Hydrogen Naturally Inc.

Carbon-Negative Bright Green™
Hydrogen from the Air

Our plan: Hydrogen from Natural Air Capture

- Use carbon negative Hydrogen to produce low CI fuels
- Proven technology and management
- Vast feedstock from Certified Sustainable Forestry

Experienced Founders

PEAK RENEWABLES

Forests and Fibre

NORTH WEST CAPITAL PARTNERS INC.

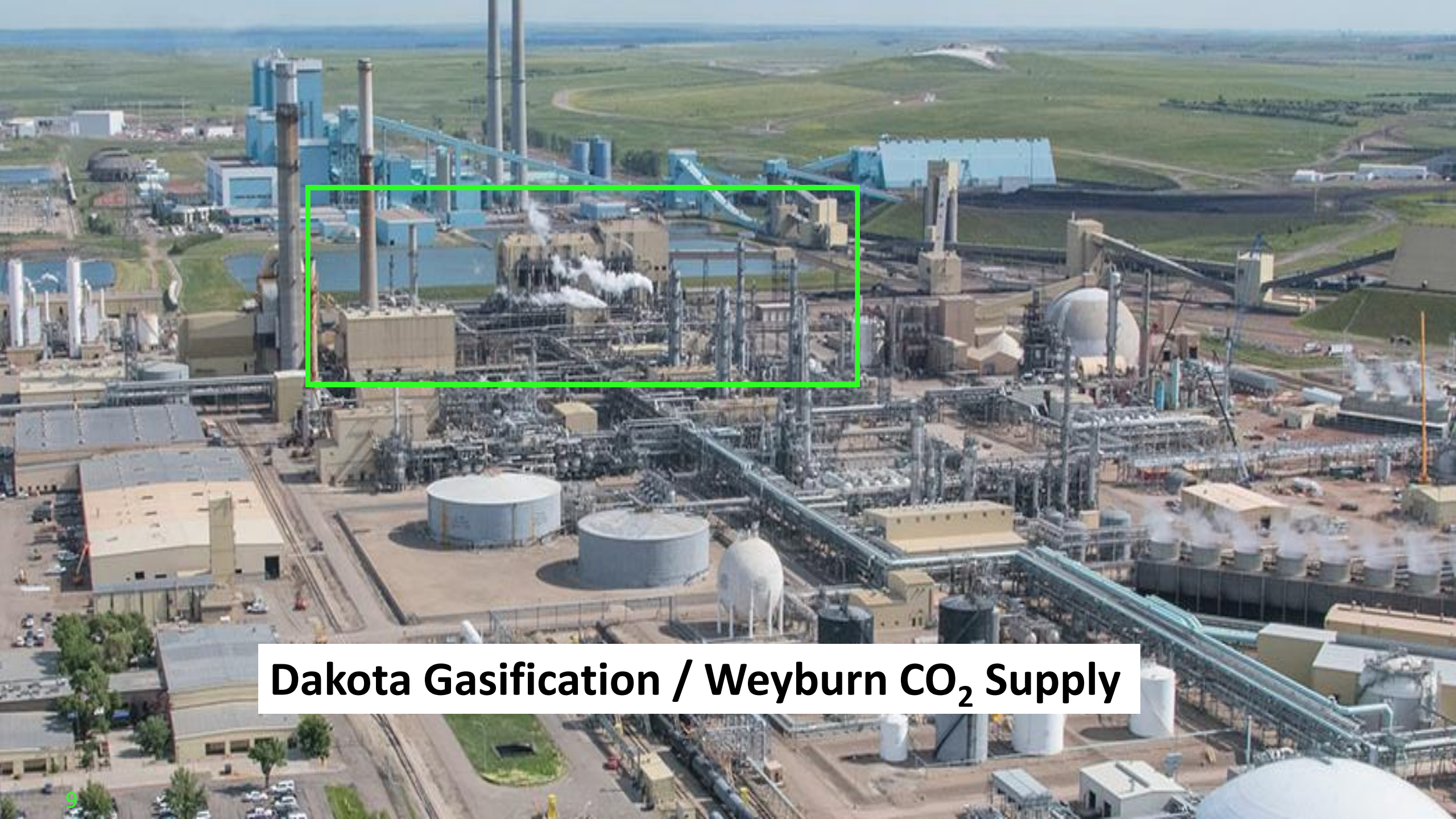
Pipes and Carbon


2x6 DF 116 5/8 #2
2x6 #2 116 5/8"
D-Fir
36858142 PC 189
SDS
Lumber Company
2x4 Util 10
D-Fir
36858142 PC 294


