



Update on Hydrogen in Strathcona County

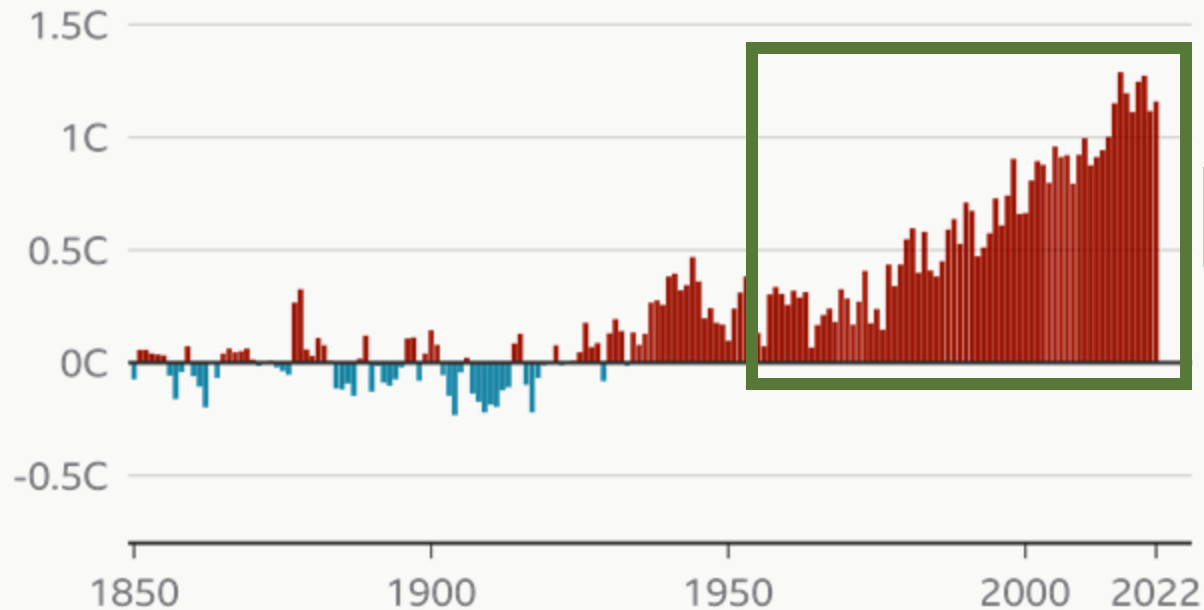
June 18, 2024



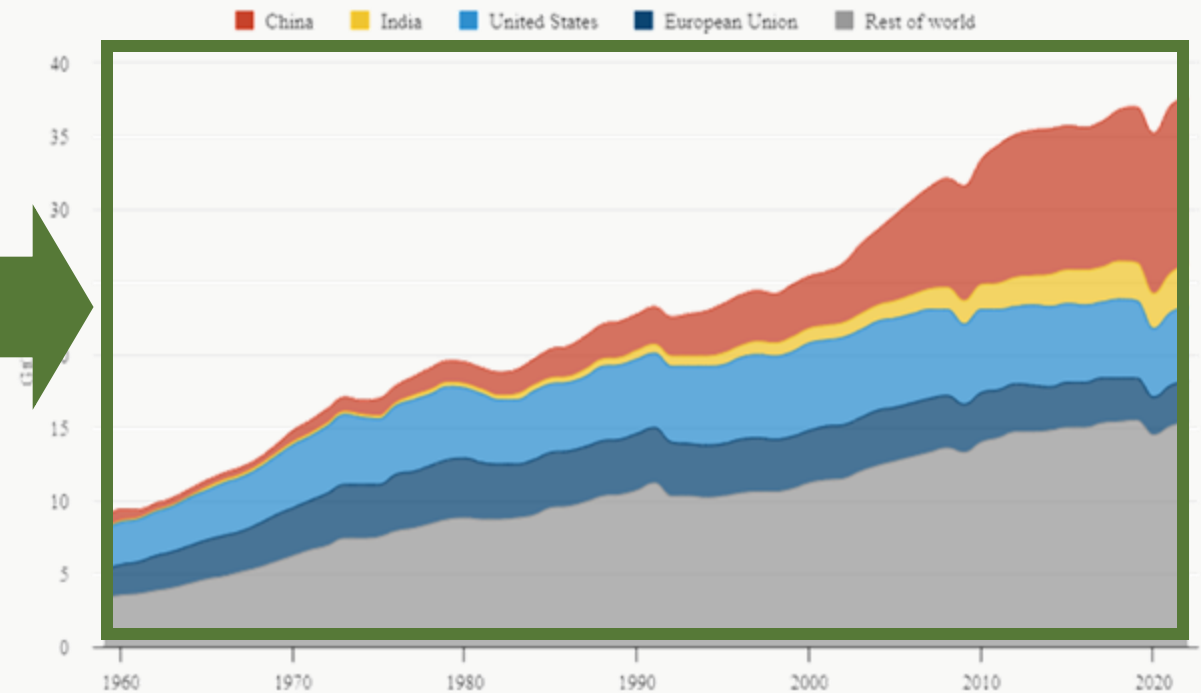
Troubling Trends

The world has been getting warmer

Change in annual average global temperature from pre-industrial levels (1850-1900) in degrees C



Global CO2 Emissions from Fossil Fuels



Canada's share: < 2% of global emissions

The Hydrogen Opportunity



Attract new investment to Strathcona County that can reduce net global emissions

“Alberta has all the key ingredients of a 21st century energy superpower. To seize the opportunity, it needs a strategic approach to unlocking its tremendous ability to produce energy for a rapidly decarbonizing world.... Now is the time to maximize Alberta’s ability to attract low-carbon investment.”

- Bentley Allan, Research Director at The Transition Accelerator

Three Pillars of Decarbonization

**Take carbon
out of fuel**
(low-carbon fuels)

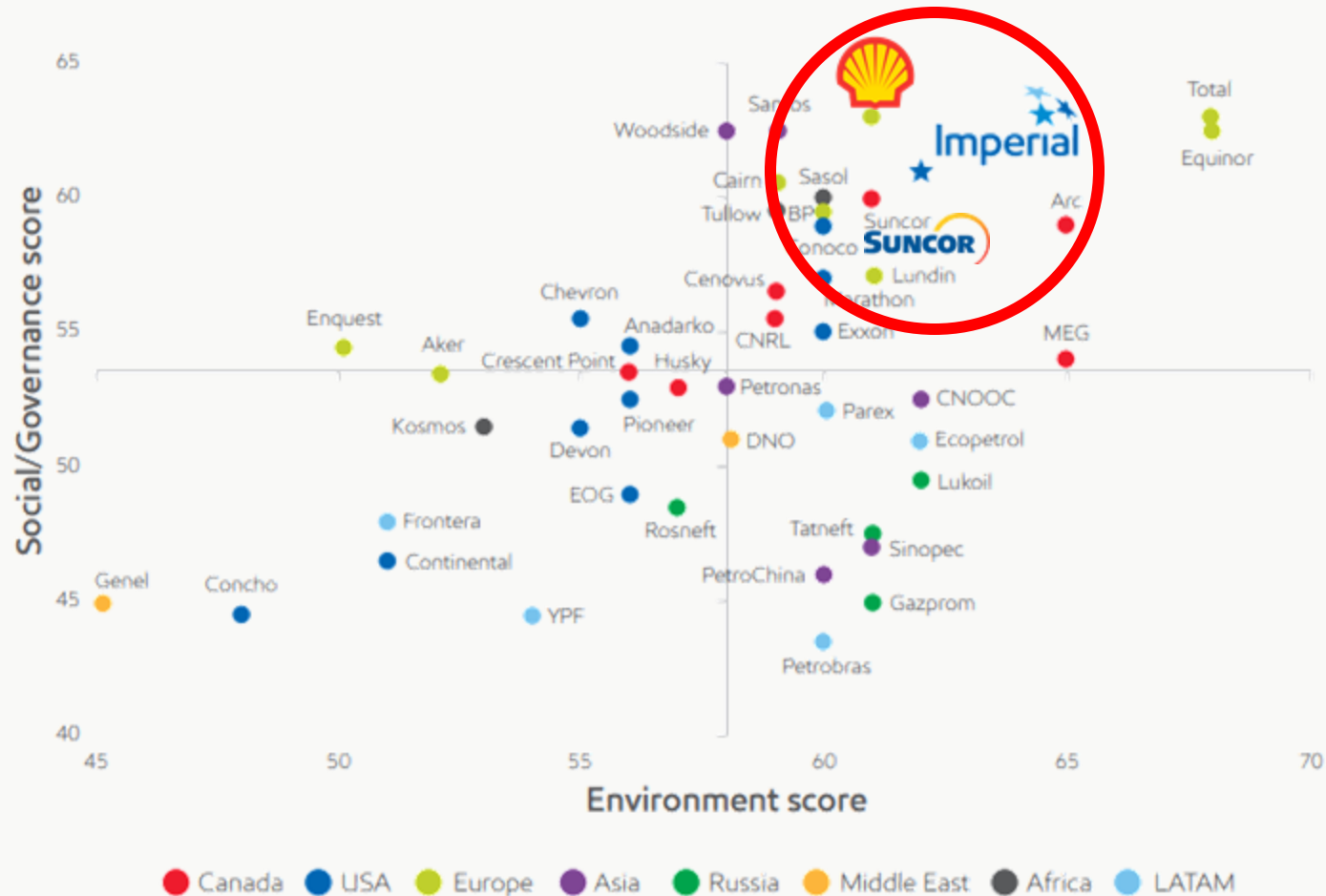
**Take carbon
out of air**
(carbon capture/storage)

**Reduce
energy use**
(increase efficiency)



70% of all carbon in the fuel supply chain comes from combustion of end products

Environmental and Social Impacts



Strathcona's three refiners are leaders in global ESG rankings (environmental, social, and governance)

Corporate GHG reduction targets

Imperial: net-zero by 2050

Suncor: net-zero by 2050

Shell: net-zero by 2050

Source: BMO Capital Markets, Bloomberg CSRHub – database of CSR rankings of companies representing 90 percent of world's market cap.

