EDMONTON REGION
Hydrogen HUB

# State of the Province 2023

# Hydrogen Luncheon

# Hub Leaders

Alberta

Prairies Economic Development Canada / Développement économique Canada pour les Prairies
Canada

Edmonton

Edmonton Global

Lamont County

Sturgeon County

Strathcona County

Enoch Cree Nation

City of Fort Saskatchewan
Alberta

Alexander First Nation
#134 Treaty 6

The Transition Accelerator

Emissions Reduction Alberta

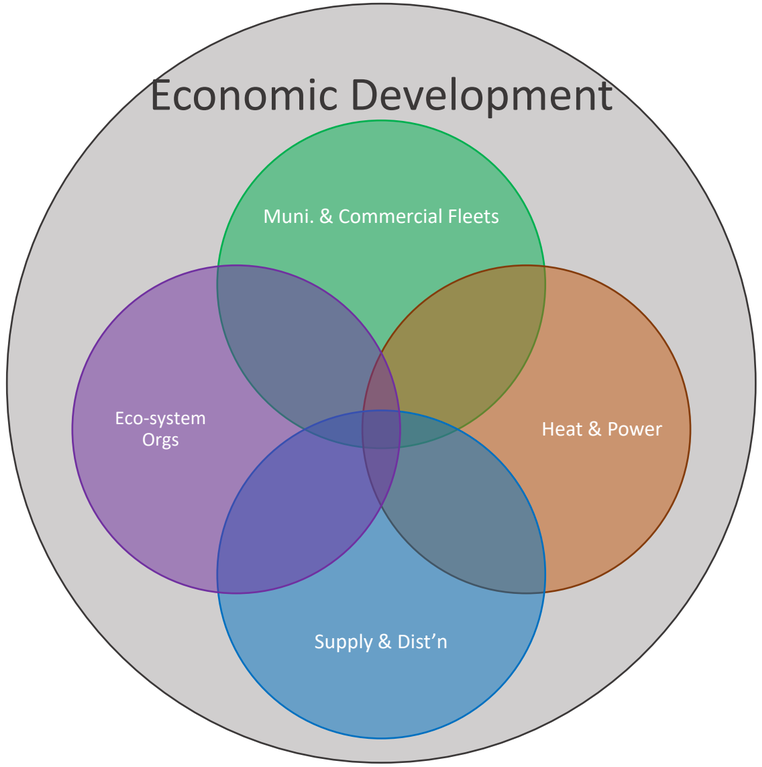
Alberta's Industrial Heartland

The Transition Accelerator

L'Accélérateur de transition

# HUB Overview

**Leader's Team**
- Elected Officials of 5 Municipalities & 2 First Nations




**CAO Group**
- 5 Municipalities

**Management Advisory Team**
- Integrating Secretariat
- Alberta Government ED
- Alberta Government Funders CEO
- Federal Ec. Dev ADM
- Municipal CAOs
- Ec. Dev CEOs

## Mandate

**Accelerate development of hydrogen value chain:**

- **Improve knowledge, awareness of H2 potential**
- **Analysis to support strategic investments**
- **Connect players along hydrogen value chain**
- **Identify and solve key value chain barriers**
- **Aggregate market to critical mass, achieve economies of scale**
- **Breaking cycle of no supply ←→ no demand**