North West Capital
Merchant Engineers

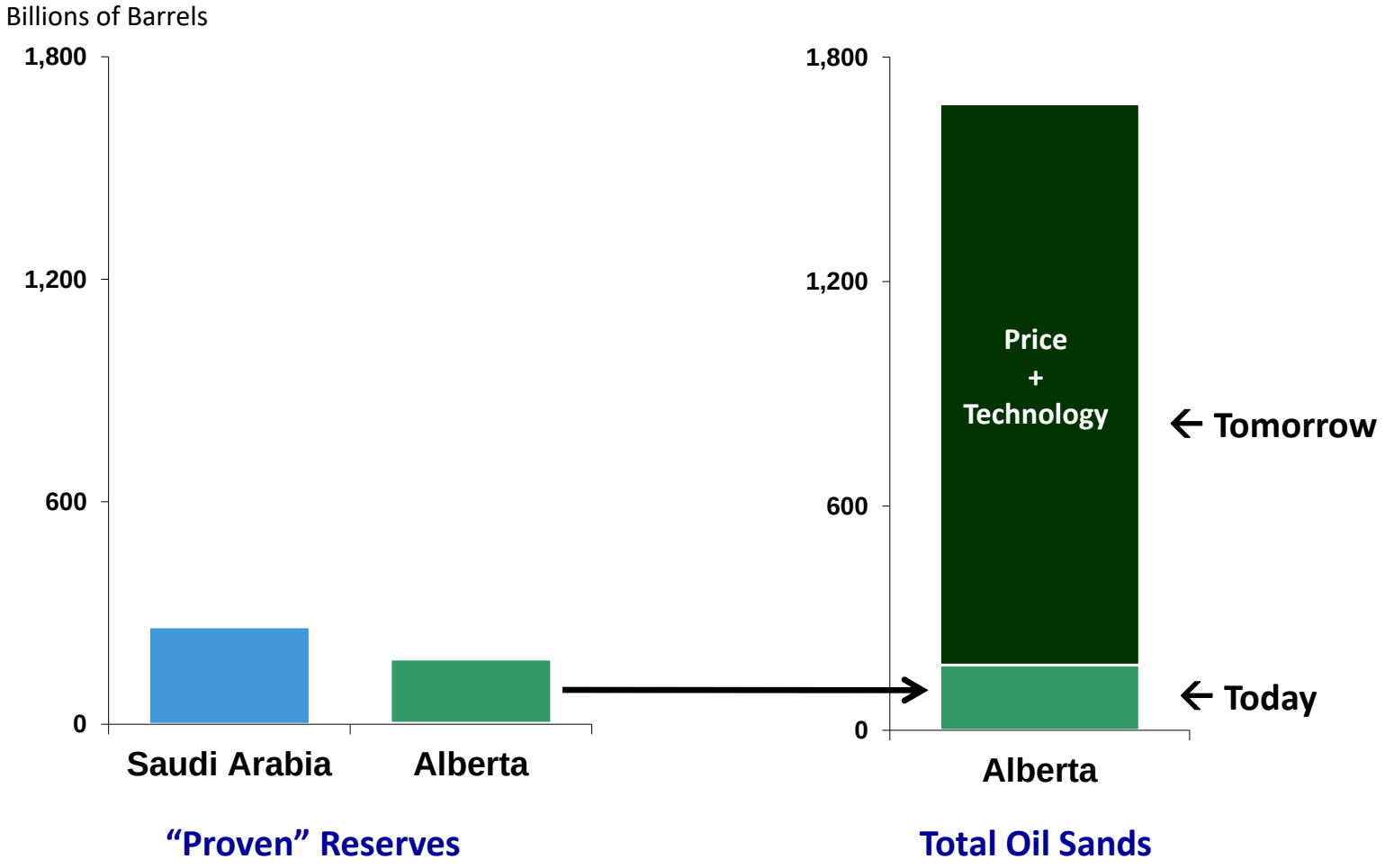

EIRIK RAUDE

CO_2: 40 M Tonnes
Oil: 150 M bbls

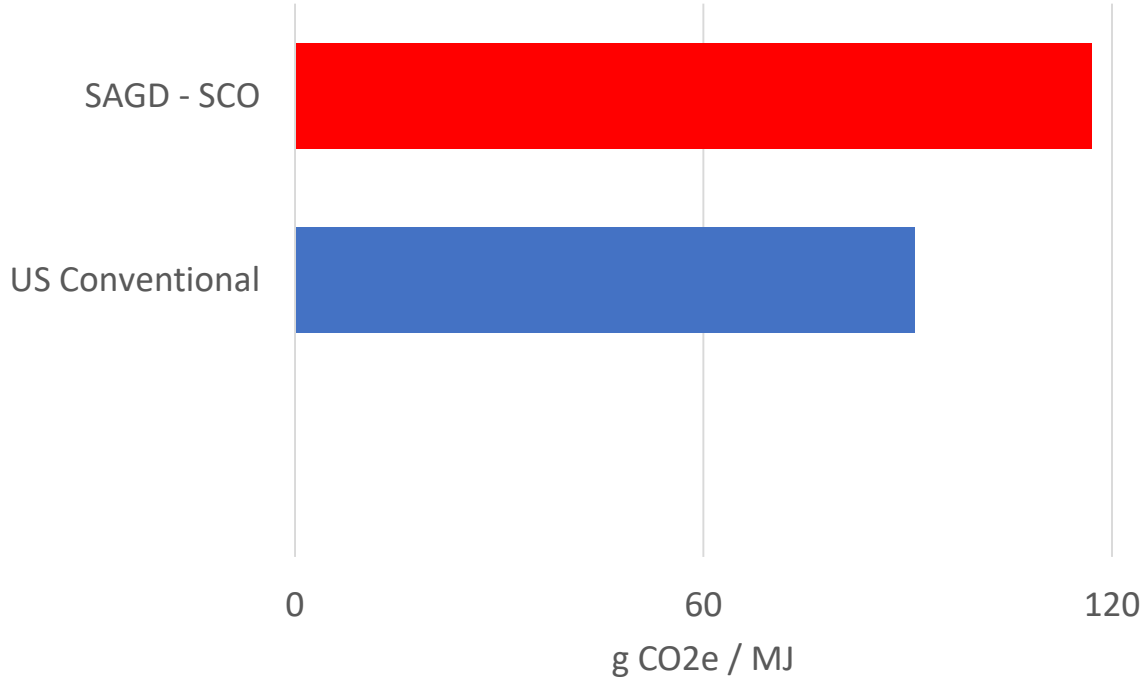


Dakota Gasification / Weyburn CO_2 Supply

Alberta has a lot of oil



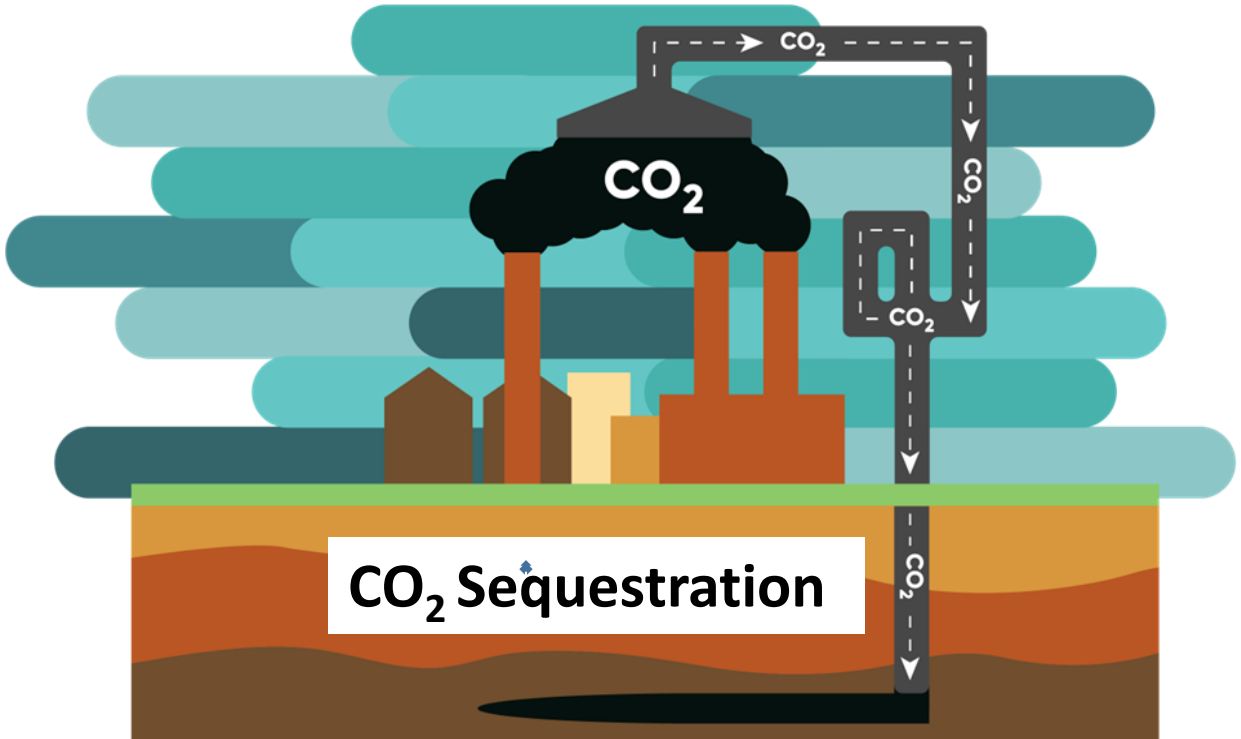
Bitumen has 2 Big problems



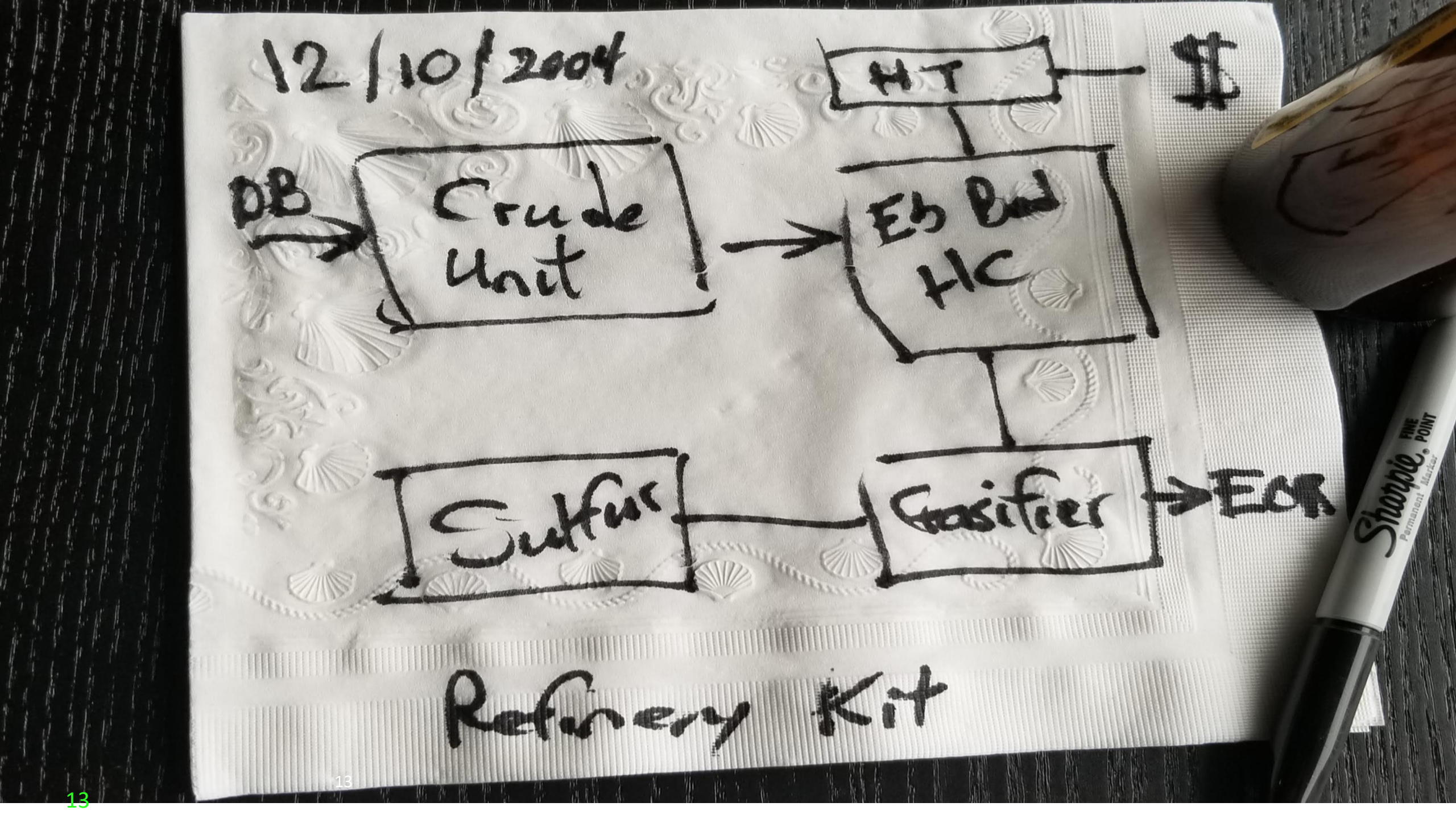
Low Value

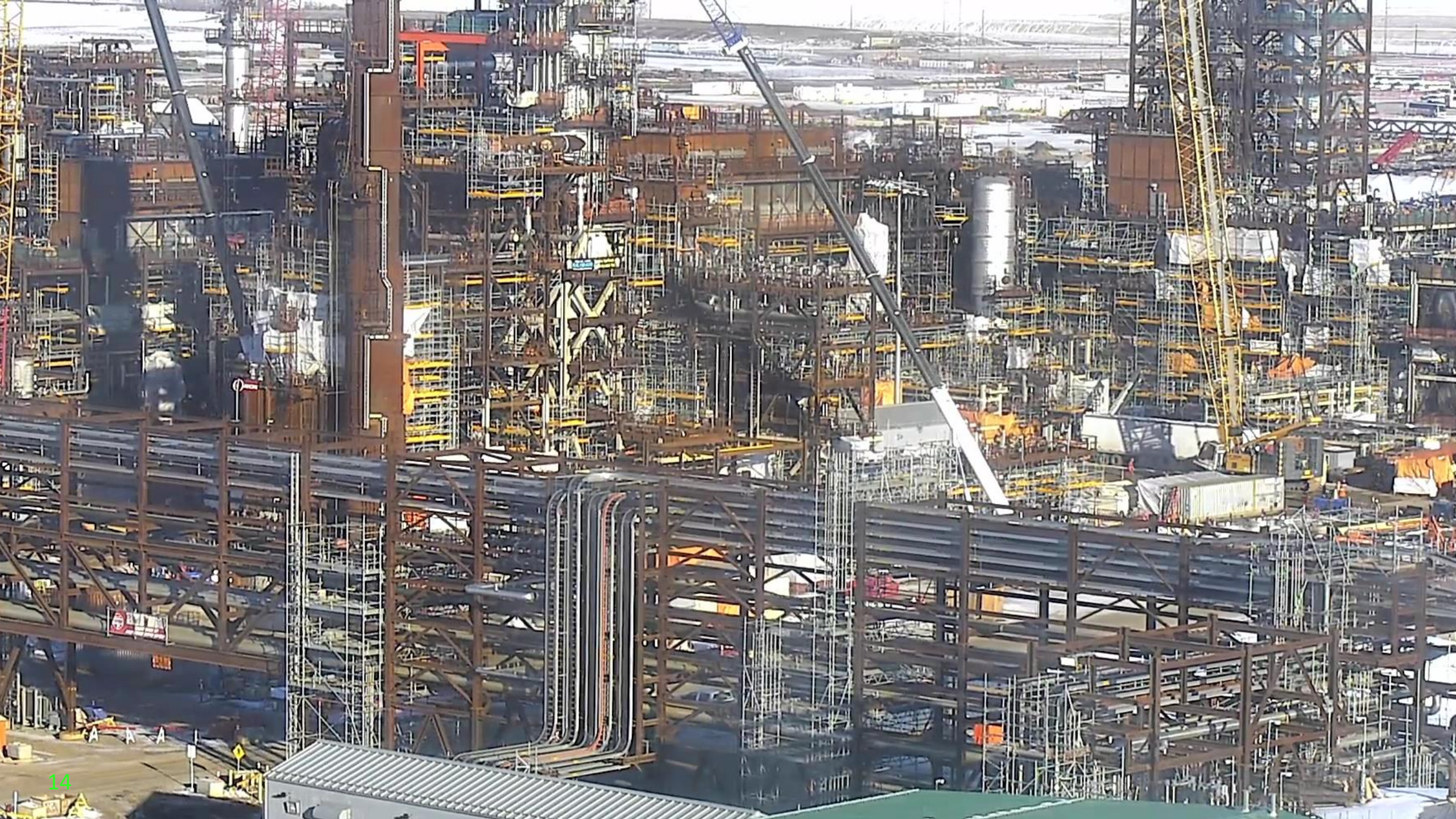
High CO_2

NORTH WEST REFINING



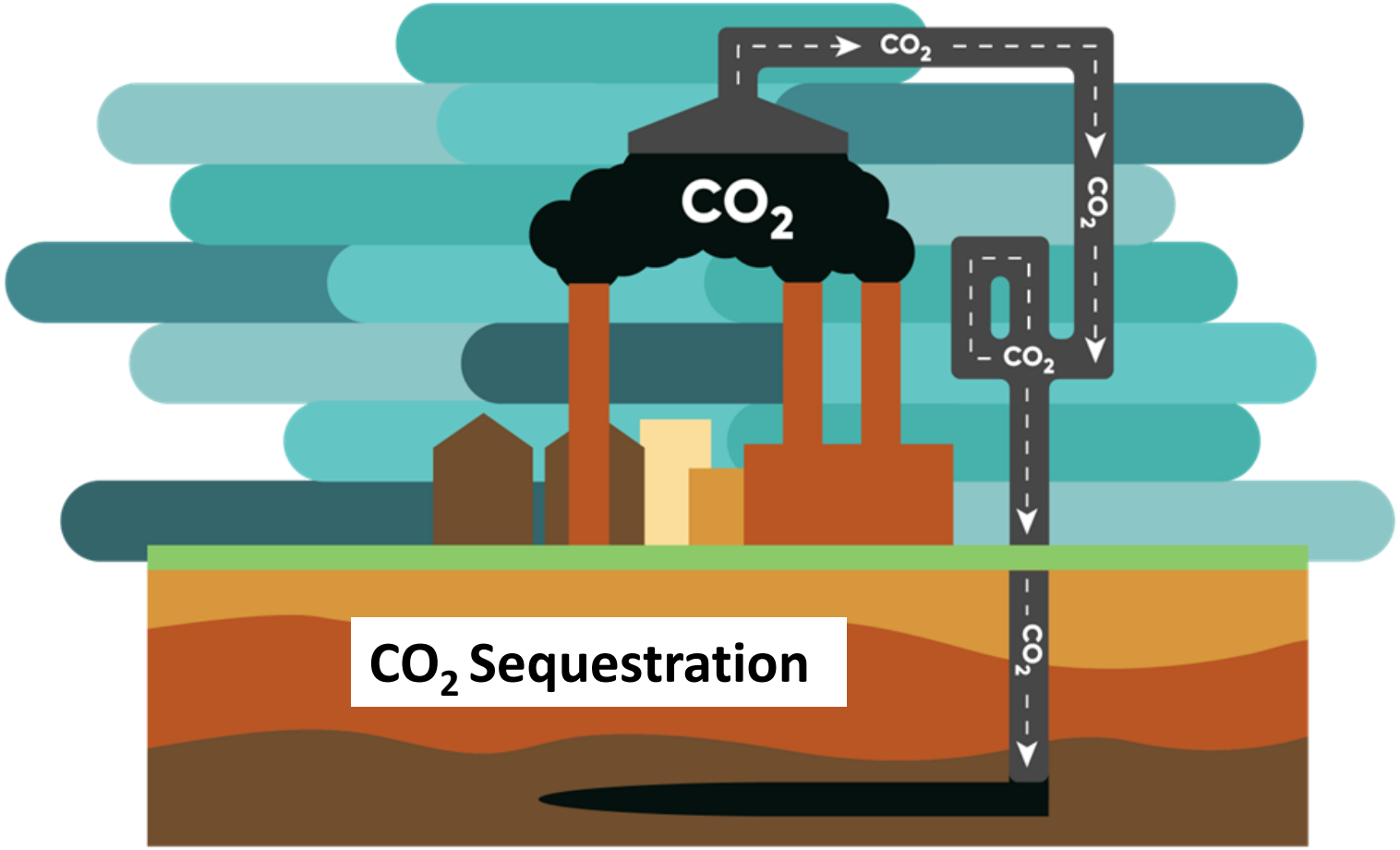
ENHANCE
ENERGY INC.


12/10/2004
HT
$
DB
Crude Unit
Eb Bed HC
Sulfur
Gasifier
Ecr
Refinery Kit



ENHANCE
ENERGY INC.