Local Benefits

Direct Jobs

- Each new major facility represents, on average:
 - Thousands of construction jobs
 - Hundreds of new full-time jobs
 - Endless local procurement opportunities

Economic Impacts

- Indirect and induced local jobs
- New tax revenues = improved municipal services

Community Investment

- Shell's Fuelling Kindness
- Imperial's United Way partnership
- Suncor's Linking Generations program
- Donations and sponsorships from across industry
- Volunteer hours and charitable support



Why hydrogen?

Hydrogen, H₂, atomic number 1



Ideal chemical carrier for clean energy

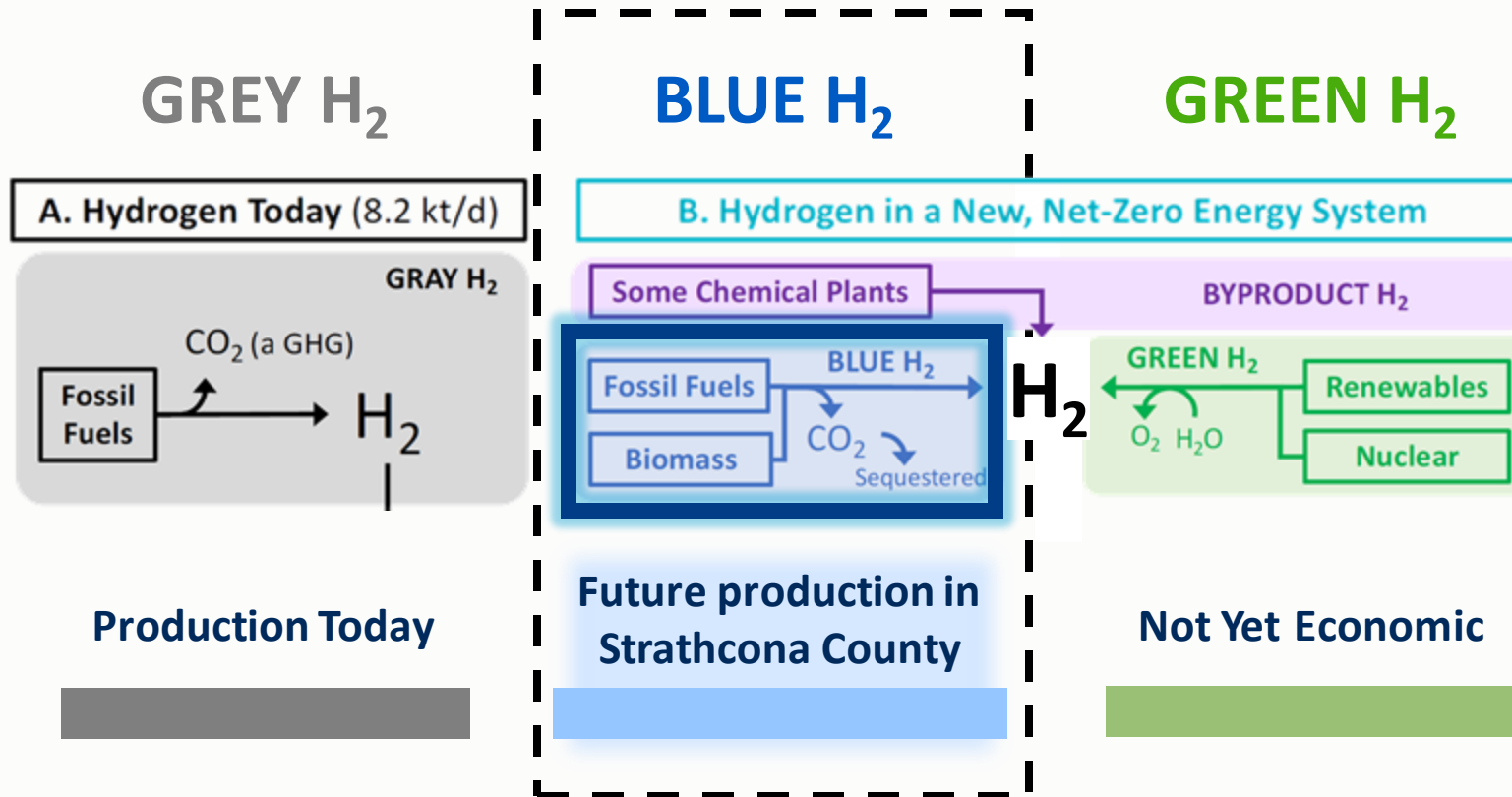
Zero-emissions combustion

Low-carbon electricity generation

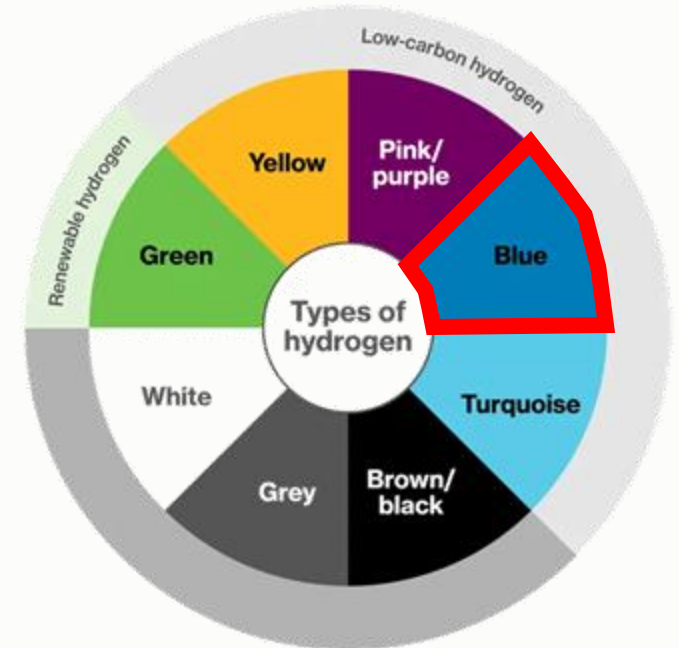
Replacement fuel source for coal power plants

Complements production of bio-based fuels

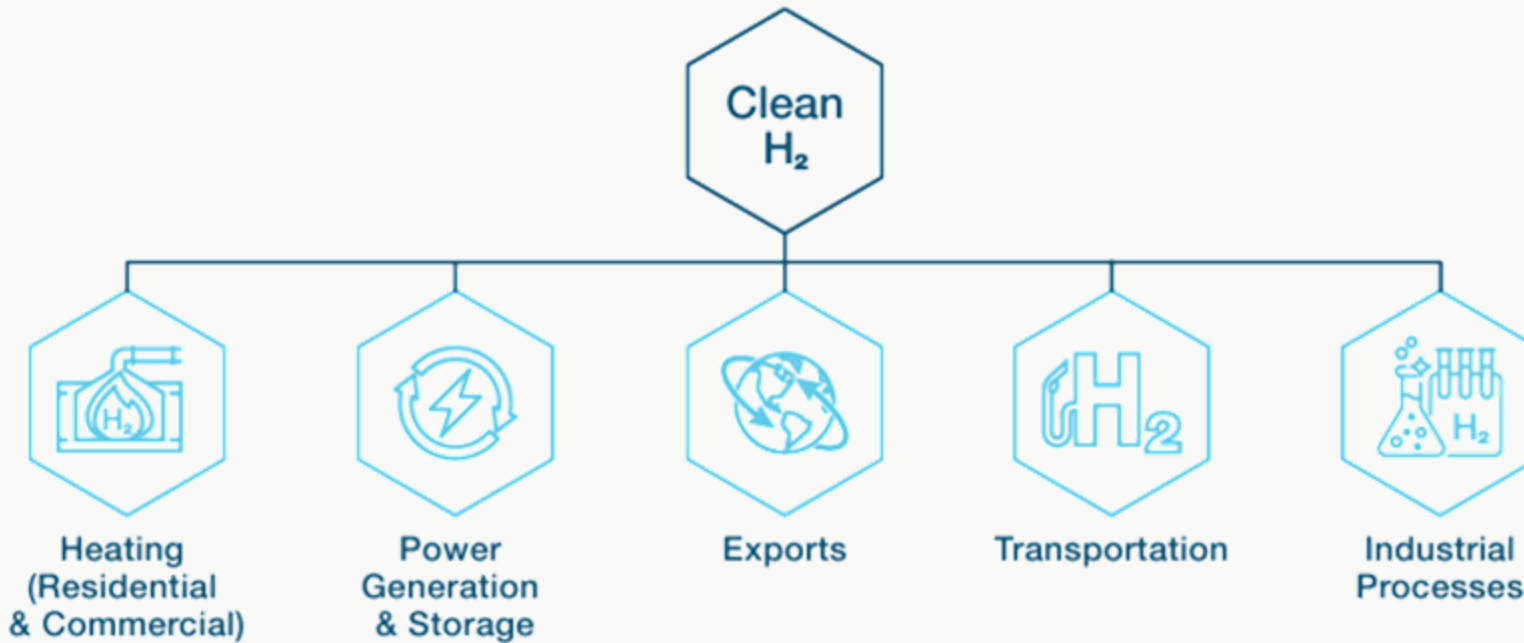
Types of Hydrogen



Colors vs. Carbon Intensity (CI)



Hydrogen in Alberta



Hydrogen is currently produced in most of the world through the **processing of natural gas**

In Alberta, hydrogen is primarily used for industrial processes like cracking bitumen to manufacture end products such as **gasoline, diesel, jet fuel, plastics, asphalt, and fertilizer**