# HUB Efforts

- > 4,000 stakeholders engaged through events, workshops, and webinars
- 1000’s of hours of analysis / business case dev
- 13 major Reports
- 23 Webinars
- Models of Full $H_2$ Value Chain
- > 30 projects launched or in development
- + 8000 at global convention
- *95% satisfaction rate*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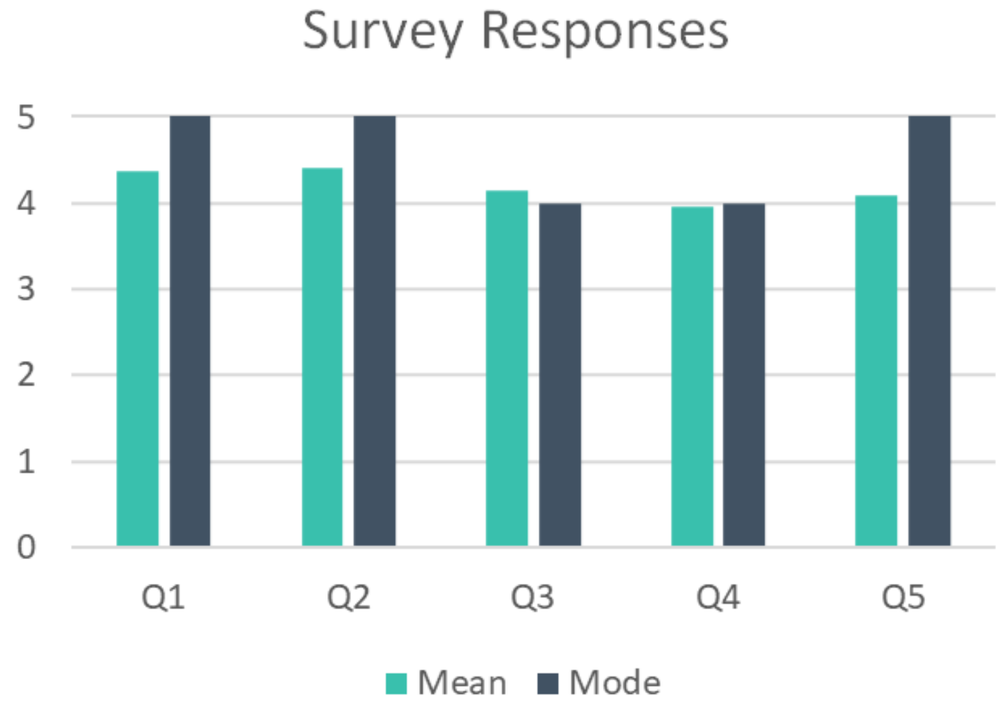
The Transition Accelerator | L'Accélérateur de transition

# We’re listening!

## *HUB Survey Results*




- Question 1: improved my knowledge
- Question 2: provided critical analyses
- Question 3: fostered productive dialogues that have connected organizations
- Question 4: identified barriers
- Question 5: helped launch projects

***95% Satisfaction Rate***

# HUB Outcomes - Projects

## Alberta Zero Emissions Truck Electrification Collaboration (AZETEC)

- >$20 million

*April 2023–Aug 2024*

*launch pre-dates HUB, but we have ongoing involvement



## EVID Demonstration Fueling Station

*Dec 2022–2027*

## Alberta Zero Emissions Hydrogen Transit (AZEHT)

- $9.9 million


## H2 Truck Demonstration Road Show

*Dec 2022–Sep 2024*


## $H_2$-Diesel Dual Fuel (co-combustion)

- Multiple Projects

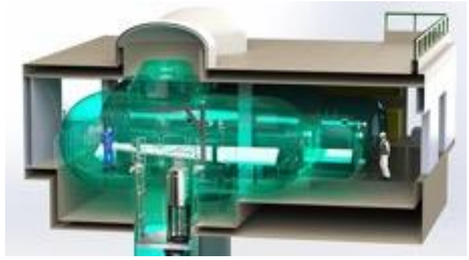
*($10+ million, 10+ Companies)*

- Pilots, technology development, emissions study, demonstrations

# Initiatives with HUB Input

## Hydrogen Technology Testing

- Environmental Chamber
- Legacy pipe material research



Prairies Economic Development Canada | Développement économique Canada pour les Prairies

C-FER Technologies

Emissions Reduction Alberta

## HUB a trusted partner in shaping provincial policy

- Provincial $H_2$ Roadmap
- Clean Hydrogen Centre of Excellence
  - $50 million + $150 million (est.)
- Provincial request for fueling station EOIs


Alberta

Alberta Innovates

Emissions Reduction Alberta

InnoTech Alberta

C-FER Technologies

## Fort Sask. Natural Gas Blending Pilot

- $5.7 million

ATCO

Emissions Reduction Alberta

## CP Hydrogen Locomotive Program

- >$33 million

*Dec 2020–2023*

CP

Emissions Reduction Alberta

## Edmonton International Airport Zero-Emissions Fleets

YEG Edmonton International Airport | Aéroport international d'Edmonton

Toyota

hydra

EXSL Global

Letenda

FE FUEL

# Recently Funded Projects

## The Hydrogen Innovation Accelerator

- $744 k

The Hydrogen Innovation Accelerator

Prairies Economic Development Canada | Développement économique Canada pour les Prairies