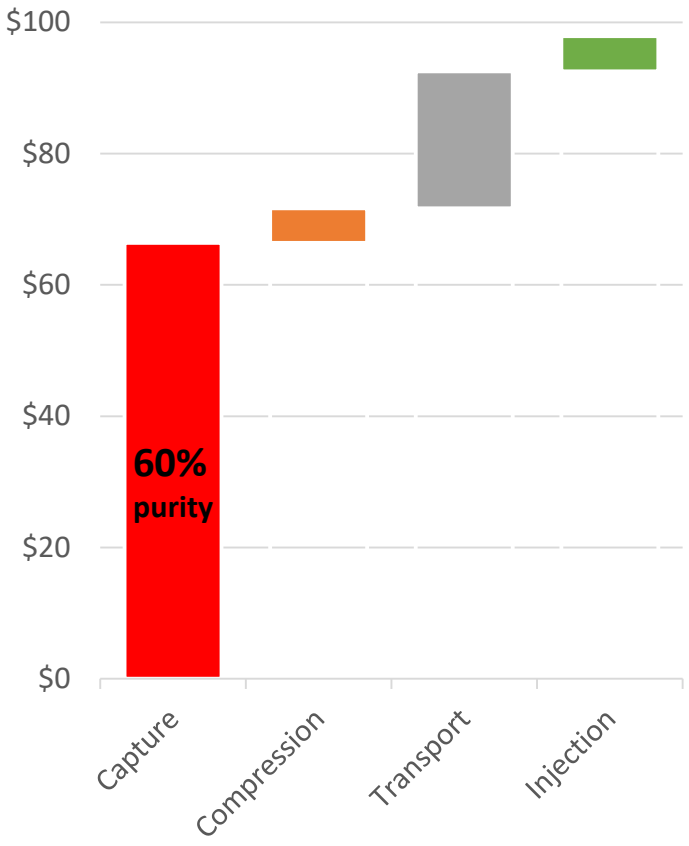
CO_2



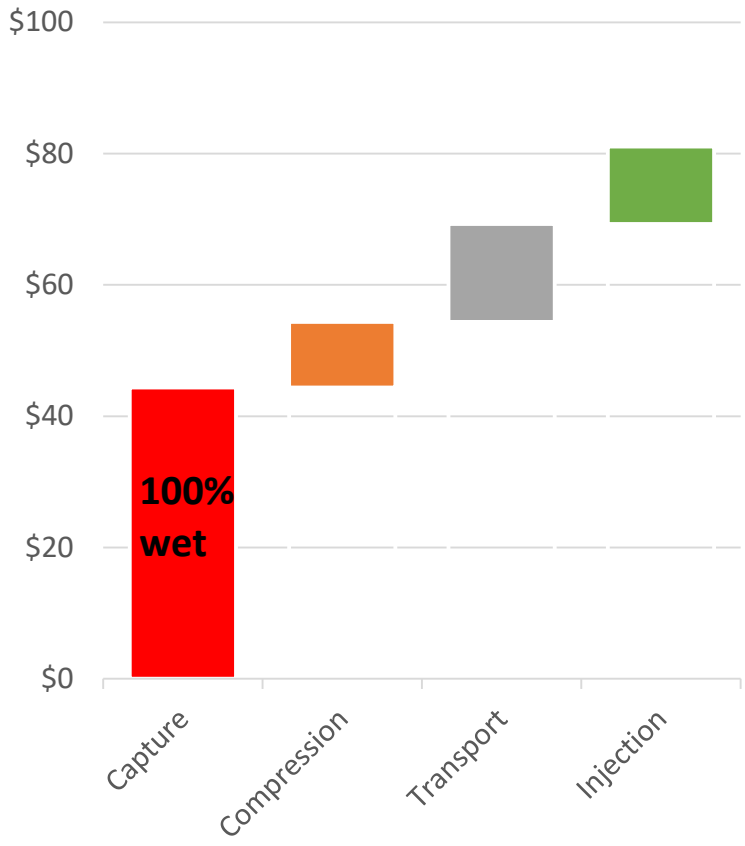

World's largest blue H_2 plant

CCS: cost is all about purity, Red is bad

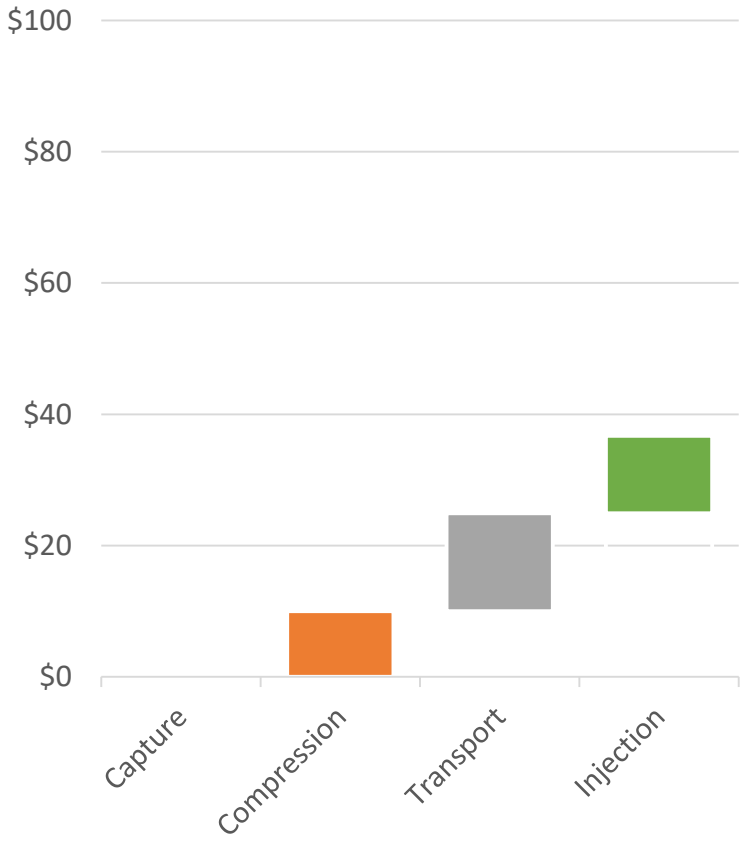
Shell Quest (2020) ($/tonne)

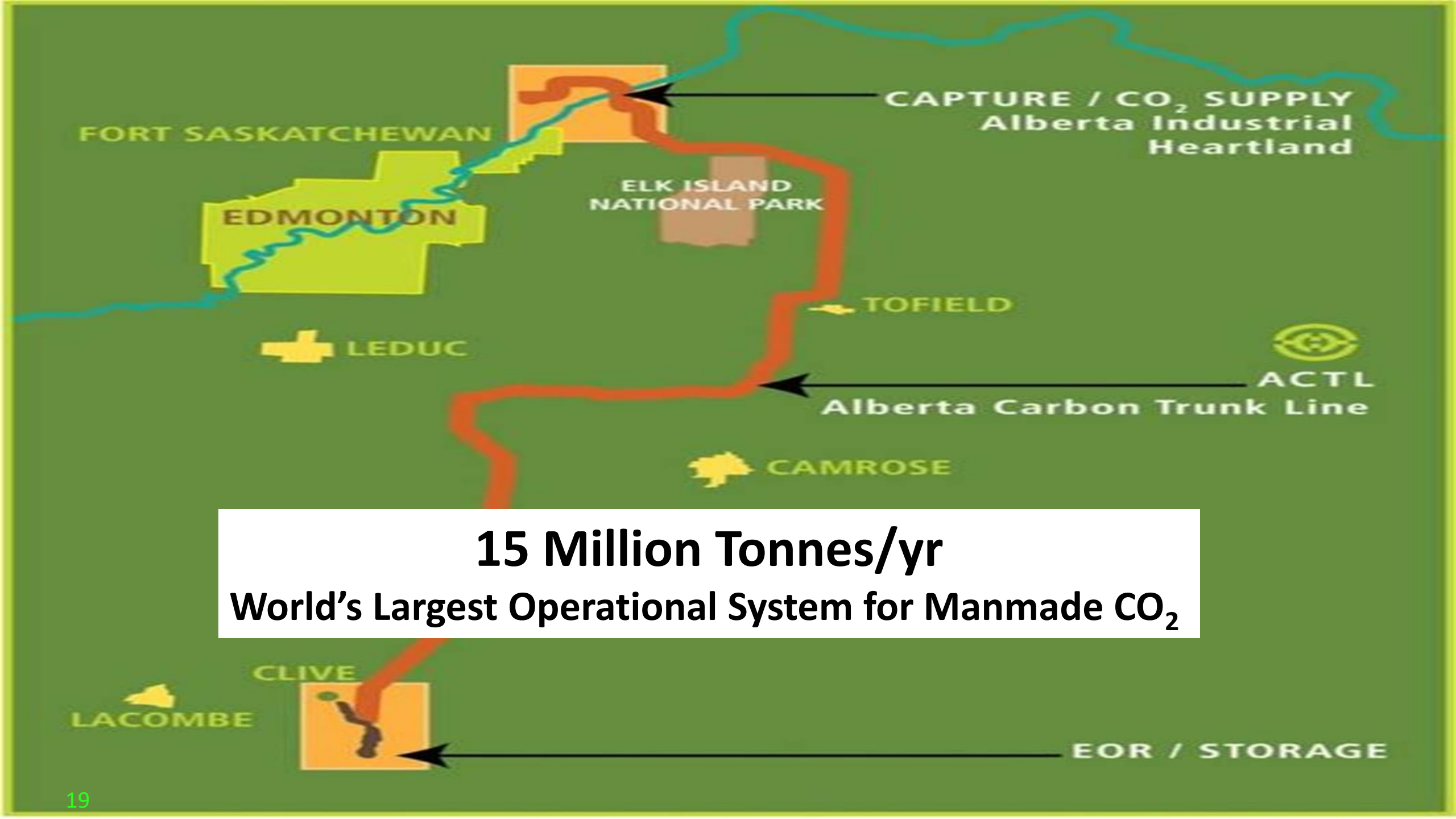


Nutrien ACTL (2020) ($/tonne)



Sturgeon ACTL ($/tonne)





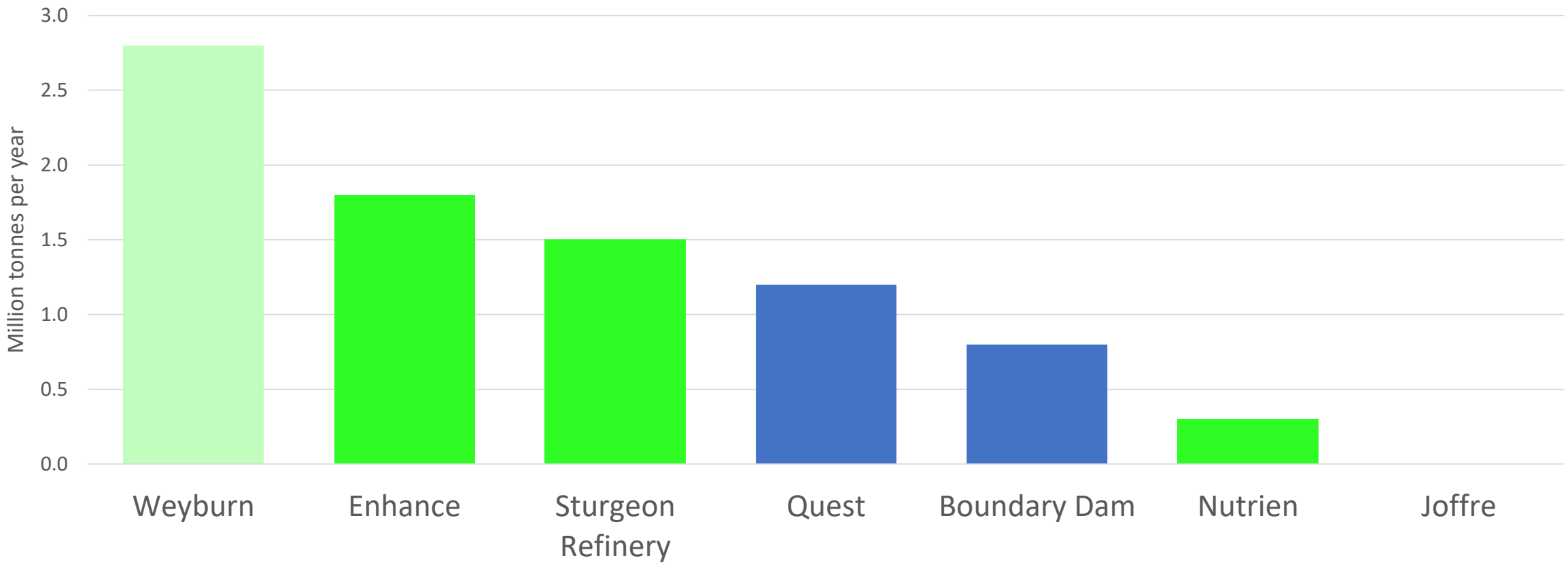
15 Million Tonnes/yr

World's Largest Operational System for Manmade CO_2

ACTL: World's Largest Operational CCS System

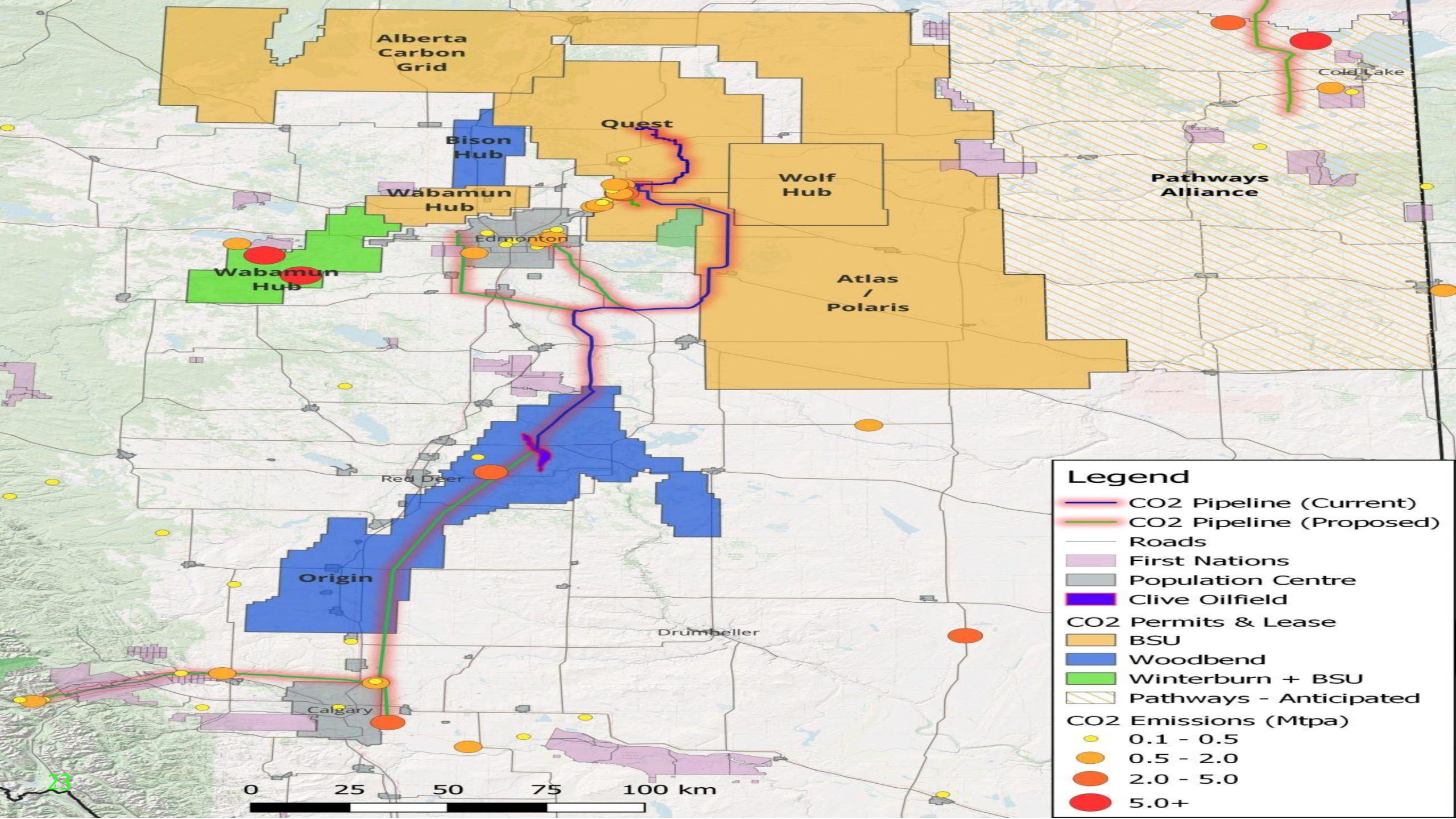
~4 million Tonnes injected so far

NWC CCS experience: >20 years as inventor, builder and owner



In addition, NWC founded the Alberta Carbon Trunk Line, a 15 million tonne per annum CO_2 transportation system