Alberta is positioned to be one of the **lowest cost hydrogen** producers on the planet

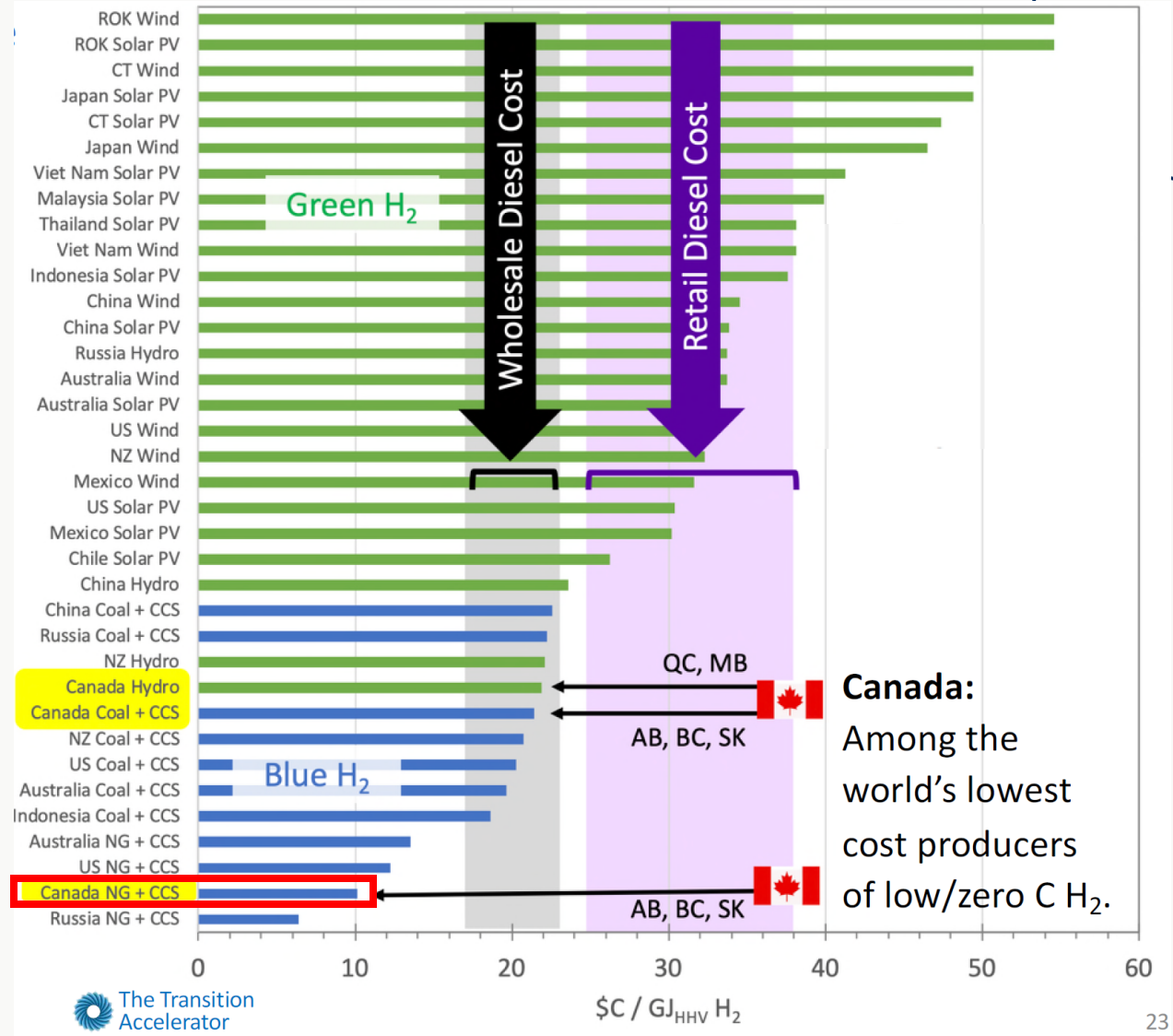
The Opportunity

Abundant Low-Cost Feedstock

Production Costs

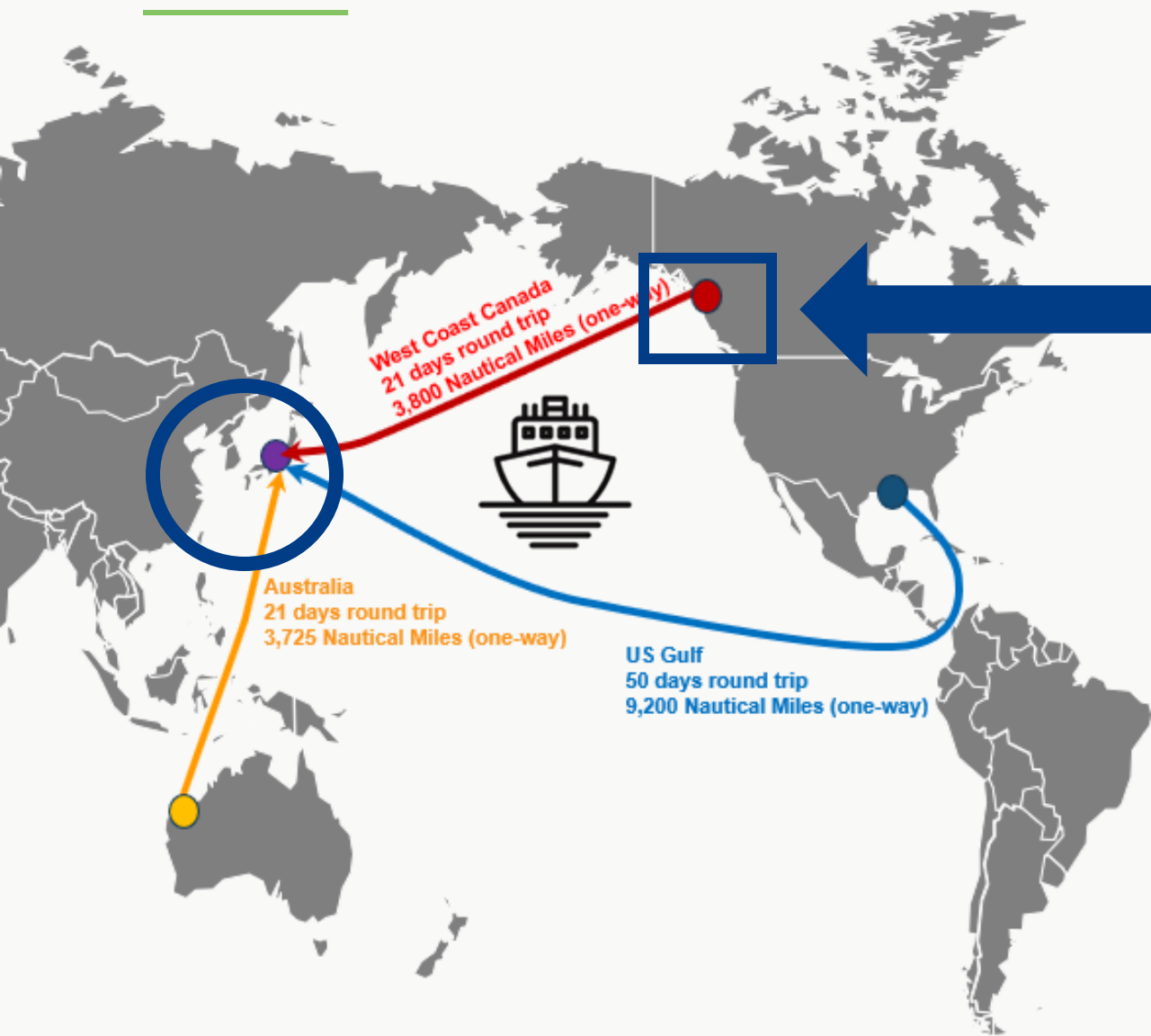
AB blue hydrogen:	\$10/GJ
CA green hydrogen:	\$22/GJ
Wholesale diesel:	\$17-23/GJ
Retail diesel:	\$25-38/GJ

The Alberta price advantage



Canada:
Among the world's lowest cost producers of low/zero C H₂.