MOUNT ROYAL UNIVERSITY 1910

Edmonton Global

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## Bremner Community

- $2 million+
- Feasibility of pure $H_2$ Community

ATCO

QUALICO HELPING BUILD BETTER CITIES™

ALBERTA INNOVATES

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## Aurora Hydrogen

- $2 million+
- Hydrogen Pyrolysis

AURORA HYDROGEN

ALBERTA INNOVATES

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## Ampclad Coatings

- $600 k+
- Pipeline Coatings

AMPCLAD

ALBERTA INNOVATES

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# HUB PROJECTS

AZETEC
ALBERTA ZERO-EMISSION TRUCK ELECTRIFICATION COLLABORATION

**Alberta Zero-Emission Truck Electrification Collaboration**
>$20m, Apr 2023-Aug 2024

AMTA · The Transition Accelerator · Ballard · Freightliner · Emissions Reduction Alberta · Dana

**EVID Demonstration Fueling Station**
Apr 2023-Aug 2024

Natural Resources Canada / Ressources naturelles Canada · HTEC · AMTA · Suncor

AZEHT
ALBERTA ZERO-EMISSION HYDROGEN TRANSIT

**Alberta Zero-Emission Hydrogen Transit**
>$9.9m, Jan 2023-Jan 2025

ETS · Emissions Reduction Alberta · Suncor · Strathcona County · The Transition Accelerator · Calgary Transit

**H2 Truck Demonstration Roadshow**
Dec 2022-Jan 2025

Prairies Economic Development Canada / Développement économique Canada pour les Prairies · Natural Resources Canada / Ressources naturelles Canada · AMTA · The Transition Accelerator

**H2-Diesel Dual Fuel Demonstrations**
>$10m, 10+ Companies
Multiple Projects

Emissions Reduction Alberta · Prairies Economic Development Canada / Développement économique Canada pour les Prairies · The Transition Accelerator · AMTA · EIA Edmonton International Airport · hydra · VEXSL · Cummins · University of Alberta · IFS Innovative Fuel Systems · Foresight Canada · DTI Diesel Tech Industries

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The Transition Accelerator / L'Accélérateur de transition

# PROJECTS CATALYZED BY HUB

## Hydrogen Pipeline Testing*

Prairies Economic Development Canada | Développement économique Canada pour les Prairies

C-FER Technologies

Emissions Reduction Alberta

## CP Hydrogen Locomotive Program*

>$33m, Dec 2020-2023

CP

Emissions Reduction Alberta

## Alberta Hydrogen Roadmap*

~$200m across multiple initiatives, shaping policy in AB


Alberta

Alberta Innovates

Emissions Reduction Alberta

InnoTech Alberta

C-FER Technologies

## Fort Sask. Natural Gas Blending Pilot*

$5.7m

ATCO

Emissions Reduction Alberta

## YEG ZEV Fleets*

YEG Edmonton International Airport | Aéroport international d'Edmonton

hydra

Toyota

Vexsl Global

Letenda

## Air Products Hydrogen Production and Liquefaction Facility

$1.6b

Air Products

Alberta

Natural Resources Canada

## Suncor-ATCO Hydrogen Production Facility

ATCO

Suncor

*project had input from the Hub

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Hydrogen HUB

# Fueling the Hydrogen Transition in the Edmonton Region

# Regional Hydrogen Updates: Panel 1

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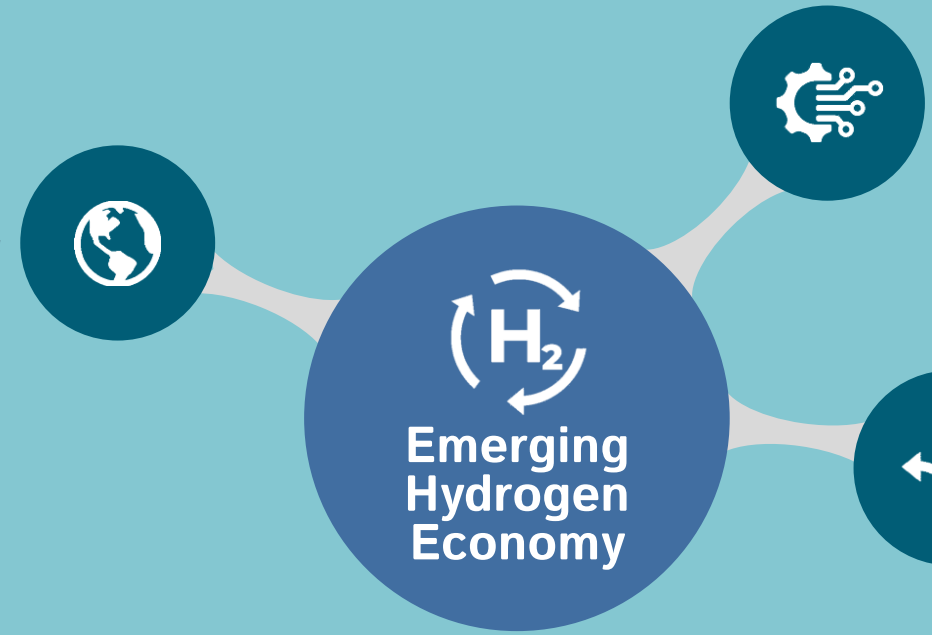
CITY OPERATIONS
Fleet and Facility Services