NWC founded **NWC Investment**


Alberta Carbon Grid
Quest
Bison Hub
Wabamun Hub
Wolf Hub
Pathways Alliance
Cold Lake
Edmonton
Wabamun Hub
Atlas / Polaris
Red Deer
Origin
Drumheller
Calgary
0 25 50 75 100 km
Legend
CO2 Pipeline (Current)
CO2 Pipeline (Proposed)
Roads
First Nations
Population Centre
Clive Oilfield
CO2 Permits & Lease
BSU
Woodbend
Winterburn + BSU
Pathways - Anticipated
CO2 Emissions (Mtpa)
0.1 - 0.5
0.5 - 2.0
2.0 - 5.0
5.0+

3 Stages of Megaprojects

1 Euphoria
2 Helping Hands
3 What's the big deal?

Stage 1 Euphoria

Company/Upgrader	Scheduled start-up	Bitumen (barrels/day)
Athabasca Oil Sands (Shell) — Scotford #1 and expansion	2003-10	290,000
BA Energy/Value Creation — Heartland	2008-13	163,000
North American Oilsands Corp/ StatoilHydro — Strathcona	2016-20	243,000
North West Upgrading	2010-16	150,000
Petro-Canada/Fort Hills — Sturgeon	2011-15	340,000
Shell — Scotford #2	2013-22	400,000
Synenco — Northern Lights	on hold	115,000
Total E&P Upgrader	2013-19	245,000
Total for 8 upgraders		**1,946,000**
Suncor (land holdings for upgrader, no details available)	?	?

Stage 2 Helping Hands

Volume 7 • Issue 3
April 2015

THE NORTH WEST STURGEON UPGRADER: GOOD MONEY AFTER BAD?

Ted Morton

DEBORAH YEDLIN

ALSO SEE
■ Expansion already on CNRL's Horizon D4

Upgrader argument doesn't make sense

There's a surprise. Not. The provincial government announced Tuesday it had picked **North West Upgrading Inc.** as the winning candidate to build an upgrader in Alberta.

Talk about a badly kept secret. Ever since **Canadian Natural Resources Ltd.** announced it had bought a 50 per cent interest in the orphaned project back in January, the guesswork as to which company would get the go-ahead to build an upgrader in the province disappeared. It was just a question of when the official announcement would take place. Interesting, too, that it came in conjunction with CNRL's annual investor day, which also took place Tuesday.

Still, making the argument that the province needs another upgrader is a tough one. It simply doesn't make sense from an economic standpoint — even with the jobs created during the construction of the facility.

Where to begin?

Let's start with the fact that merchant upgraders — those that are not tied to an existing oilsands operation — don't make economic sense.

SEE YEDLIN, PAGE D5

TUESDAY, JANUARY 5, 2016 PROUDLY CALGARY SINCE 1883 POSTMEDIA

NEWS

NATURE
National park passes free for nation's 150th anniversary A3

CBC MOVING
Broadcaster to sell studios near Memorial

Refinery review urged

Auditor General asked to look at financial risks of $8.5B project

DARCY HENTON
CALGARY HERALD

Alberta's auditor general has been urged to assess the financial risk to taxpayers from the province's partnership in the $8.5-billion Sturgeon Refinery after the NDP increased its borrowing limit for the project to $400 million.

Greg Clark, Alberta Party leader, said Monday he is concerned about the project's profitability following the increase of the loan limit and Moody's Investor Service announcing it is considering whether the refinery's credit rating should be downgraded.

In a letter to Merwan Saher on Monday, Clark requested the auditor general provide a special report to the legislative assembly "evaluating the extent of the risk to Alberta taxpayers" from the NDP government's financial involvement in the North West Redwater Partnership.

Clark cited the Dec. 18 cabinet order increasing the borrowing limit of the province's Alberta Petroleum Marketing Commission (APMC) to $400 million from $300 million, and the announcement by Moody's the same day that it is reviewing the progress of construction on the project and its costs.

"In light of Moody's announcement of a potential rating downgrade and the NDP's decision to increase the APMC borrowing limit, it is important that Albertans have a clear understanding of the financial risks involved in supporting this project," Clark noted in the letter provided to reporters.

Energy Minister Marg McCuaig-Boyd said the auditor general already reviews the financial statements of APMC each year to ensure that under the accounting guidelines there is no liability to the province.

SEE FINANCE ON A4

NDP is 'throwing good money after bad,' Alberta Party says

FINANCE FROM A1

"With regard to the Moody's report, low oil prices are driving credit reviews across the sector right now. This is another example of that," she said in a state-

of three partners in the project to construct a massive refinery, near Redwater, 45 kilometres northeast of Edmonton, to upgrade oilsands bitumen into ultra-low-sulphur diesel fuel.

Mc[illegible]-Boyd said in Novem-

'Path to hell' with refinery backing

EWART FROM C1

In the paper, Morton throws former Alberta premiers Ed Stelmach and Alison Redford along with several of his one-time cabinet colleagues, bureaucrats and oil industry executives — some named, some anonymous — under the bus.

He claims most ministers didn't understand the "hopelessly complex" agreement that was amended in 2010 to extend the government's financial obligation

CALGARY BUSINESS

Critics raise alarm over provincial investment in energy projects

JAMES WOOD
CALGARY HERALD

Opposition parties say the Redford government is getting into a risky business with the possibility of a $1-billion expenditure on the Sturgeon Refinery and other energy projects.

Last week, the Progressive Conservative cabinet approved an order-in-council authorizing the government's December decision to provide a $300-million loan for the Sturgeon project — a partnership between North West

ALSO SEE
■ Diesel politics add fuel to wrangling C1

make a loan, enter a joint venture or make a guarantee to finance the Sturgeon facility, also known as the North West Redwater refinery.

Energy Minister Diana McQueen said in an interview Monday that the government does not anticipate putting more than the planned $300-million loan into the Sturgeon refinery or further restructure the deal.

But APMC's new ability to borrow up to $1 billion gives the corporation the capacity to provide financing for Sturgeon, as well as other projects — including the Energy East pipeline, she said.

"It puts

that the way the order-in-council is worded, it appears the government is considering putting up to $1 billion in the Sturgeon facility alone.

Once the project is built, the province expects to receive a higher return for its raw product as the facility converts heavy oil bitumen

Calgary Herald (Calgary, Alberta, Canada) · Thu, Nov 15, 2018

A16 THURSDAY, NOVEMBER 15, 2018 CALGARY HERALD CITY+REGION

Sturgeon delays add to heavy oil discount woes

Equipment failures push back Alberta refinery's bitumen intake to year's end

DAN HEALING

OPINION | **This 'Bitumen Boondoggle' is costing Alberta taxpayers billions**

Mad about billions going to Bombardier? Sturgeon Refinery saga will make your head explode

Andrew Leach · for CBC News · Posted: Sep 14, 2020 5:00 AM MT | Last Updated: September 14, 2020

Stage 3 What's the Big Deal?

Varcoe: A surprise surplus in Alberta

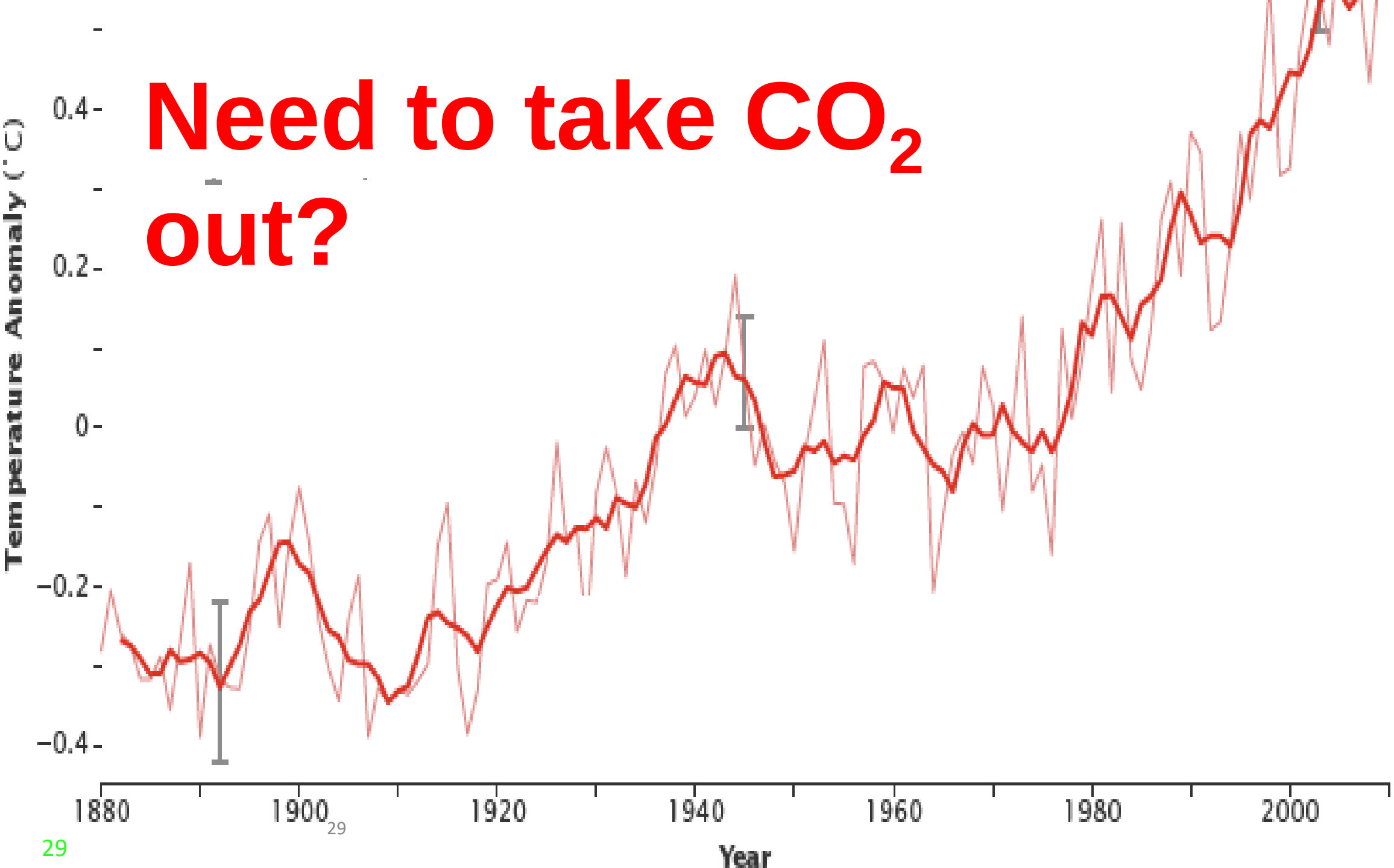
Author of the article:
Chris Varcoe • Calgary Herald
Publishing date:
Jun 28, 2022 •

"The province also reported a $2 billion gain from the Sturgeon Refinery."

Hydrogen Naturally Inc.

Carbon-Negative Bright Green™
Hydrogen from the Air

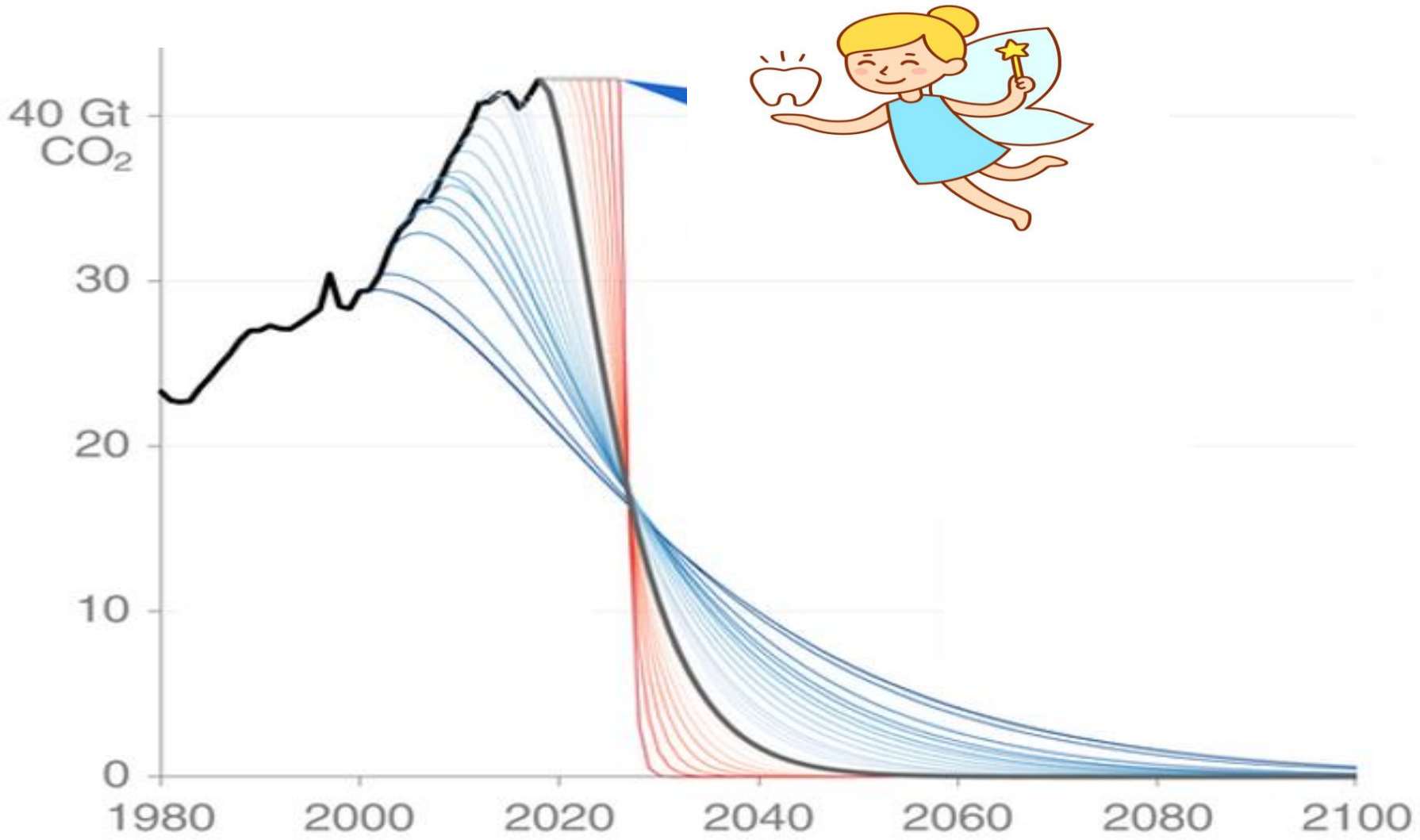
Need to take CO_2 out?