Market Access



Economic and Environmental Opportunity



350,000
HYDROGEN
SECTOR JOBS



\$50 BILLION
IN DOMESTIC
REVENUE



PART OF AN
\$11 TRILLION
GLOBAL
OPPORTUNITY



UP TO 30% OF
CANADA'S
ENERGY MIX
BY 2050



REDUCE CO₂
EMISSIONS IN
HEAVY-
EMITTING
INDUSTRIES

The Edmonton region is the epicentre of Canada's hydrogen economy



Abundant low-cost feedstock



International collaboration



Strong energy sector



Access to export markets



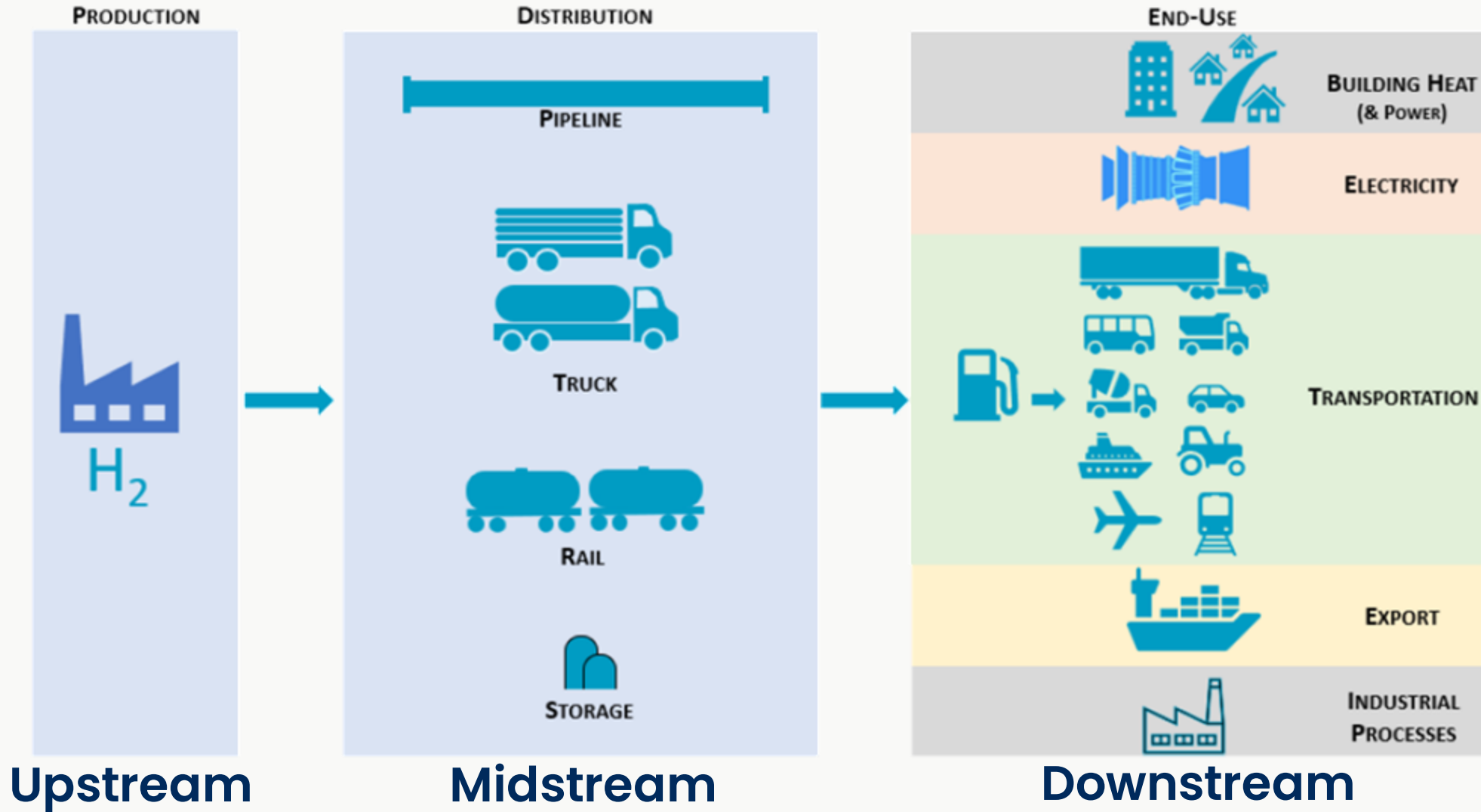
Clean energy innovations

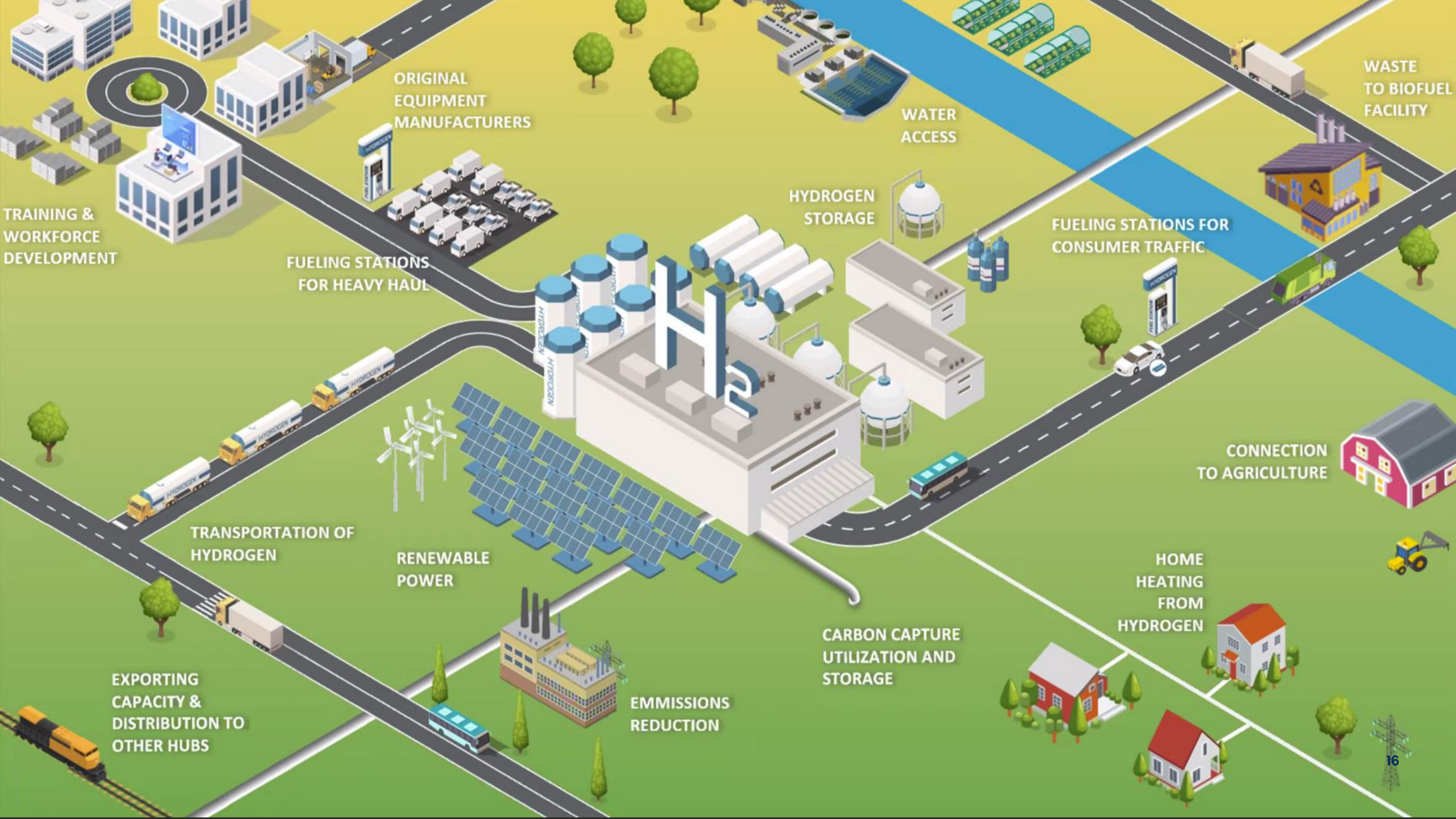


Experience in deployment



Hydrogen Value Chain





ORIGINAL
EQUIPMENT
MANUFACTURERS

WATER
ACCESS

WASTE
TO BIOFUEL
FACILITY

TRAINING &
WORKFORCE
DEVELOPMENT

FUELING STATIONS
FOR HEAVY HAUL

HYDROGEN
STORAGE

FUELING STATIONS FOR
CONSUMER TRAFFIC

CONNECTION
TO AGRICULTURE

TRANSPORTATION OF
HYDROGEN

RENEWABLE
POWER

HOME
HEATING
FROM
HYDROGEN

EXPORTING
CAPACITY &
DISTRIBUTION TO
OTHER HUBS

EMMISSIONS
REDUCTION

CARBON CAPTURE
UTILIZATION AND
STORAGE

Global scale

**Production
Investment
Exports**

Strathcona: through the petrochemical lens

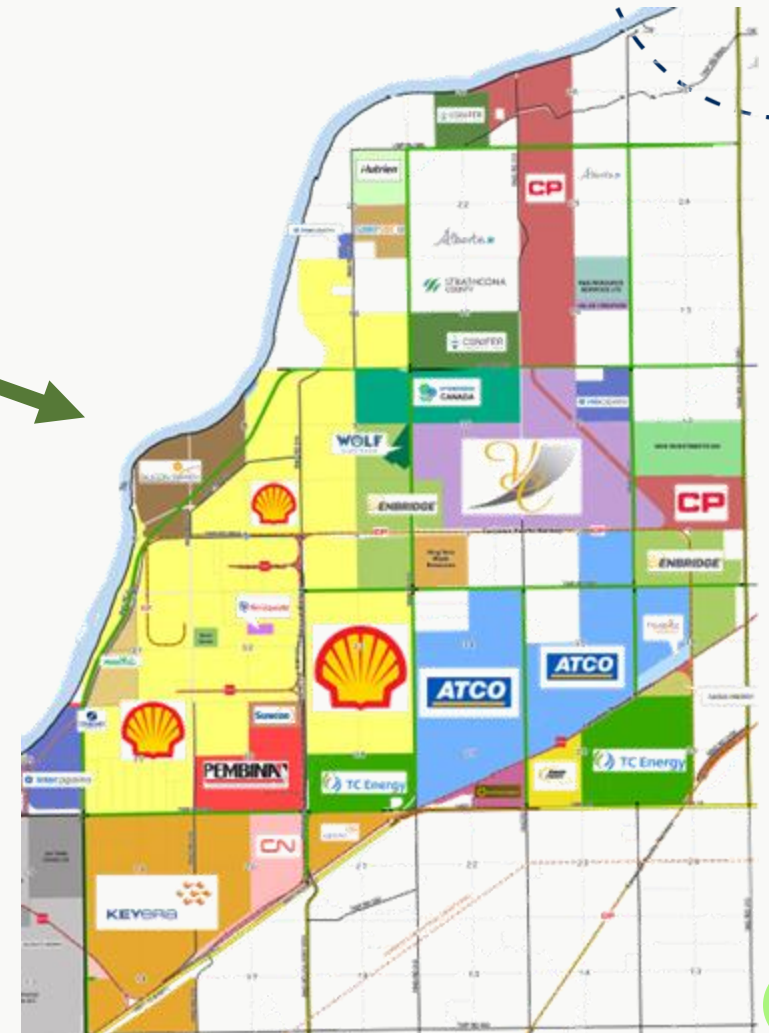