# State of the Province Hydrogen Luncheon

**Derek Hanson**
Director, Transit Fleet Maintenance
City of Edmonton

October 24, 2023

# Next Steps




## Edmonton Position in H2 Sector

## Evolved Technology in Transit Sector

- Fuel Cell Technology
- Potential to meet program outcomes

## Emissions Reduction Alberta (ERA) Opportunity

- Alberta Zero Emissions Hydrogen Transit Project (AZEHT)

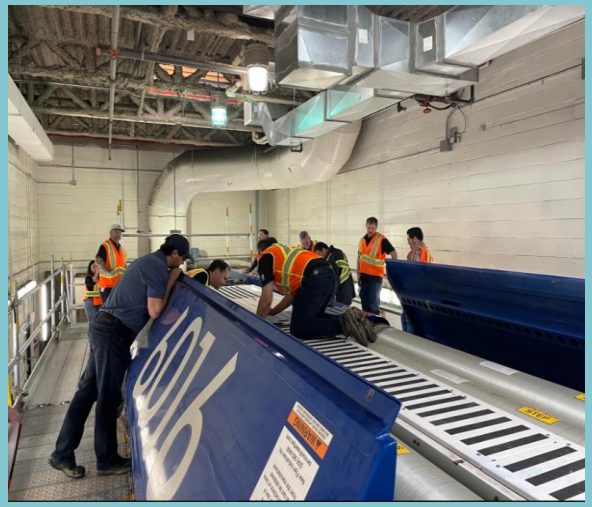
# It Started with a FCEB...


- ➔ Is not prone to mechanical failures and fluid leaks
- ➔ Improvements to energy efficiency
- ➔ Improved fuel economy
- ➔ Fuel cells provide a consistent and reliable on-board power source

Edmonton

# What Edmonton is Doing

Hydrogen Fuelling at Suncor



First H2 Maintenance Bay in Edmonton

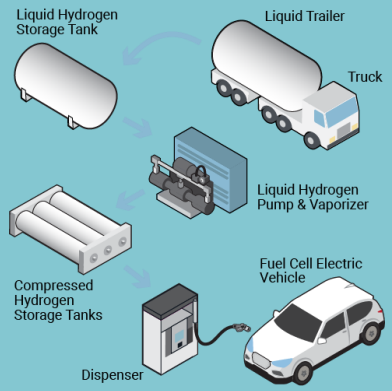

Retrofits on Existing Rolling Stock

# THE APPROACH

1. FUELLING STATION
2. FLEET CONVERSION
3. TRANSIT GARAGE

# On Site Hydrogen: 3 Options

## Liquid Delivery and Cryo Compression:



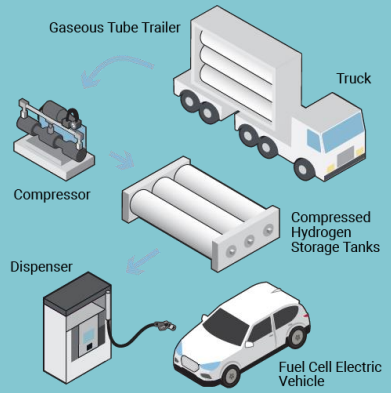

**Pro:**

- H2 production by others
- Eliminate cooling requirements

**Cons**

- Cryo Compression is relatively new
- Cryogenic tanks are still a new technology with an emergent market wide adoption

## Gaseous Delivery and Compression + Cooling:



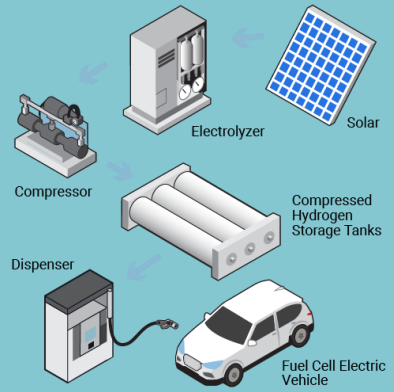

**Pro:**

- H2 production by others
- Well known mature technology

**Cons**

- Delivery challenges >1 metric ton/day

## Onsite Production and Compression + Cooling:




**Pro:**

- H2 on site can be made green
- Well know mature technology
- Lower Operating cost (fuel purchase)