29


CO_2 from People
2 Degrees C
CO_2 Capacity of Atmosphere

Vertical CO_2 reductions required to meet 2^o goal



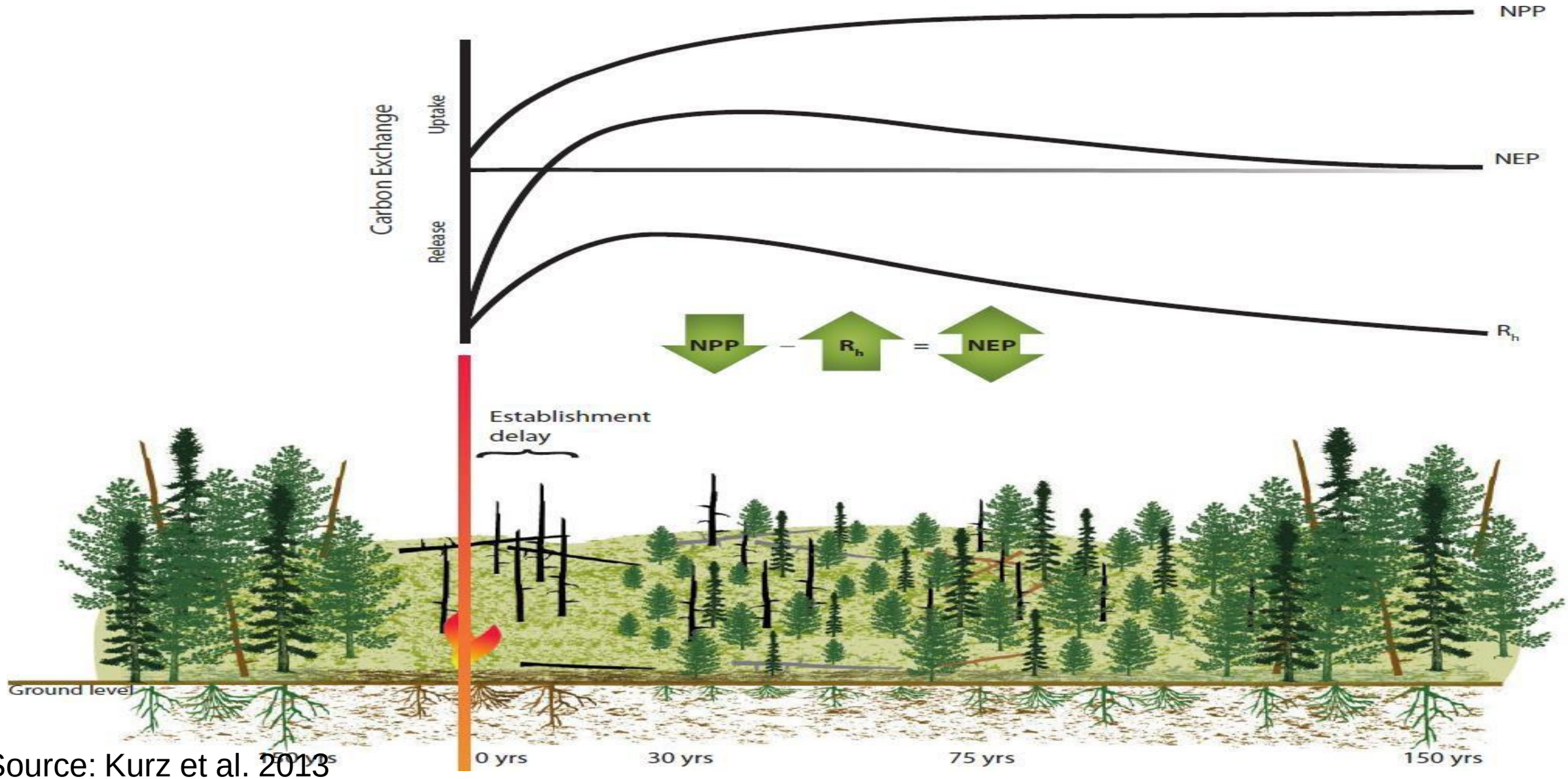

Air 400 PPM
Dairyland
2%


Air 400 PPM
2%
LAIT 100 % CANADIEN


45,000 needed for 1 MT/yr

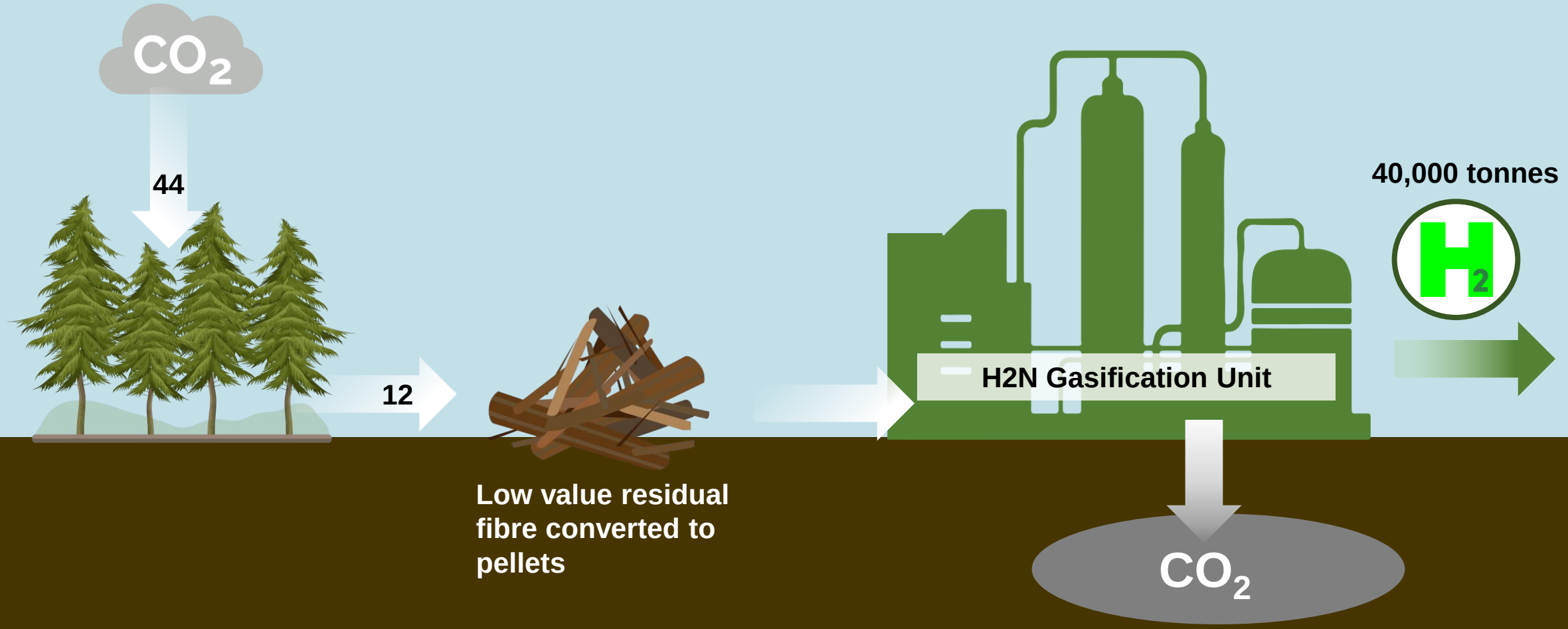
Natural Air Capture: working for 250 million years