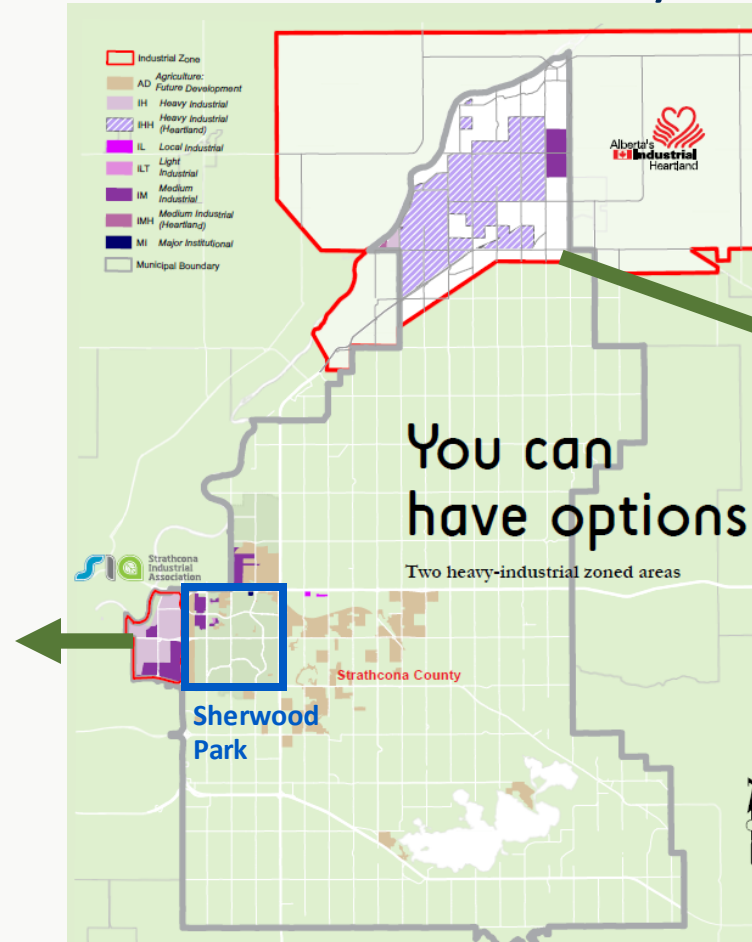
- Existing cluster of world scale petrochemical facilities and supply chain
- Robust developed infrastructure (roads, utilities, pipeline network)
- Abundant cost-advantaged oil & gas feedstocks
- Ideal geology for carbon sequestration
- Access to export markets
- Immediate proximity to specialized labour pool and research/training institutions



Location, Location... LOCATION



Strathcona County



Strathcona County Refining Capacity

Annual production in approx. barrels per day (bpd)

Imperial: 200,000 bpd

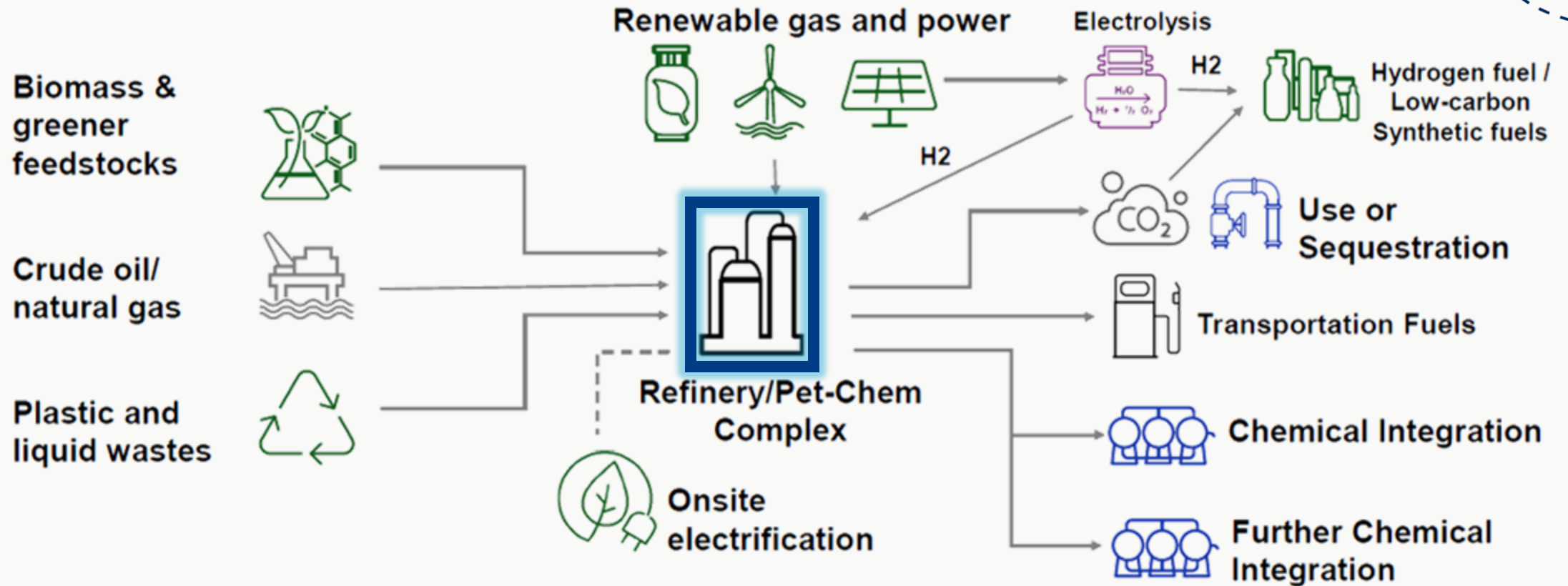
Suncor: 146,000 bpd

Shell: 114,000 bpd

~2/3 of all Western Canadian refining takes place in Strathcona County!



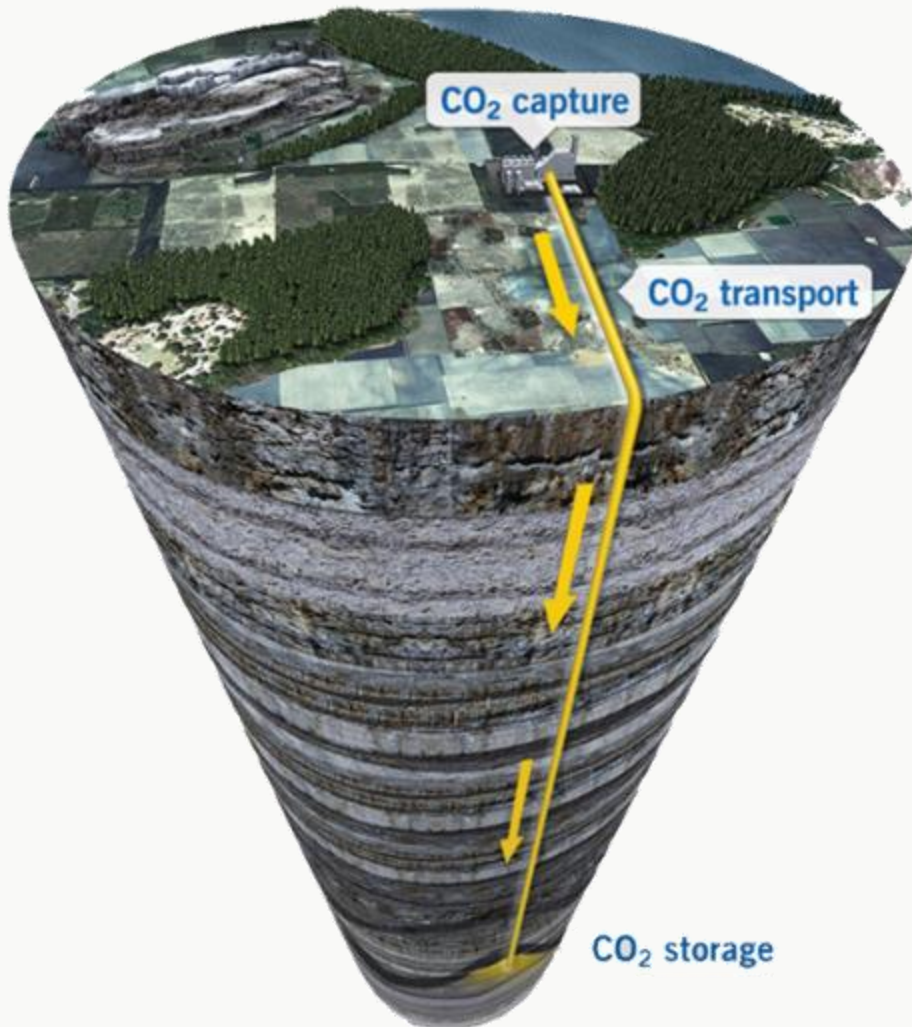
Pathways to Net Zero



Notes: H₂ = hydrogen, list of options shown non exhaustive
Source: S&P Global Commodity Insights

Carbon Capture & Storage

Carbon Capture, Utilization and Storage (CCUS)



The Alberta Carbon Trunk Line (ACTL)

240km pipeline running from Alberta's Industrial Heartland to Central Alberta

Capable of transporting up to 14.6 million tonnes of CO₂ annually (initially ~2 million)