**Cons**

- Higher CAPEX
- Higher Power requireme

# THANK YOU!

Hydrogen Bus Video

# Alberta Zero Emission Hydrogen Transit



## Great collaboration in the perfect test environment

- AZEHT
- Emissions Reduction Alberta
- Alberta Innovates
- Transition Accelerator
- Alberta Motor Transport Association
- City of Edmonton
- Suncor
- Strathcona County

## Lessons learned

- Building codes for storage and service
- Technician training
- Community safety awareness
- Security long-term fuel supply



STRATHCONA COUNTY

# Opportunities for our region's technology, infrastructure, expertise



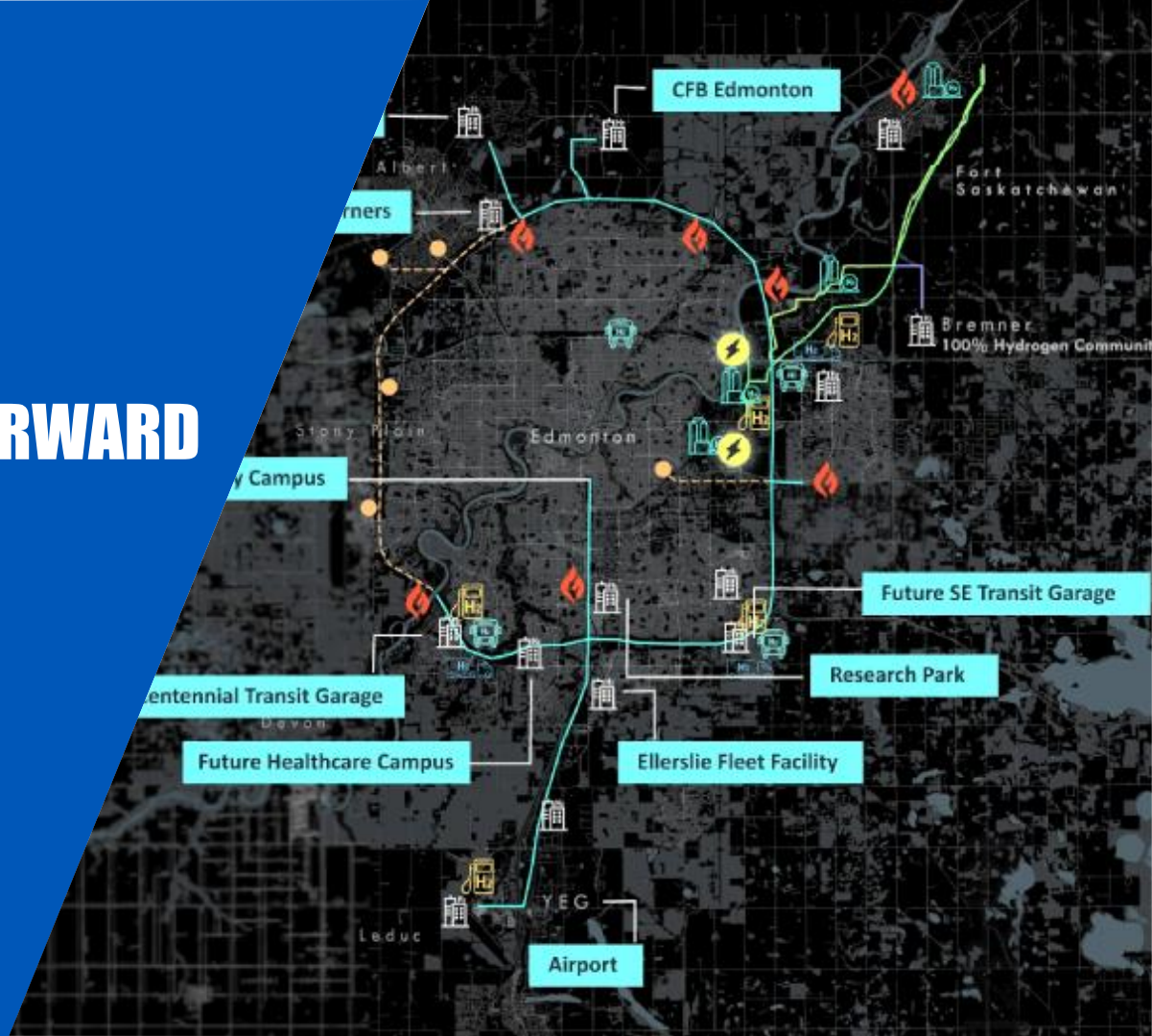




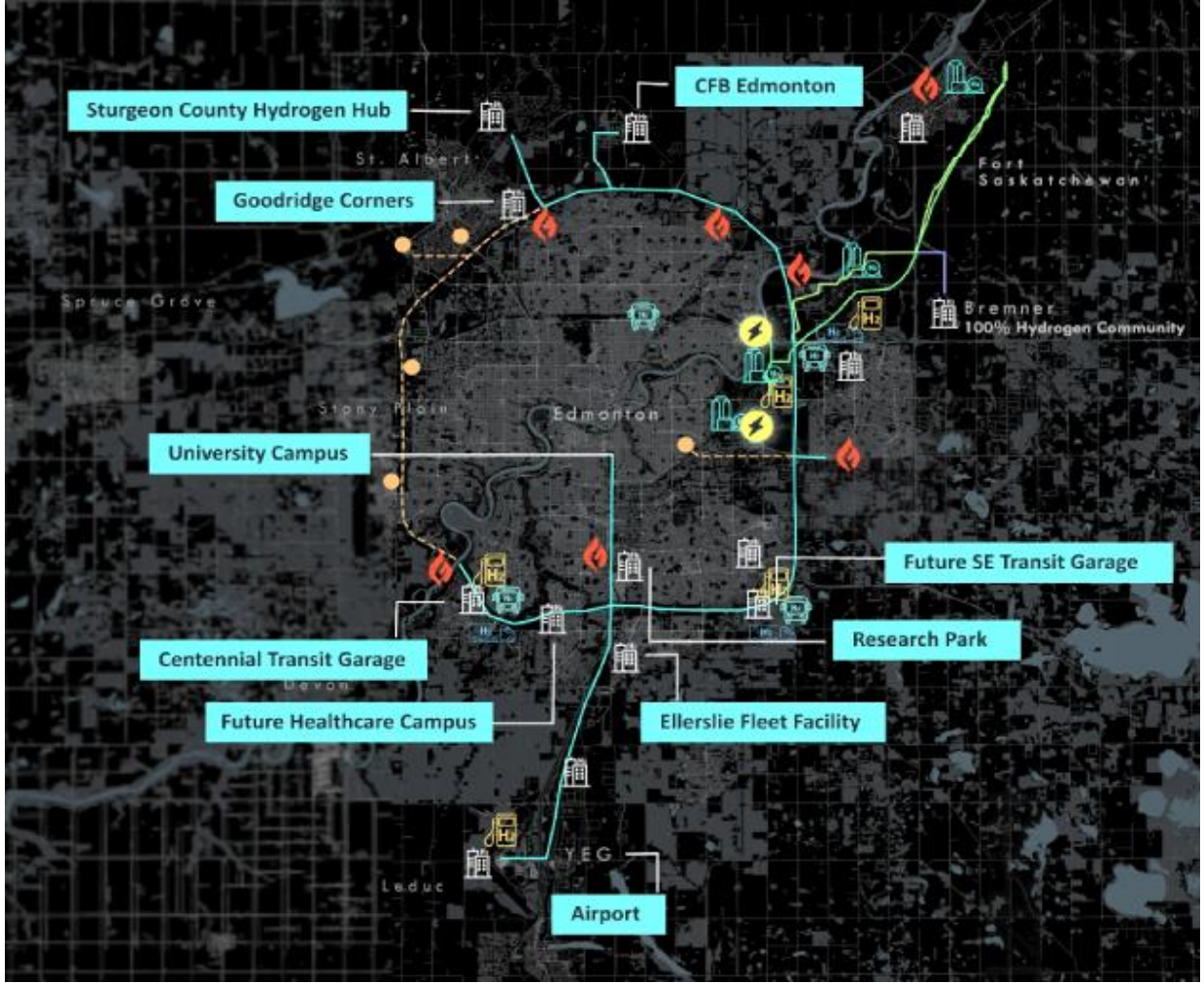

STRATHCONA COUNTY

# MOVING HYDROGEN FORWARD

## October 2023



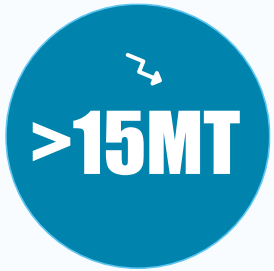
# CAPITAL REGION HYDROGEN OUTLOOK



# ATTRACTING ENERGY INVESTMENT IN A CARBON NEUTRAL FUTURE

**Providing a legislative pathway for regulated hydrogen pipelines will support economic growth.**


**of new pipelines by 2030**




**Avoids ~15MT of CO2e**

**Support job growth in manufacturing, trades, transport sectors** who will support this energy infrastructure

**Edmonton Global estimates**

## 14,000 NEW JOBS

will be created by 2044 in the Capital Region as a result of $H_2$ investments resulting in **a net workforce increase of 56%** when compared to the 2022 regional number of oil and gas workers

