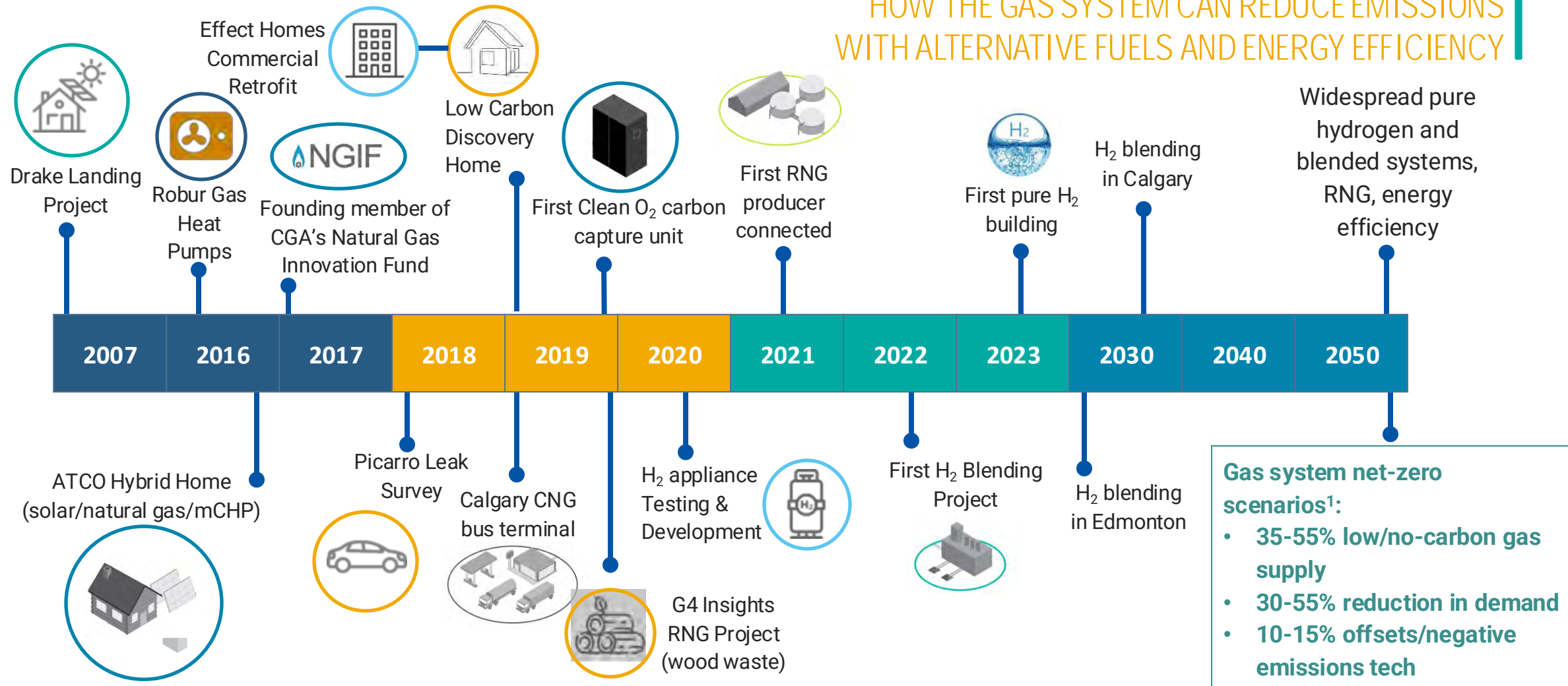
ATCO IS PURSUING ALL PATHWAYS TO AFFORDABLE NET-ZERO.

For Albertans, hydrogen provides the most efficient, attainable, and sustainable path to reaching net-zero by 2050.



A PROVEN INNOVATOR IN LOW CARBON / TECHNOLOGY SOLUTIONS FOR THE GAS SYSTEM

HOW THE GAS SYSTEM CAN REDUCE EMISSIONS WITH ALTERNATIVE FUELS AND ENERGY EFFICIENCY



¹ CGA: Potential Gas Pathways to Support Net Zero Buildings in Canada. Low/no-carbon gas supply includes RNG, hydrogen blending and pure hydrogen systems. Demand reductions includes gas and electric heat pumps, general energy efficiency measures and building code improvements.