The C balance is age-dependent

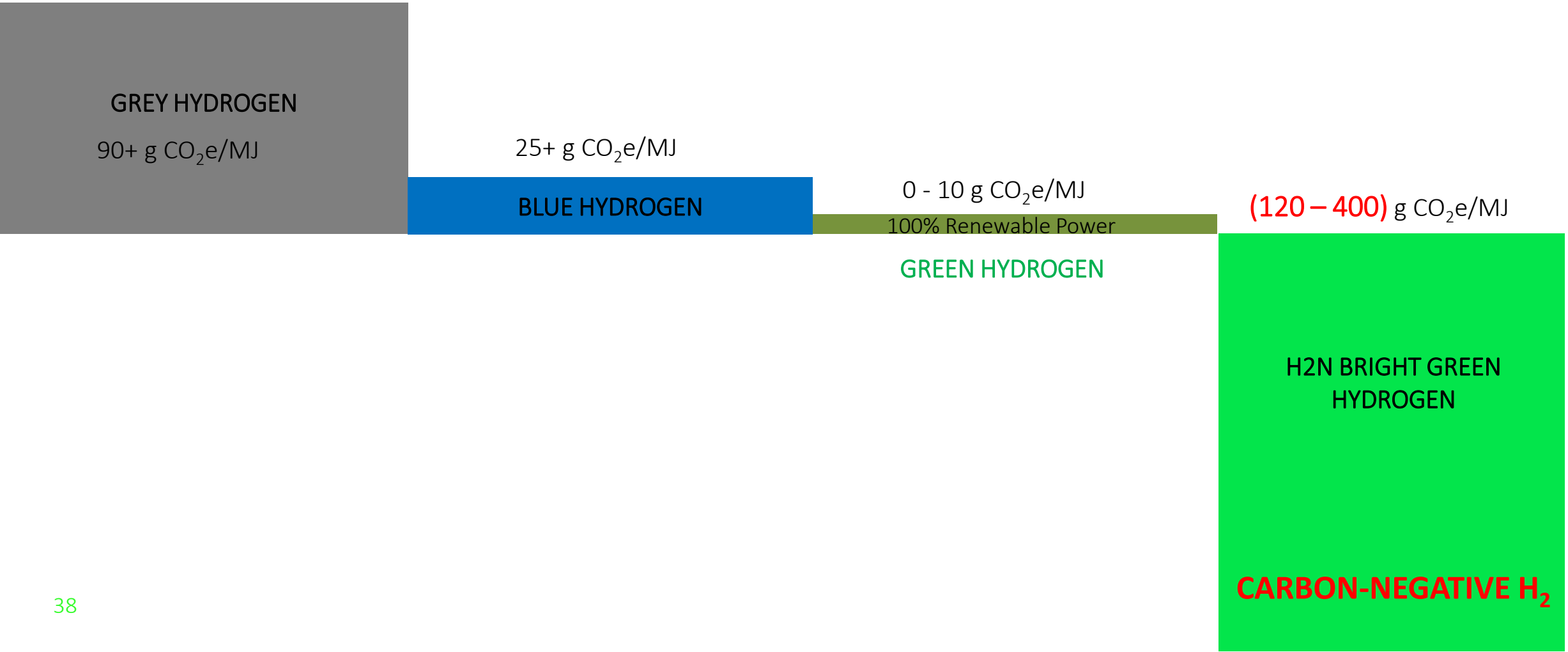


Source: Kurz et al. 2013

Air Capture+sequestration = carbon-negative Bright Green H_2



Negative emission Bright Green™ hydrogen



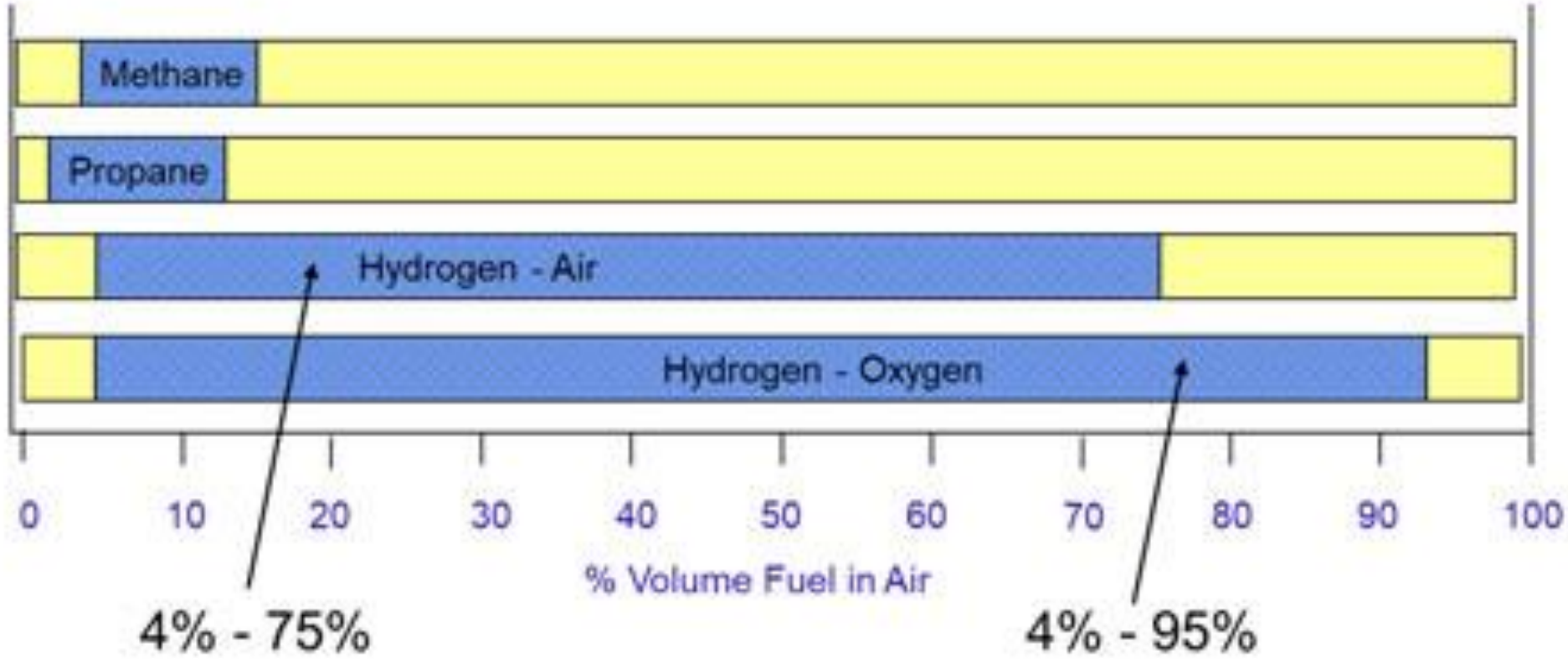
Bad Fuel

Good Molecule

Hydrogen as Fuel

HYDROGEN FLAMMABILITY RANGE

AS COMPARED TO OTHER COMMON FUELS



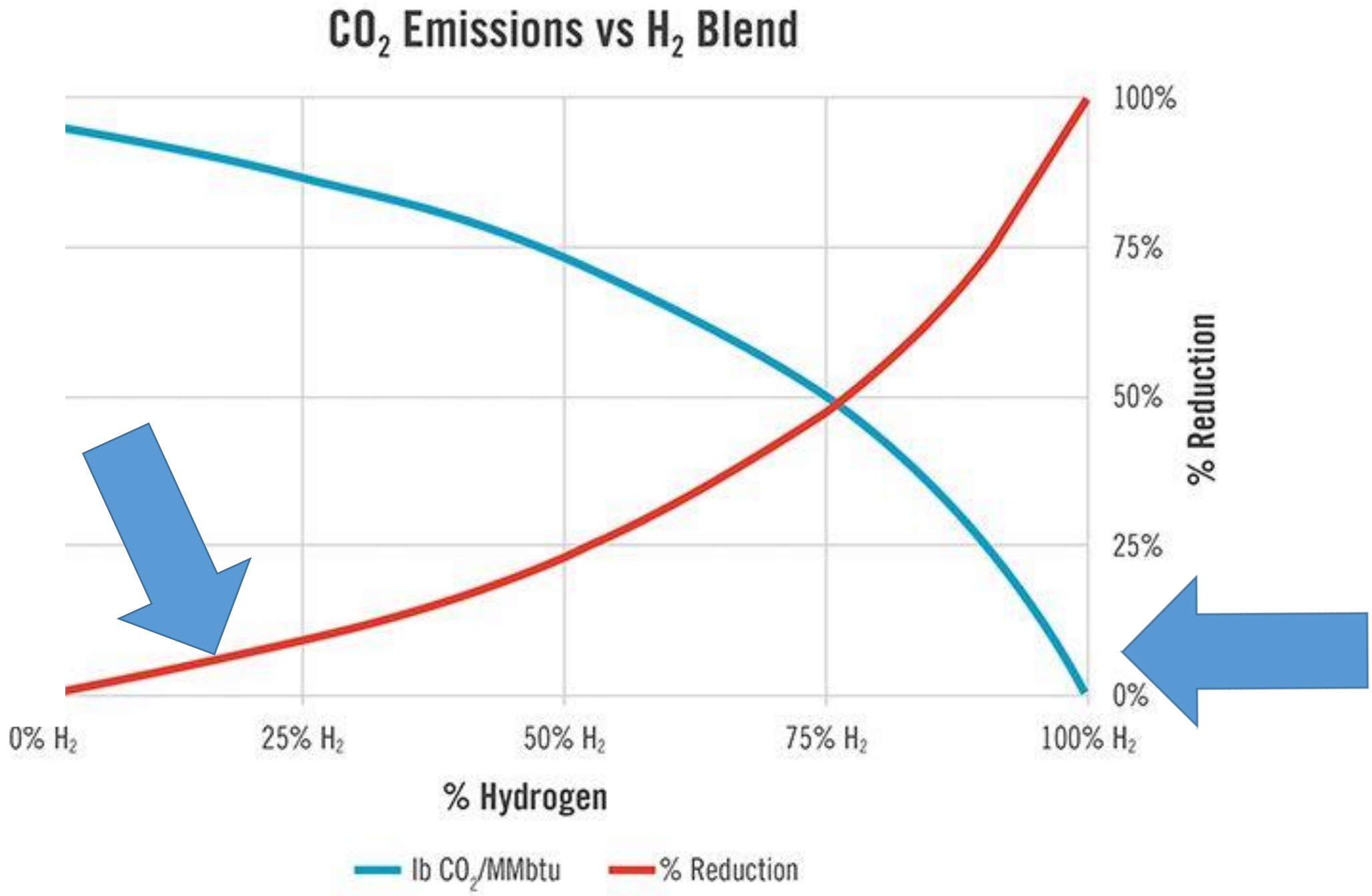
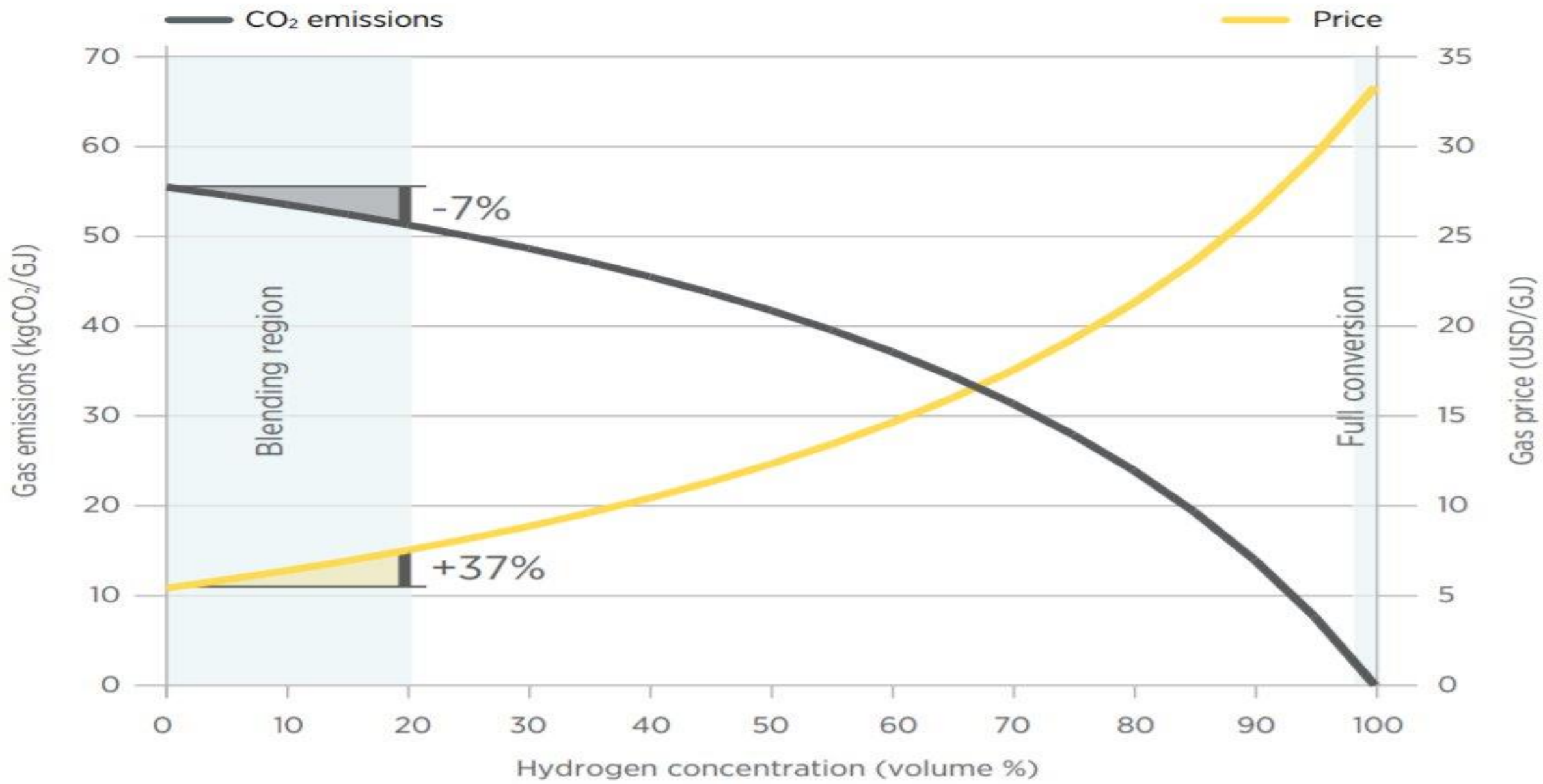
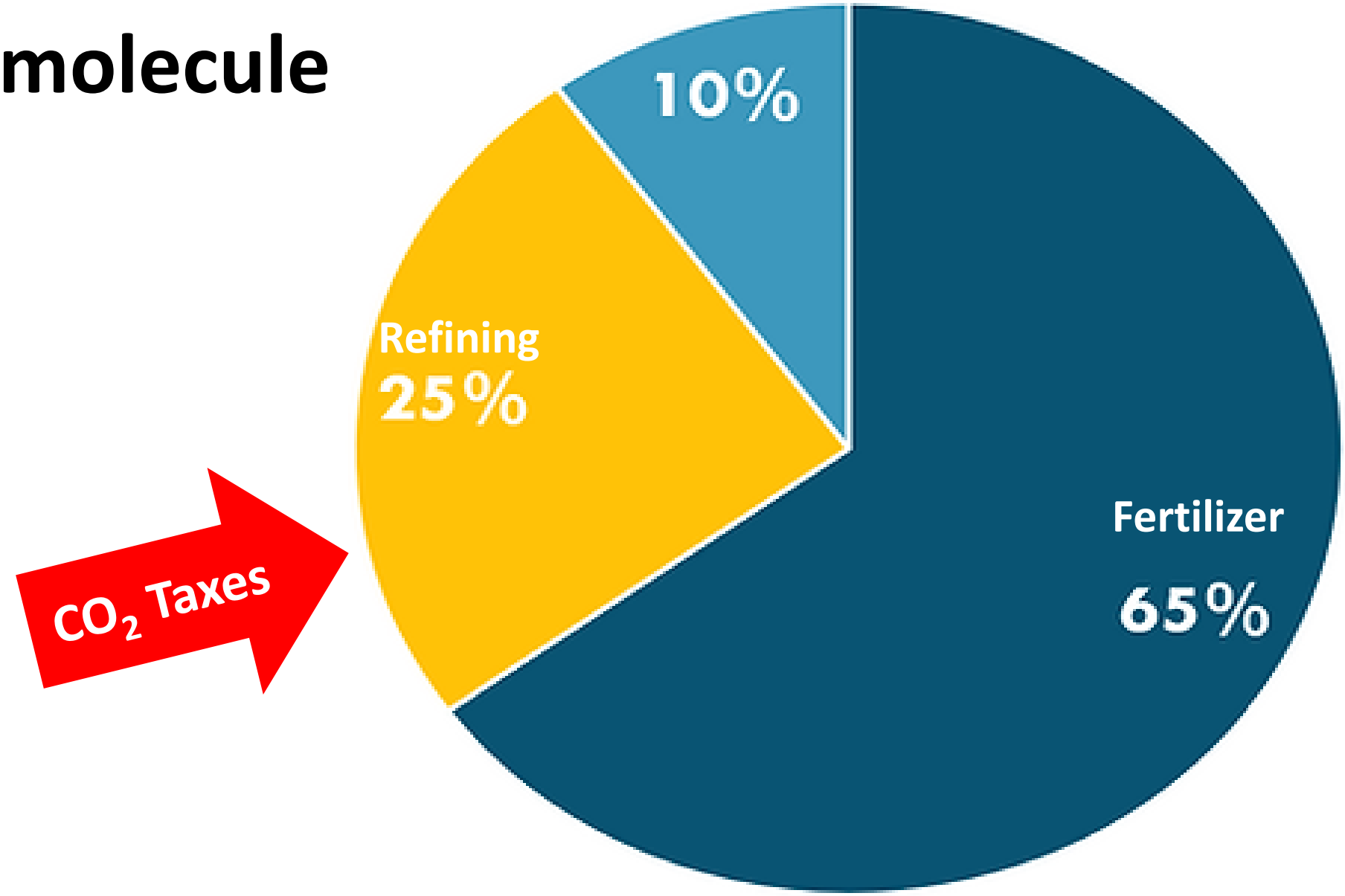

CO_2 Emissions vs H_2 Blend
100%
75%
50%
25%
0%
% Reduction
0% H_2
25% H_2
50% H_2
75% H_2
100% H_2
% Hydrogen
lb CO_2/MMbtu
% Reduction

Figure 2.6 CO_2 benefit and gas price increase from blending and converting the gas grid to hydrogen