Used for enhanced oilfield recovery (EOR) and permanent storage of CO₂



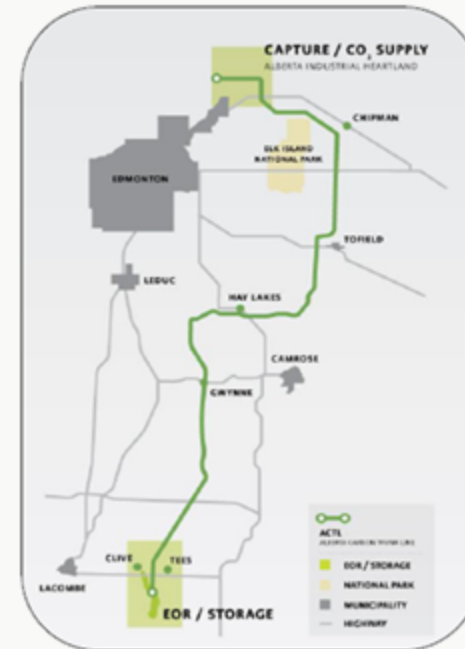
Existing CO₂ and CCUS Infrastructure

Alberta's Industrial Heartland is home to ~10% of the large-scale carbon capture storage/utilization projects operating in the world



Quest Carbon Capture and Storage

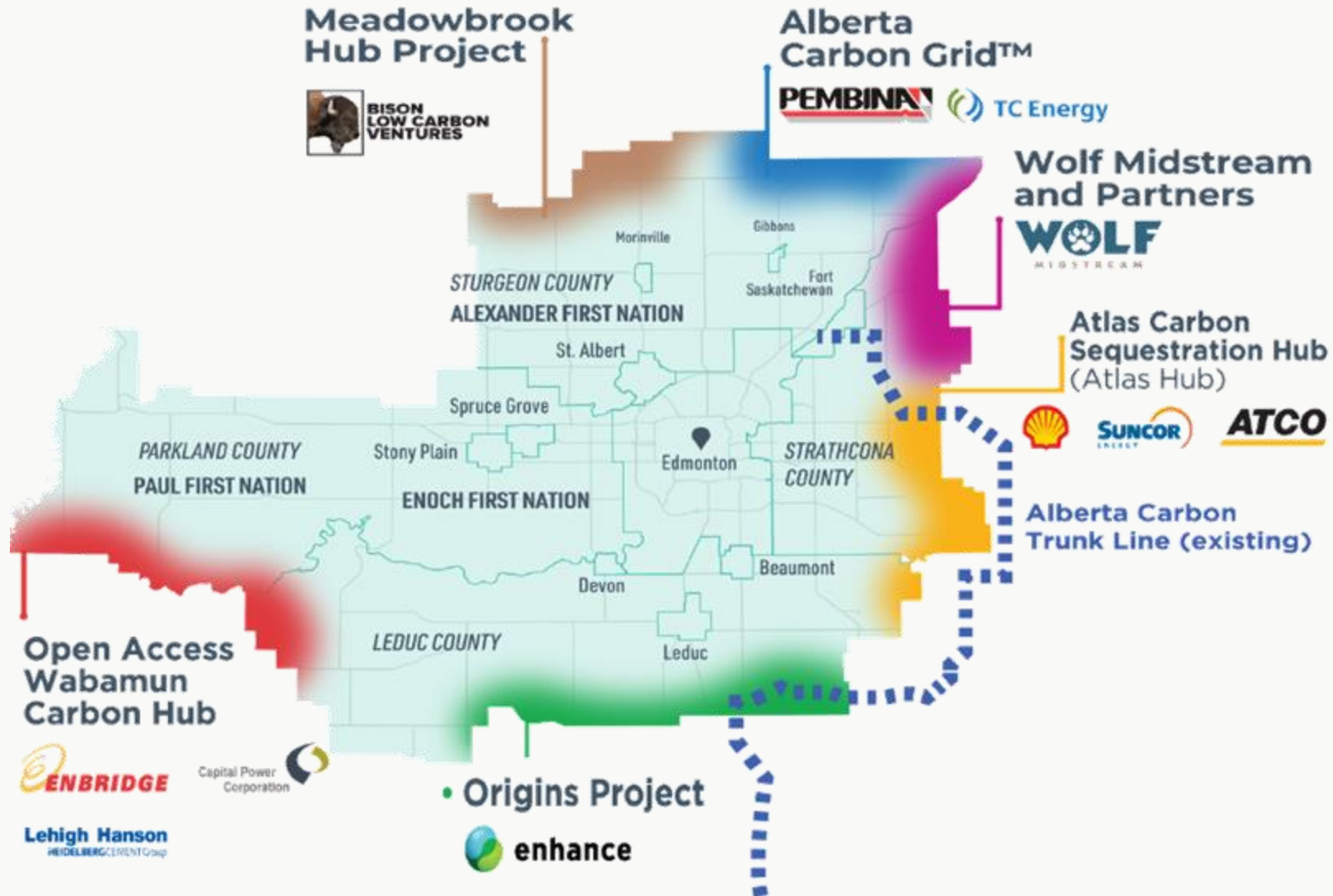
- A world-class capture project designed to capture and store over 1 million tonnes of CO₂ per year
- Quest began operations in 2015 and, to date, has captured and stored more than 9 million tonnes of CO₂
- Quest is owned by the Athabasca Oil Sands Project (70% CNRL, 20% Chevron, 10% Shell) and operated by Shell Canada



Alberta Carbon Trunkline

- Alberta's first large-scale carbon capture utilization and storage project
- Consists of a 240-kilometre pipeline collecting and transporting up to 14.6 million tonnes per year of CO₂ for enhanced oil recovery and storage
- Developed as a partnership between Wolf Carbon Solutions (Wolf), Enhance Energy, Nutrien, and NWR

New Edmonton Region CCS Infrastructure



Hydrogen production: in the news

MITSUBISHI CORPORATION AND SHELL SIGN MOU TO COLLABORATE ON HYDROGEN PLANS IN ALBERTA

Mitsubishi Corporation (MC) and Shell Canada Products, by its managing partner, Shell Canada Limited (Shell Canada) have signed a Memorandum of Understanding relating to the production of low-carbon hydrogen through the use of carbon capture and storage (CCS) near Edmonton, Canada.

The Sherwood Park and Strathcona County News: "Shell and Silicon Ranch to build \$100M solar farm at Scotford"

November 12, 2021



and storage

The Sherwood Park... DATE ON

INTER PIPELINE ASSESSING BLUE AMMONIA & BLUE METHANOL PROJECTS

May 11, 2022



SUNCOR AND ATCO PARTNER ON A POTENTIAL WORLD-SCALE CLEAN HYDROGEN PROJECT IN ALBERTA

- Our ATCO/Suncor decision to collaborate on this potential project follows welcome messages of support from both the Government of Canada and the Government of Alberta for emission-reduction projects and infrastructure. Such collaboration between governments and business and across sectors will be critical to progressing this project and achieving Canada's net zero by 2050 goals.

[View all news](#)

Imperial Approves \$720 million for Largest Renewable Diesel Facility in Canada

January 26, 2023

- Facility expected to produce more than 1 billion litres per year, or 20,000 barrels per day, of renewable diesel
- Renewable diesel has potential to reduce annual greenhouse emissions by about 3 million tonnes compared to conventional fuels

SHELL PROPOSES LARGE-SCALE CCS FACILITY IN ALBERTA

Jul. 13, 2021

Calgary – Today, Shell announced a proposal to build a large-scale carbon capture and storage (CCS) project at its Scotford Complex near Edmonton. This would be a key step in transforming Scotford into one of five energy and chemicals parks for Shell around the world, providing customers with lower-carbon fuels and products into the future, such as hydrogen.

January 26, 2023

- Facility expected to produce more than 1 billion litres per year, or 20,000 barrels per day, of renewable diesel
- Renewable diesel has potential to reduce annual greenhouse emissions by about 3 million tonnes compared to conventional diesel

SHELL PROPOSED

Dow announces plan to build world's first net-zero carbon emissions ethylene and derivatives complex

10/06/2021

- Organic, brownfield investment would more than triple Dow's ethylene and polyethylene capacity from its Fort Saskatchewan, Alberta site while retrofitting the entire site to net-zero scope 1 and 2 carbon dioxide emissions
- Decarbonizes ~20% of Dow's global ethylene capacity while growing polyethylene supply by ~15% and supporting ~\$1 billion of EBITDA growth by 2030
- Project builds on success of Dow's industry-leading TX-9 investment and is expected to deliver ~15% lower capital intensity vs. TX-9 cracker and derivatives
- Fort Saskatchewan site selected due to availability of carbon capture infrastructure, competitive feedstocks and attractive government partnerships
- Investment will advance Dow's commitments to reduce carbon emissions, reaching ~30% by 2030, on the path to carbon neutrality by 2050

- Facility expected to produce more than 1 billion litres per year, or 20,000 barrels per day, of renewable diesel
- Renewable diesel has potential to reduce annual greenhouse emissions by about 3 million tonnes compared to conventional diesel

SHELL PRO

Dow announces

10/06/2021

- Organic, brownfield invest
- Decarbonizes ~20% of Dow's
- Project builds on success of Dow's in
- Fort Saskatchewan site selected due to availability
- Investment will advance Dow's commitments to reduce carbon

- Facility expected to produce more than 1 billion litres per
- Renewable diesel has potential to reduce annual greenhouse emissions