**$H_2$ network is a key differentiator; will attract investor capital in low carbon $H_2$ production**

# PROPOSED NEXT STEPS

**Amendments to the Gas Utility Act and the Gas Distribution Act are essential to advancing the Emission Reduction and Energy Development Plan, the Hydrogen Roadmap, and Alberta's emission neutral future.**


**Together, the Government of Alberta and ATCO can be global leaders in hydrogen production**, creating economic opportunities and prosperity in our province and responsibly supplying low carbon energy to the world. A $H_2$ market will create long-term demand for our abundant supply of natural gas and the jobs that come with it ensuring energy workers and infrastructure won't be abandoned.

ATCO™

# THANK YOU

HYDROGEN – THE NATURAL NEXT STEP

# Regional Hydrogen Updates: Panel 2

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Hydrogen HUB

**$40M+**
IN DIRECT PROJECTS

**$3B**
IN CATALYZED INVESTMENTS


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EDMONTON REGION Hydrogen HUB

# The Hub has touched almost every application

TRUCKS

PIPELINES

EXPORT

RAIL

INDUSTRIAL & CHEMICAL

BUILDING HEAT & POWER

MUNICIPAL FLEETS

ELECTRICITY

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# Activating the hydrogen trucking value chain

- Assessing the Hydrogen Value Chain for Heavy Trucking
- Integrated Vehicle Business Case Analysis
- Hydrogen for Municipal Fleets
- Western Canadian Trucking Corridors and Hydrogen Hubs
- Pipeline-Fed Hydrogen for Building Heat & Power
- Hydrogen for Trucking in the Cement & Concrete Industry
- Advancing Clean Fuels in Heavy Trucking Course

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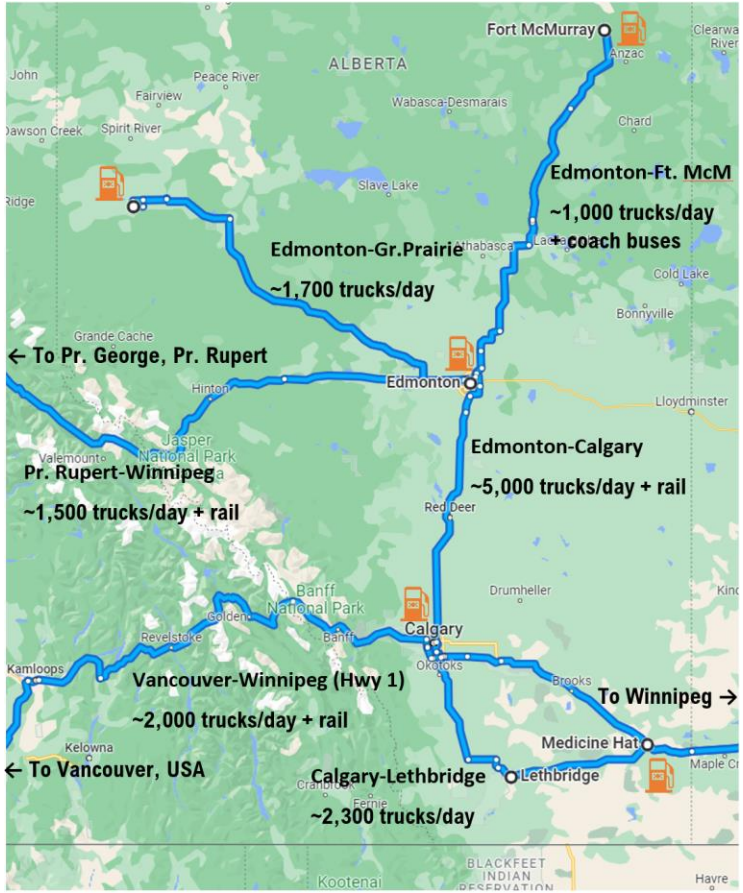
# Launching Workshop Series:

## Developing a Viable Business Case for Heavy-Duty Hydrogen Truck Fleets

- Working with AMTA and AB's fleets
- Key step to move past pilot projects: Launching economically viable trucking corridors
- Establish conditions for investment to flow
- Consideration of full value chain
- Total cost of ownership of Class 8 trucks
- Cost of distribution, pipelines + permanent, semi-permanent, and mobile fueling infrastructure
- Stock and flow of Class 8 trucks

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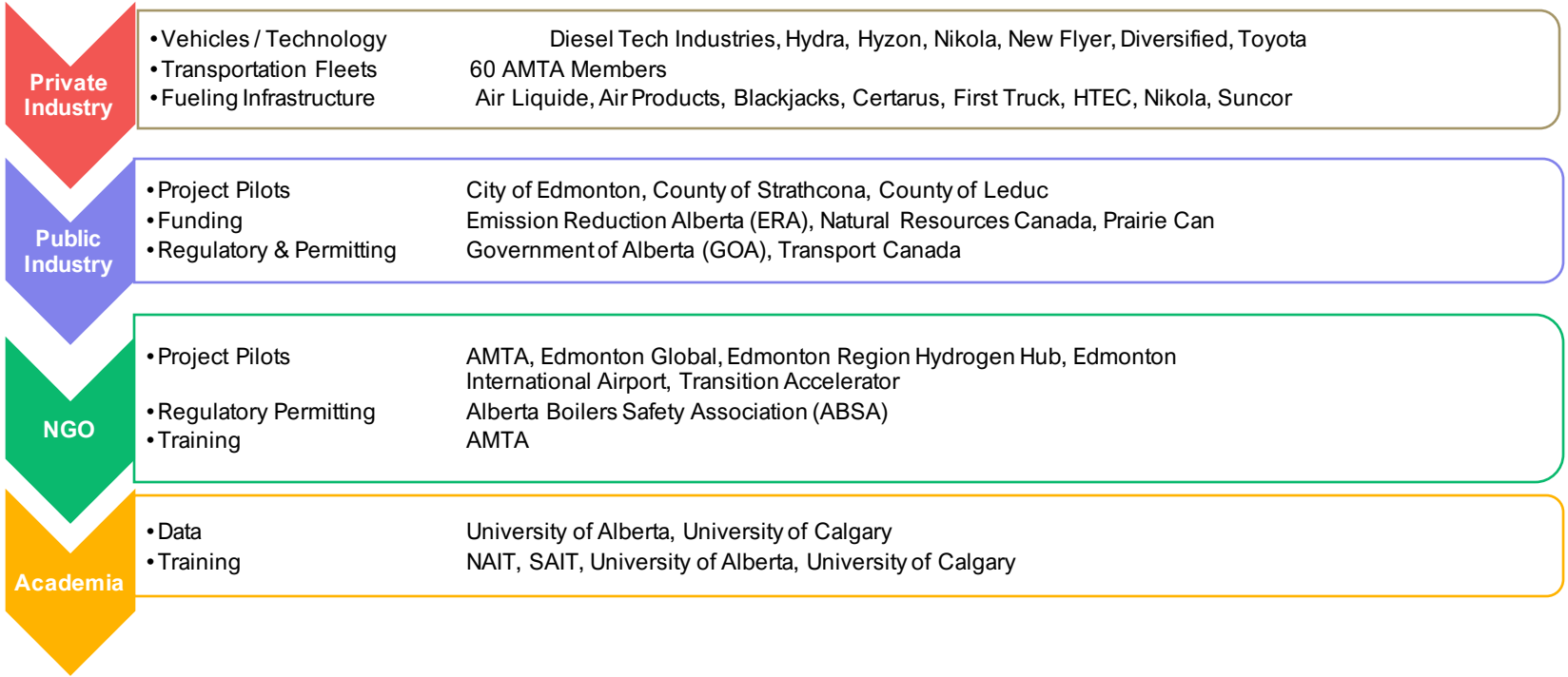
# Collaborations leading the way

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AMTA Alberta Motor Transport Association

# HYDROGEN VEHICLES






EDMONTON REGION Hydrogen HUB

# VEHICLE SHOWCASES and RIDE & DRIVES

# CARRIER TRIALS




# HYDROGEN FUELING


# CONGRATULATIONS

AMTA Alberta Motor Transport Association



EDMONTON REGION Hydrogen HUB

EMISSIONS REDUCTION ALBERTA

STRATHCONA COUNTY

Edmonton

SUNCOR

HTEC Hydrogen Technology & Energy Corporation

AMTA

Government of Canada

The Transition Accelerator