NEWS PROVIDED BY
Hydrogen Canada Corp. →
27 Oct, 2023, 12:00 ET

Hydrogen Canada Corp. Announces World Scale Blue Hydrogen/Ammonia Facility with Product Bound for South Korea

ethylene and derivatives complex

site to net-zero scope 1 and 2 carbon dioxide

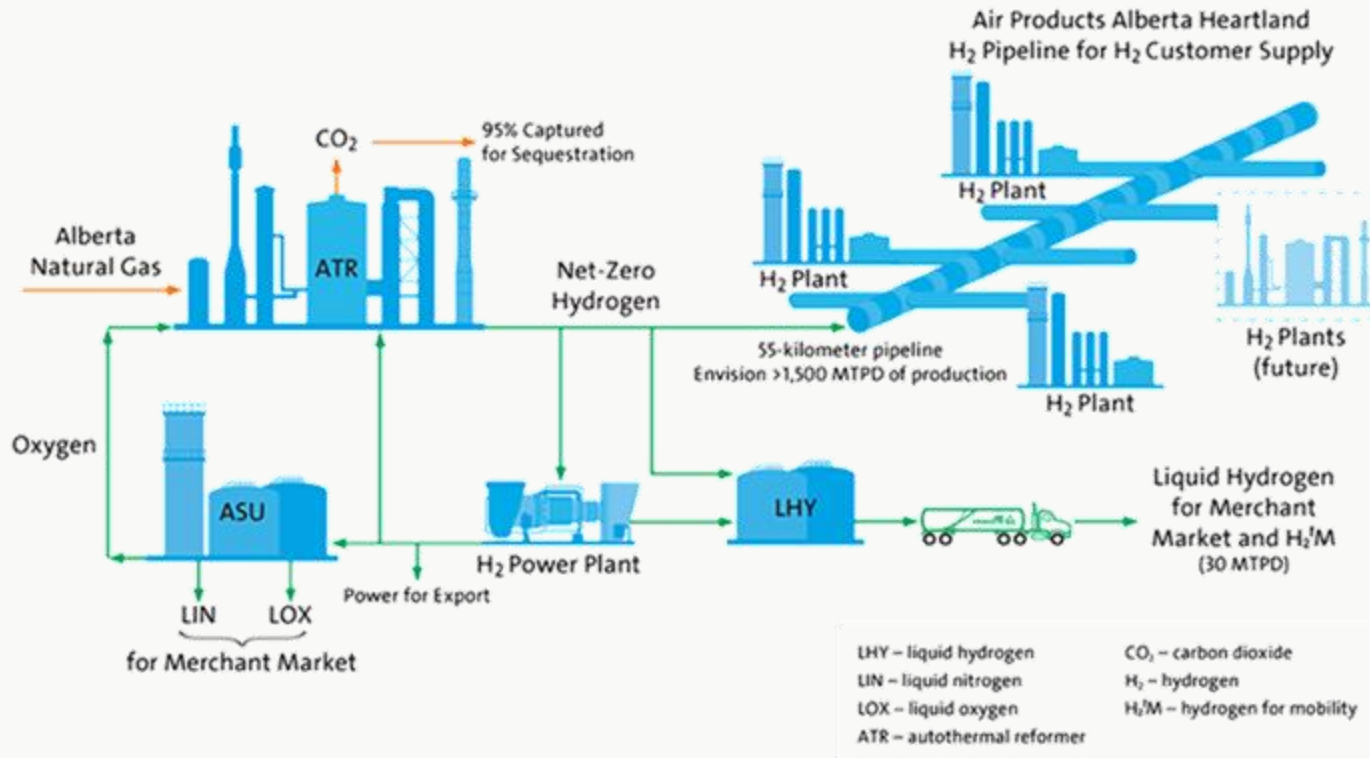
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Announced and Upcoming Hydrogen Projects

Project	Estimated Values	Location	Status
Air Products Net-Zero Hydrogen Complex	\$1.6 Billion	Edmonton	Confirmed
Dow Net-Zero Ethylene Derivatives Complex	\$11.5 Billion	Fort Saskatchewan	Confirmed
Pembina & Marubeni Ammonia Project	\$1 to \$3 Billion	Sturgeon County	FID unknown
Imperial Renewable Diesel Complex	\$720 Million	Strathcona County	Confirmed
Gasia Energy DRU (Diluent Recovery Unit)	Unknown	Strathcona County	FID 2024
Shell Atlas and Polaris Carbon Capture & Storage	Unknown	Strathcona County	FID 2024
Mitsubishi & Shell Blue Hydrogen Facility	\$1 to \$3 Billion	Strathcona County	FID unknown
ATCO Heartland Hydrogen Hub	\$1 to \$3 Billion	Strathcona County	FID 2024
Inter Pipeline Blue Ammonia Facility	\$1 to \$3 Billion	<i>Not yet determined</i>	FID 2024
Hydrogen Canada Ammonia Facility	\$1 to \$3 Billion	Strathcona County	FID unknown
Confidential Hydrogen Project	\$1 to \$3 Billion	<i>Not yet determined</i>	FID unknown
Keyera Petrochemicals & Energy Park	Unknown	Strathcona County	FID unknown

Air Products' Hydrogen Energy Complex



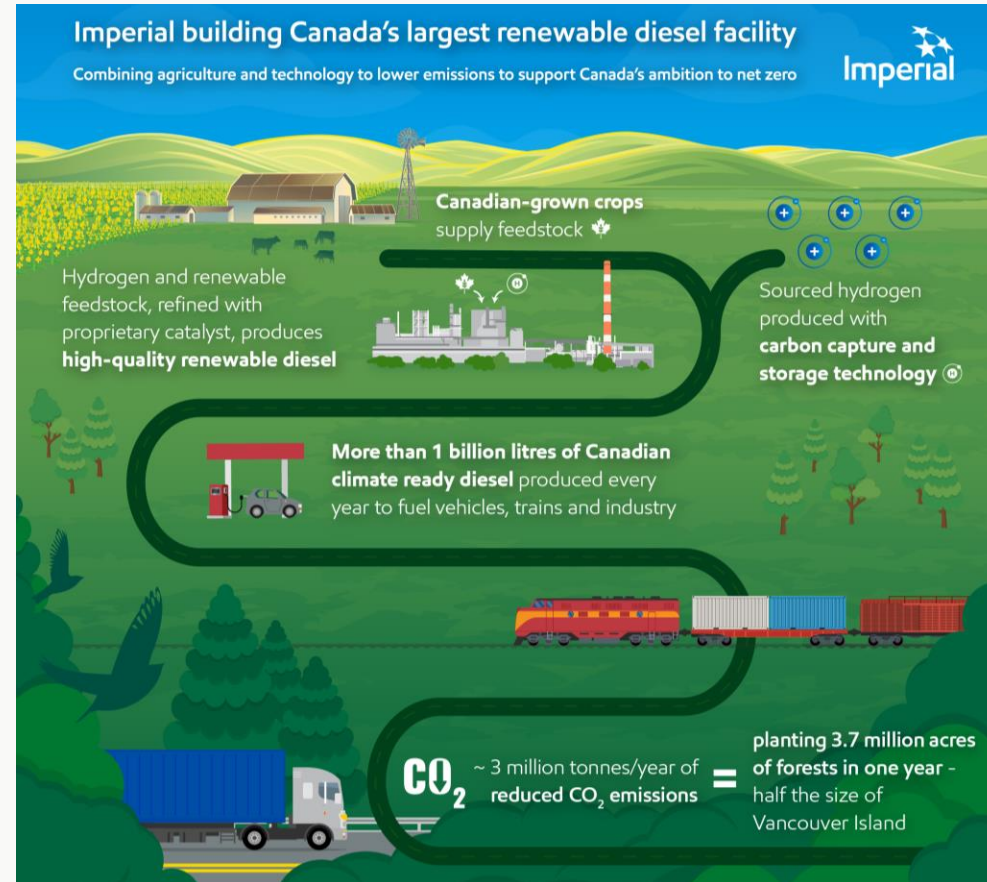
Facility Facts

- Production and liquefaction of hydrogen
- 165 million cfpd on start-up
- Location: Edmonton (Strathcona adjacent)
- Capex: \$1.6 Billion (Under Construction)
- Jobs: +2,500 construction
- Will utilize ATR technology to convert natural gas to blue hydrogen
- Will supply Imperial's renewable diesel project

Imperial Renewable Diesel Facility

Facility Facts

- Production of renewable biodiesel
- Feedstocks: hydrogen, local crops
- Location: Imperial's Strathcona Refinery
- Capex: \$720 Million (Under Construction)
- Jobs: +600 construction
- Expected to reduce CO₂ emissions by ~3 million tonnes/year
- Equivalent to eliminating emissions from 365,000 vehicles/year



ATCO Heartland Hydrogen Hub



Facility Facts

- Production: +300,000 tonnes/year of hydrogen
- Location: ATCO's Heartland Energy Centre in Strathcona County's Heartland area
- Expected capacity to capture and store between 6 to 10 million tonnes/year of CO₂ emissions
- Will reduce overall emissions in Alberta's natural gas grid (community heating and power)

Shell Scotford CCS and CO₂ Storage Hub Expansion

QUEST CCS

Quest CCS captures and stores 1 million tonnes/yr CO₂ storage for the AOSP upgrader. Quest has captured more CO₂ than planned for less cost than anticipated.

ATLAS CARBON STORAGE HUB

Shell is proposing Atlas Carbon Storage Hub to capture about 750,000 to 850,000 tonnes/yr from Scotford refinery and chemicals.

FUTURE PHASES

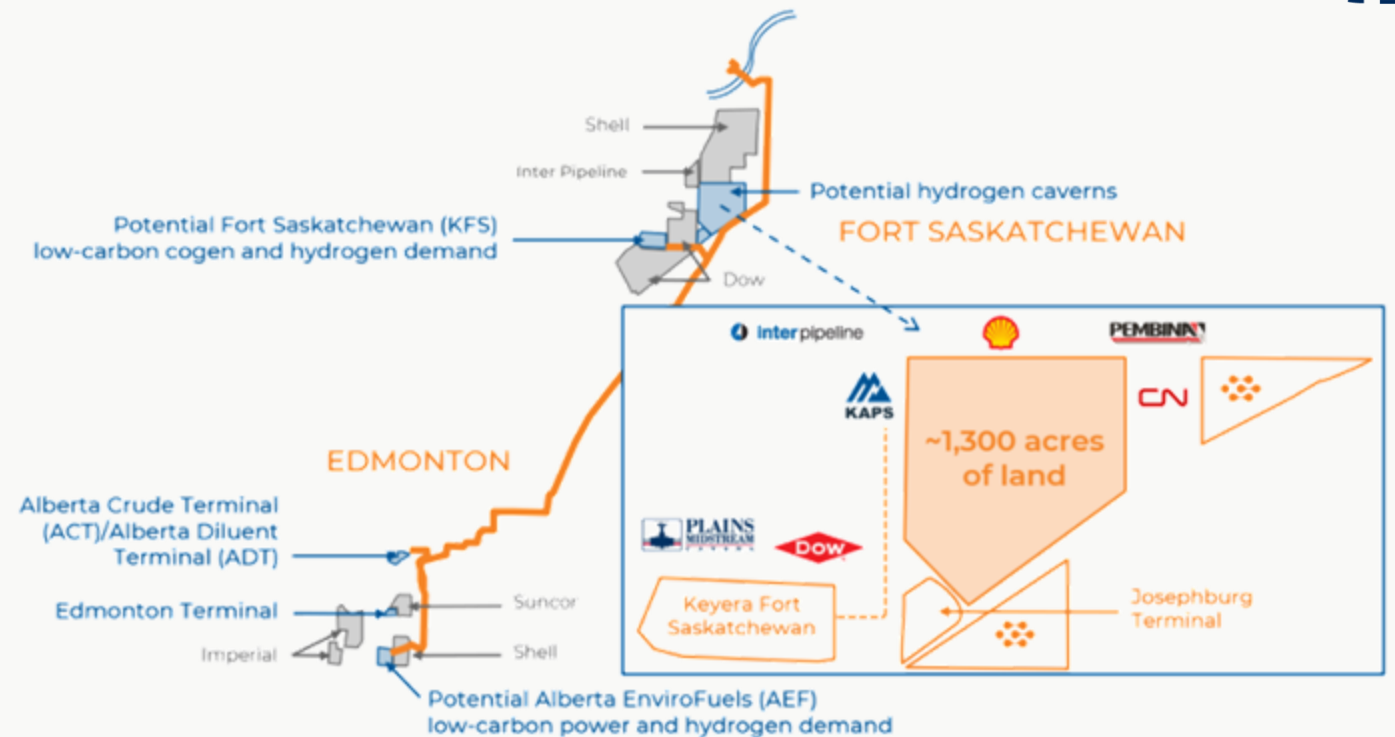
Will see the creation of a CO₂ storage hub for >10 million tonnes/yr storage. If built, it would provide CO₂ transport and storage on behalf of existing and new third-party emitters.



Keyera & CN Clean Energy Terminal

Facility Facts

- Keyera and CN are evaluating the creation of a specialized clean energy terminal in Alberta's Industrial Heartland.
- The new infrastructure would aggregate conventional and clean energy from multiple sources to support transportation of Alberta's diverse energy products



Silicon Ranch Solar Farm



Facility Facts

- 58MW solar farm with grazing livestock
- Location: Adjacent to Shell's Scotford Complex in Strathcona County
- Capex: \$100 Million (Under Construction)
- All energy generated will be sent directly for use at Shell's Scotford Complex
- Silicon Ranch's first Canadian project (+150 successful projects worldwide)

Driving Investment Home

Activities that support petrochemical investments

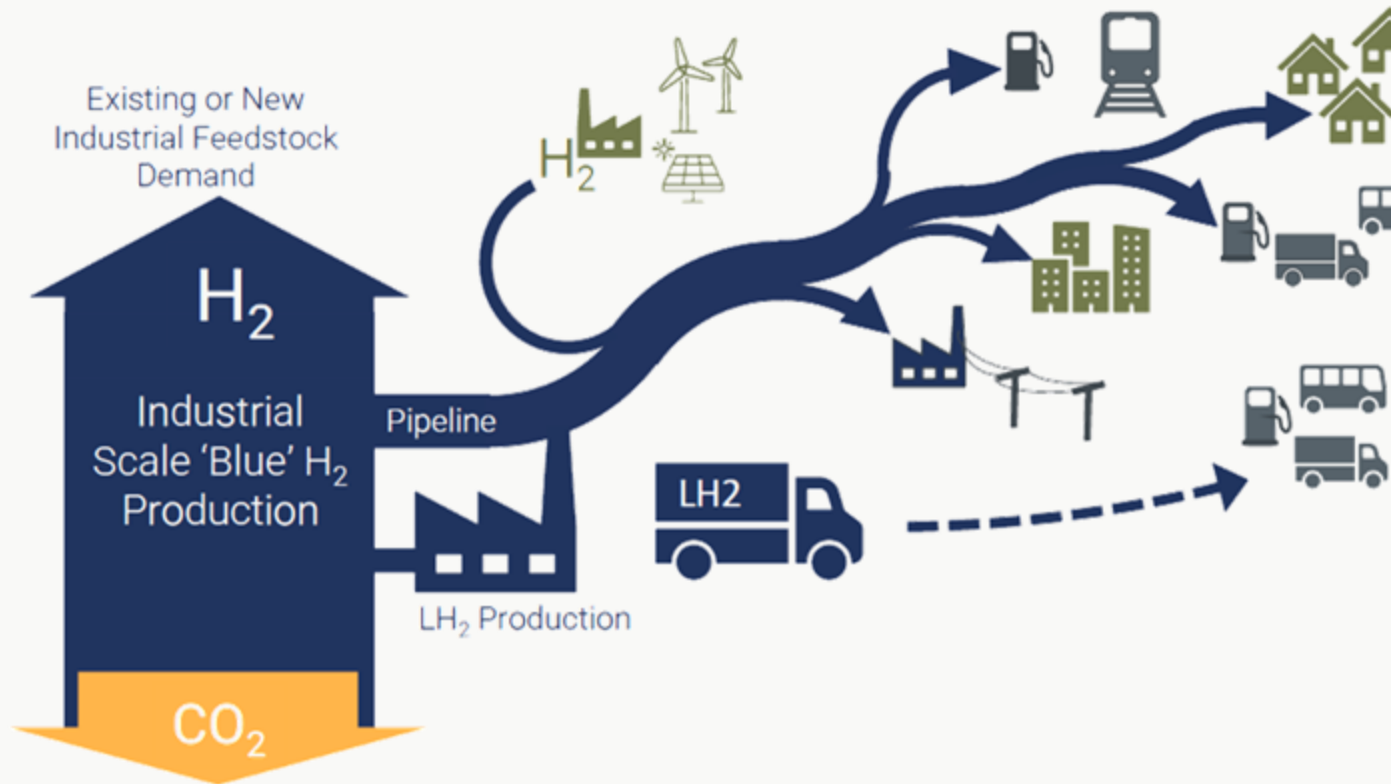
- Tax incentive bylaws
- Regulatory support
- Infrastructure
- Site readiness
- Advocacy
- Quality of life
- So much more



Sector Development

Hydrogen end uses

Leverage Assets To Develop Cluster



In the immediate future

Establish a "hydrogen hub"

- Blue hydrogen production
- Ammonia export and liquefaction

Long term opportunity

Develop hydrogen end use value chain

- Fueling stations and vehicle conversions
- Industry-led downstream projects

Strathcona County Hydrogen Bus Pilot

Zero Emission Public Transport

Partners: Strathcona County, the City of Edmonton and Emissions Reduction Alberta (ERA)

Attributes: quieter and 30% cheaper to maintain

Range: up to 480 kilometers

Now in service at a bus stop near you!



Bremner: Canada's Largest H₂ Community

In a first for North America, ATCO and Qualico study the use of **hydrogen** in the **community of Bremner**, near Edmonton.

The funding will be used for a **FEED study** to determine optimal equipment and design choices and will construct at least **one demonstration home** to test and validate design and equipment choices ahead of wider deployment.

\$ 2 M CAD in Government funding for study and demonstration home

First homes in 2025 with up to 150 homes in first two-stages

Up to **85,000 residents** ultimately



Low-carbon alternative to electrification



Minimize financial burden of carbon tax on residents



Incubation of **made-in Alberta hydrogen appliance** industry



Creation of demand for Alberta's nascent low-carbon hydrogen industry

Hydrogen for Combined Heat and Power (CHP)



Millenium Place H₂ Pipeline for CHP

Studying feasibility of developing an urban hydrogen pipeline corridor to heat and power Millenium Place, a recreation facility that receives nearly 1 million visits/year.

Partners: Strathcona County and ATCO

H₂ pipeline corridor could unlock multiple end uses:

- Fueling municipal fleets and transit
- Fueling commercial transportation/logistics fleets
- Clean energy for local advanced manufacturers
- Next steps: pre-FEED study and regulator reviews

Strategic Alignment



Collaboration with industrial partners that promotes innovation and growth opportunities

Development of emerging sectors that support innovation, economic diversification and tourism

Growth and development that prioritizes community well-being and economic benefits

Environmental stewardship that addresses climate change and demonstrates responsible use of land and natural resources



ORIGINAL EQUIPMENT MANUFACTURERS

TRAINING & WORKFORCE DEVELOPMENT



FUELING STATIONS FOR HEAVY HAUL
AIR PRODUCTS



HYDROGEN STORAGE

WATER ACCESS



Hydrogen HUB
FUELING STATIONS FOR CONSUMER TRAFFIC

WASTE TO BIOFUEL FACILITY

KEYERA
TRANSPORTATION OF HYDROGEN



RENEWABLE POWER



HYDROGEN CANADA



Imperial
CONNECTION TO AGRICULTURE

HOME HEATING FROM HYDROGEN



CARBON CAPTURE UTILIZATION AND STORAGE



ALBERTA CARBON TRUNK LINE



EMMISSIONS REDUCTION

EXPORTING CAPACITY & DISTRIBUTION TO OTHER HUBS





STRATHCONA
COUNTY

Thank You