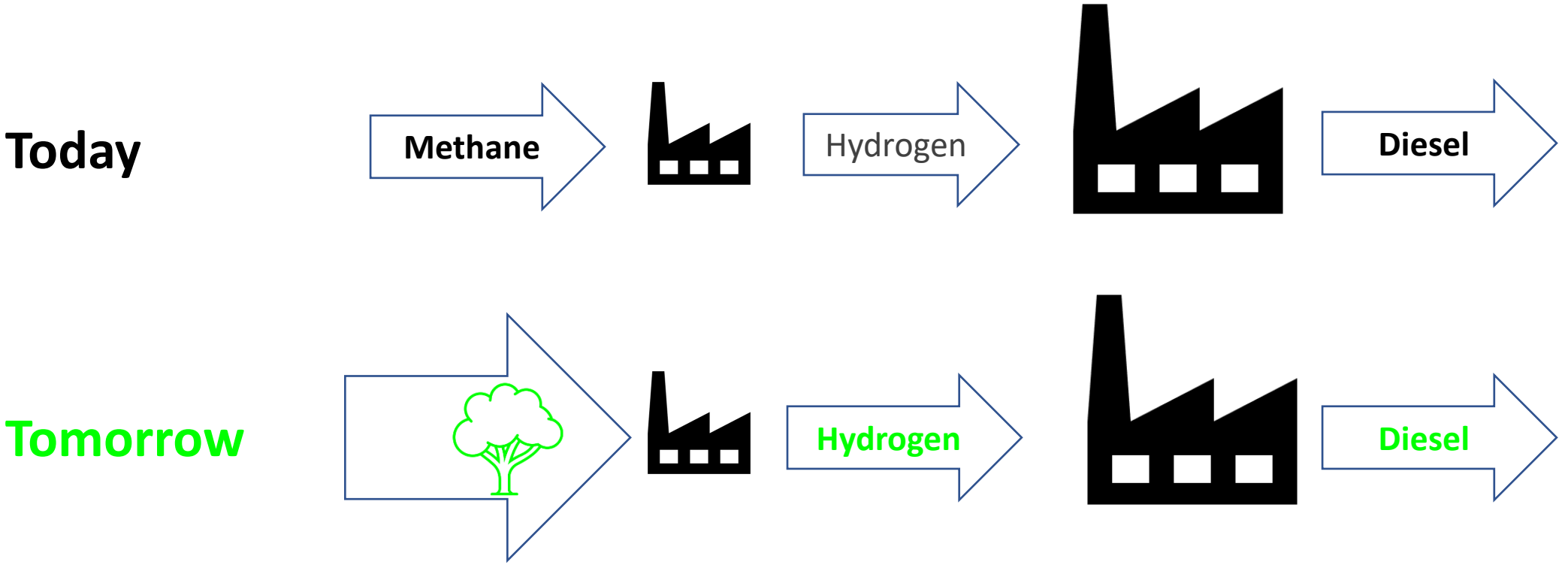


Notes: Fossil gas price = USD 5/GJ; green hydrogen cost = USD 4/kg (USD 33/GJ).

H_2 use as a molecule

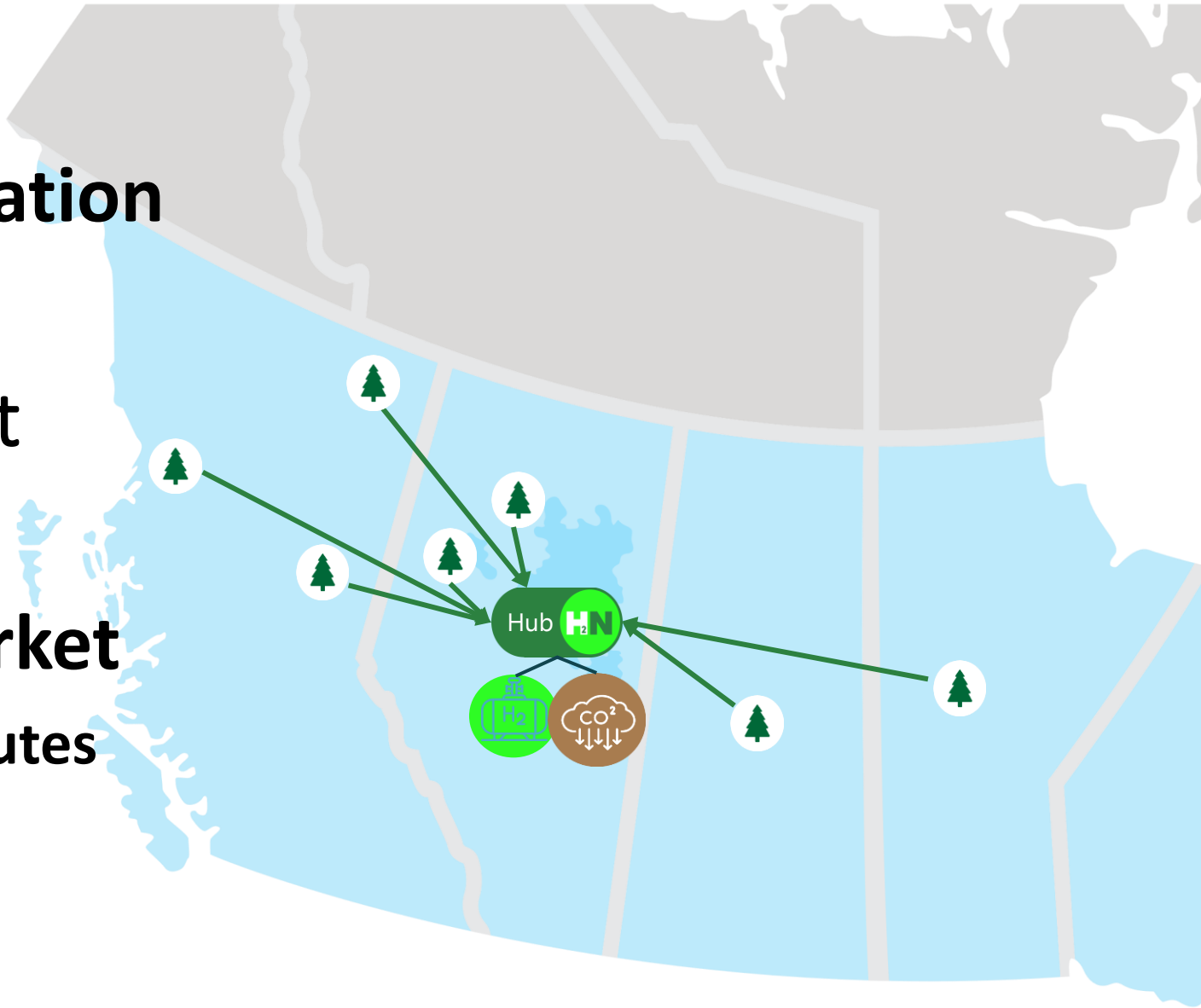


Hydrogen without the H_2 Distribution Headache

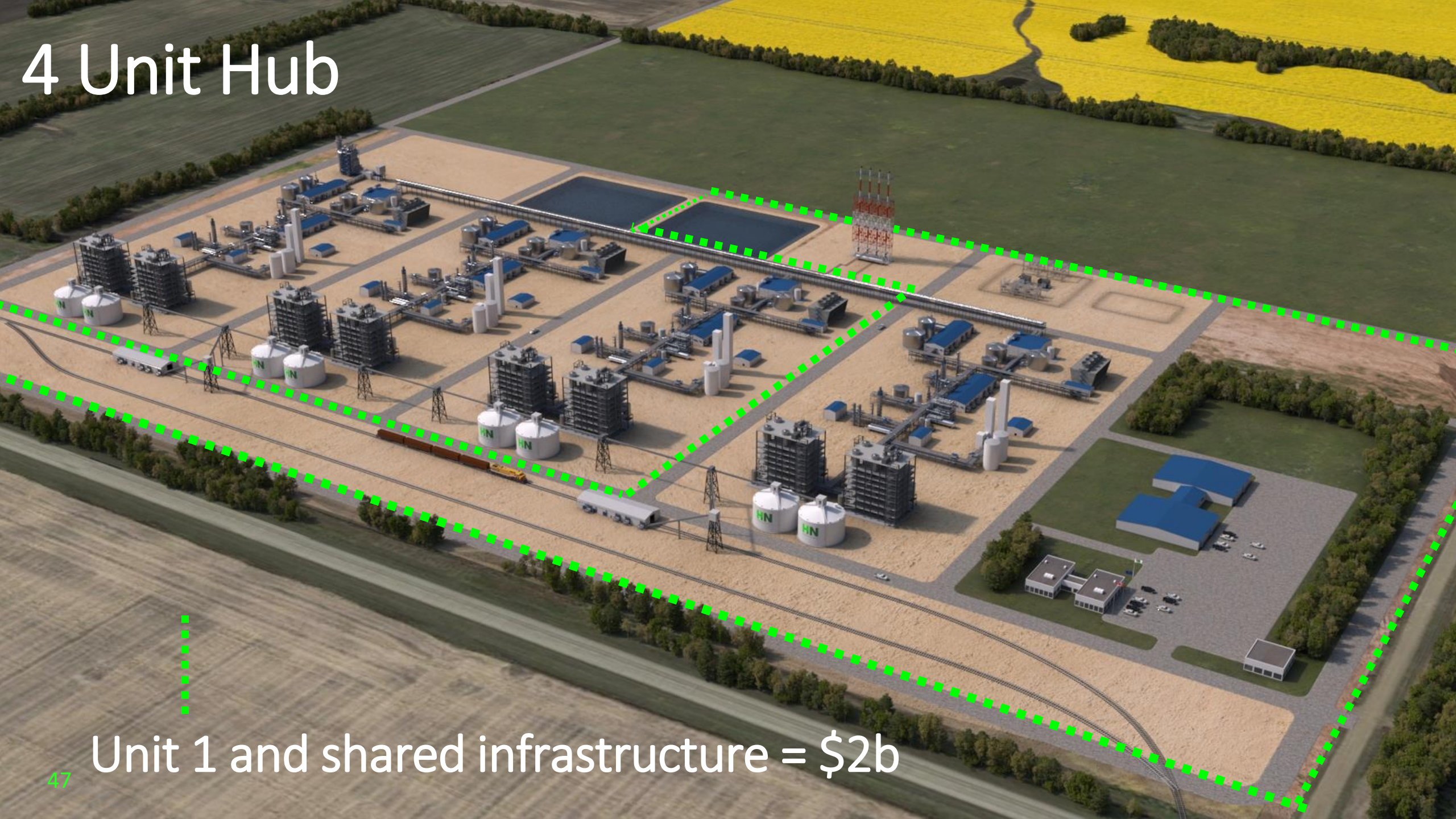


Hub 1: Alberta's Industrial Heartland

- **Operational CO_2 sequestration**
- **Efficient** rail fibre transport
- **Large Bright Green H_2 market**
  - **Values carbon negative attributes**



4 Unit Hub



Unit 1 and shared infrastructure = $2b

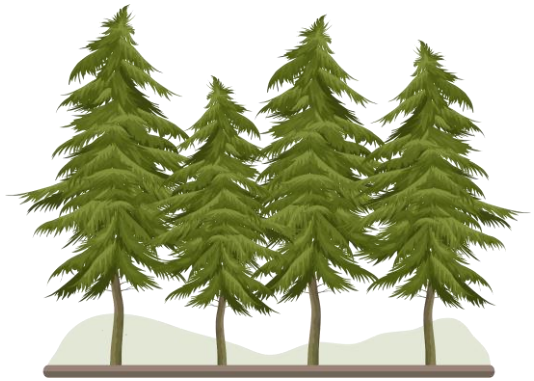
	Each Hub	Each Unit (4 units/Hub)
Raw Fibre	4,000,000 m^3	1,000,000 m^3
Pellet Volume	2,400,000 t/yr	600,000 t/yr
Harvest area	22,800 hectares	5,700 hectares
CO_2 Sequestered (gross)	**4,000,000 tCO_2/yr**	**1,000,000 tCO_2/yr**
Negative emission hydrogen	**160,000 t/yr**	**40,000 t/yr**
Capital Cost	**$6b**	**$2b (unit 1, units 2-4 $1.3b/unit)**
Operating Employment	**2,400**	**600**

1 million cubic meters of wood ~ 1 Mt CO_2

BC annual harvest ~75 times this amount

Canada: 9% of world's forests, taking CO_2 out of air

60M tonnes/yr of CO_2 return to atmosphere



40M tonnes/yr of CO_2 return to atmosphere

CO_2

Lumber

Sawmill Residuals

Pulp or combustion

Low Value Residuals

Burnt or rots

CO_2

H2N Reduces Fuel for Wildfires

~3X emissions from all other sectors in BC (62 Mt CO_2e)

Direct wildfire emissions:

2017: 184 Mt CO_2e/yr

2018: 214 Mt CO_2e/yr

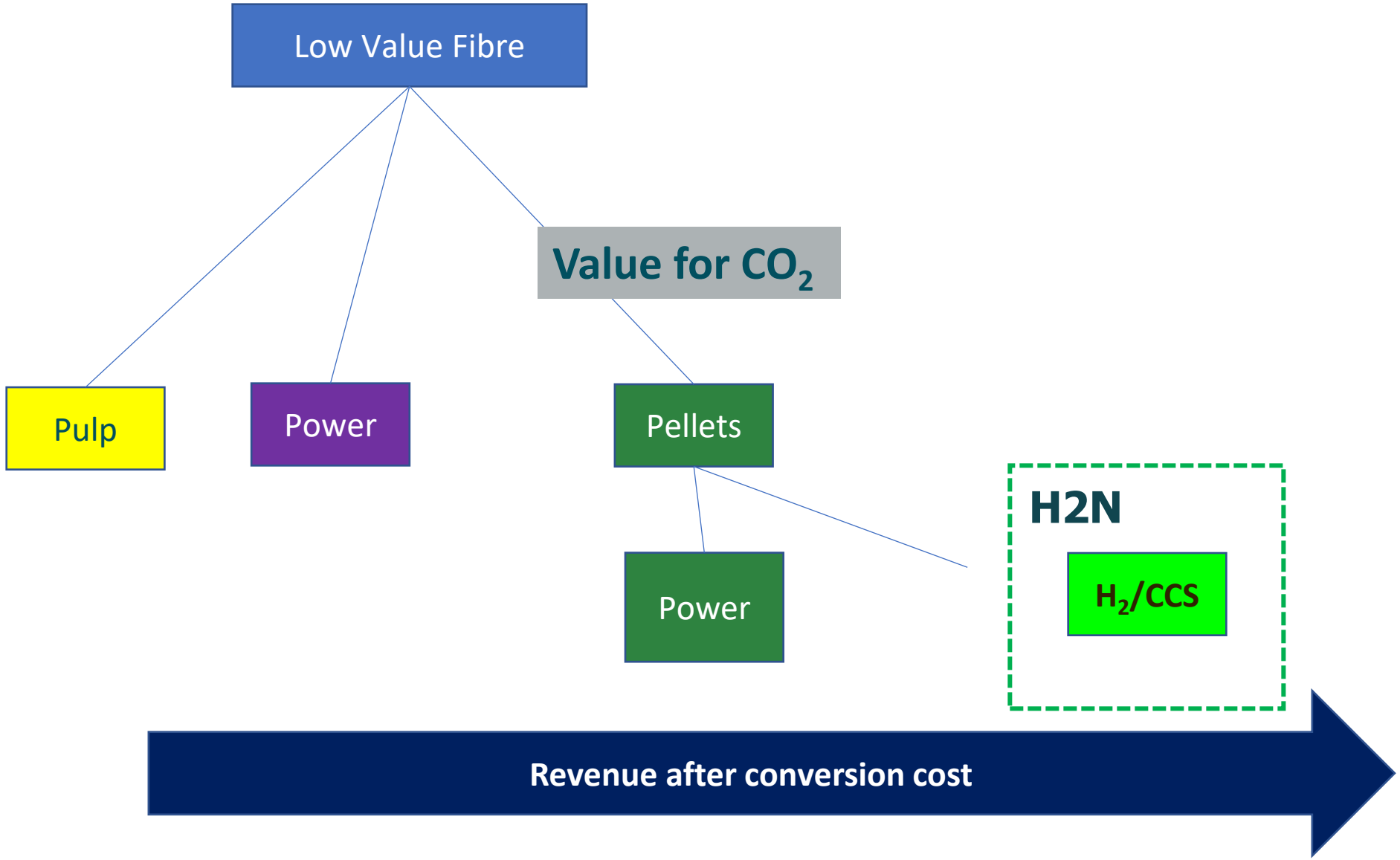
2021: 145 Mt CO_2e/yr (unpublished estimate)

+ delayed emissions from decay of fire-killed trees

Our 1st Fibre Supply Fort Neslon BC

- Timber Supply Area (TSA)
  - ~ 10 million ha (gross)
    - ~ 900k ha available for harvest
- Allowable annual cut 2.5 M m^3
- 60% Aspen

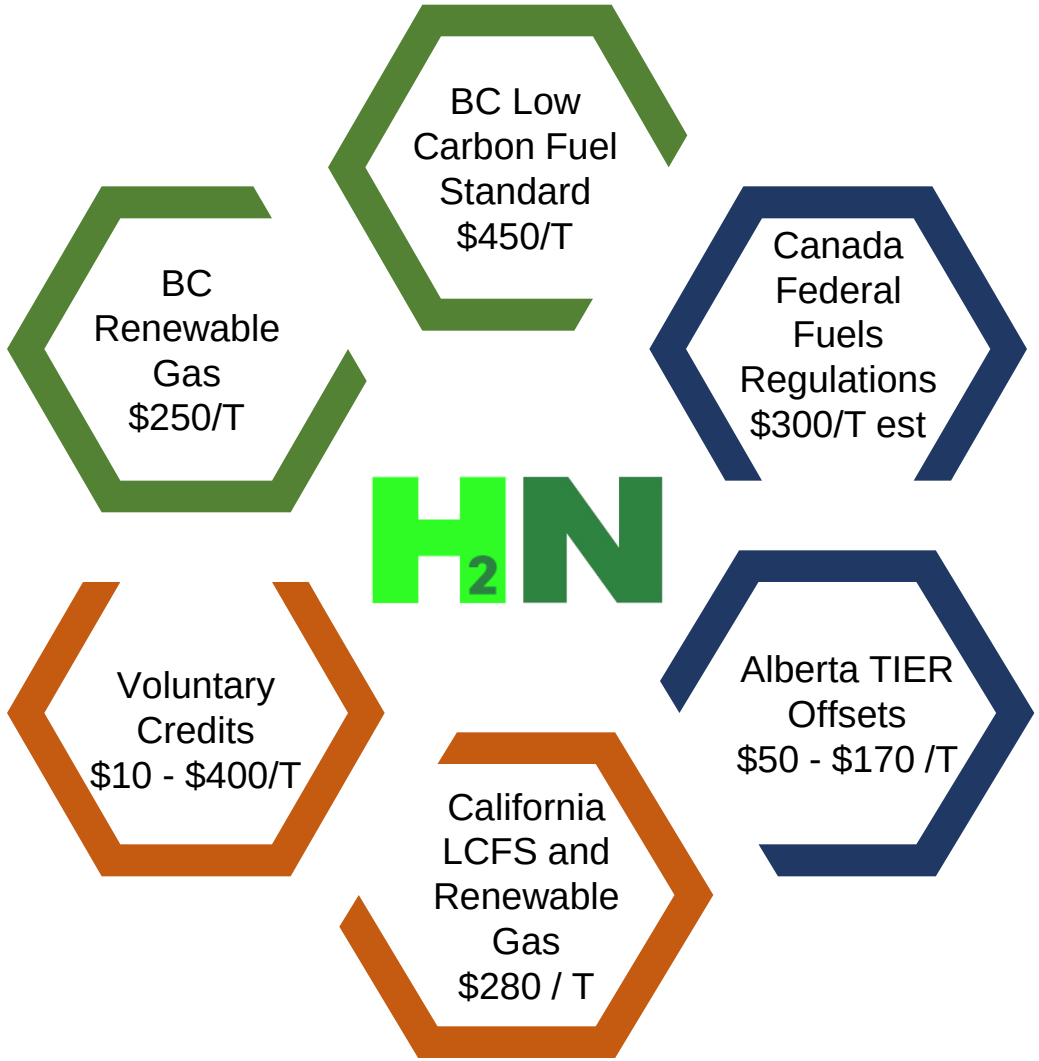
Preserve carbon attributes of fibre and use H_2 for refining



Carbon is more valuable than paper

Per ODMT	Pulp	Pellets to Power in UK	H2N with CCS
Pulp Sales	$500		
Electricity Sales @ $360/MWh		$720	
Carbon Offset Revenue		$250	$685
Hydrogen Revenue			$63
Total Revenue	**$500**	**$970**	**$748**
Non Fibre Operating Cost	$200	$806	$240
Freight Cost	$70	$80	
Margin available for Capital and Fibre	**$230**	**$84**	**$509**

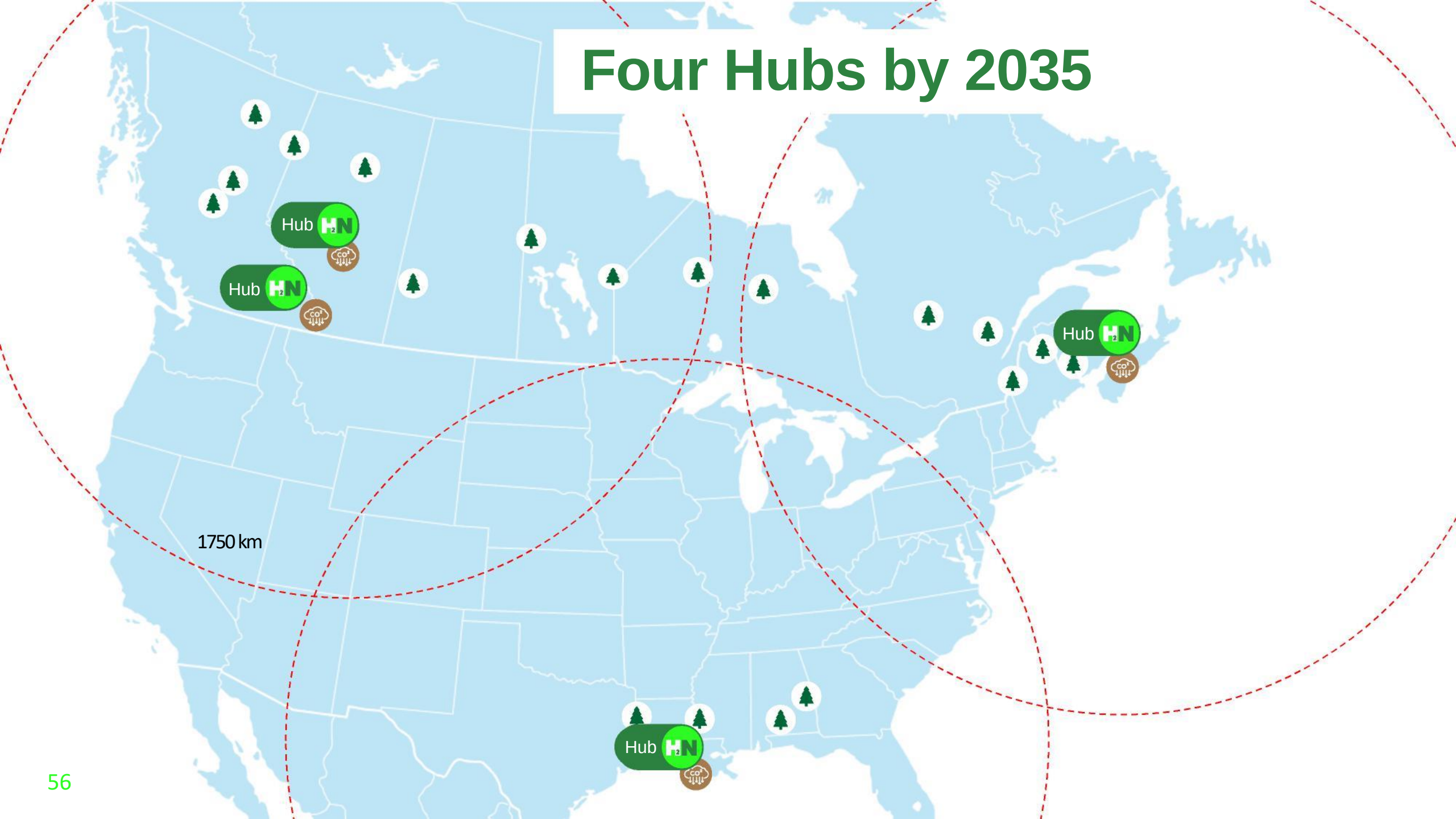
Carbon market opportunities



Legend:

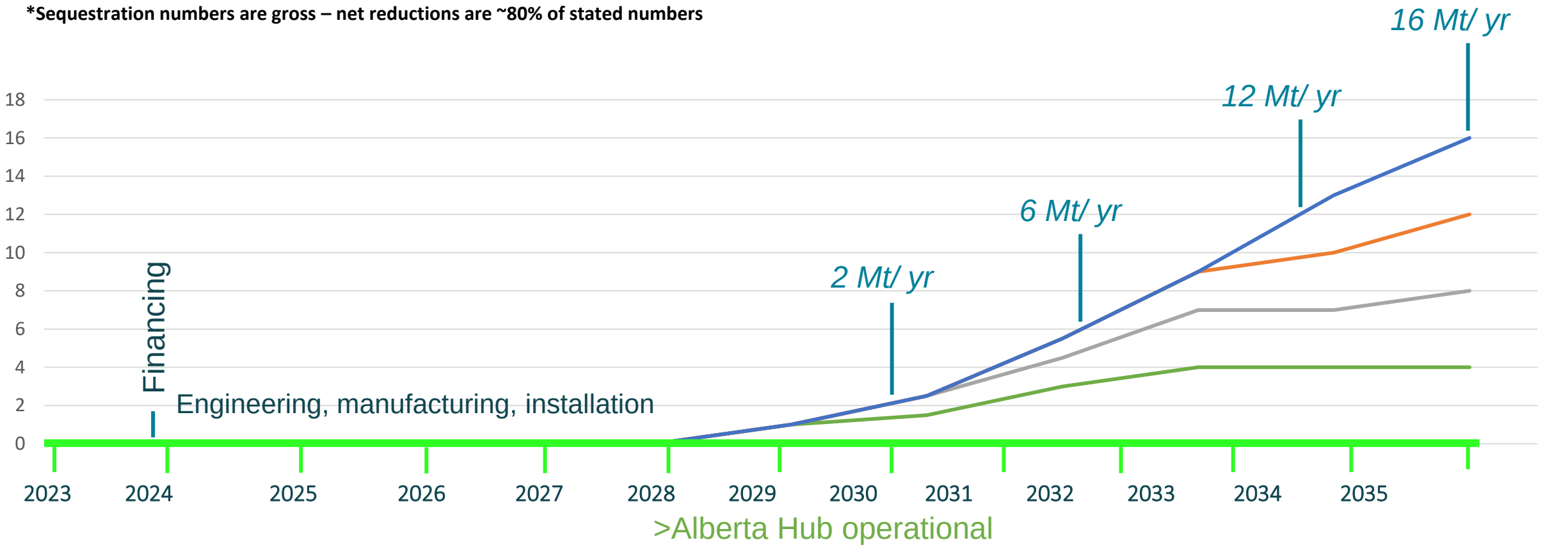
- Current markets, in discussions
- Current markets
- Future markets

Four Hubs by 2035



Scaling Up – CO_2 sequestered annually

***Sequestration numbers are gross – net reductions are ~80% of stated numbers**



then

now


North West Capital
Merchant Engineers

Problem

Unplanned emissions are a significant source of harmful GHGs

Many industrial sources of emissions are intermittently monitored (if at all)

Current reporting of emissions based on estimates and not measurements

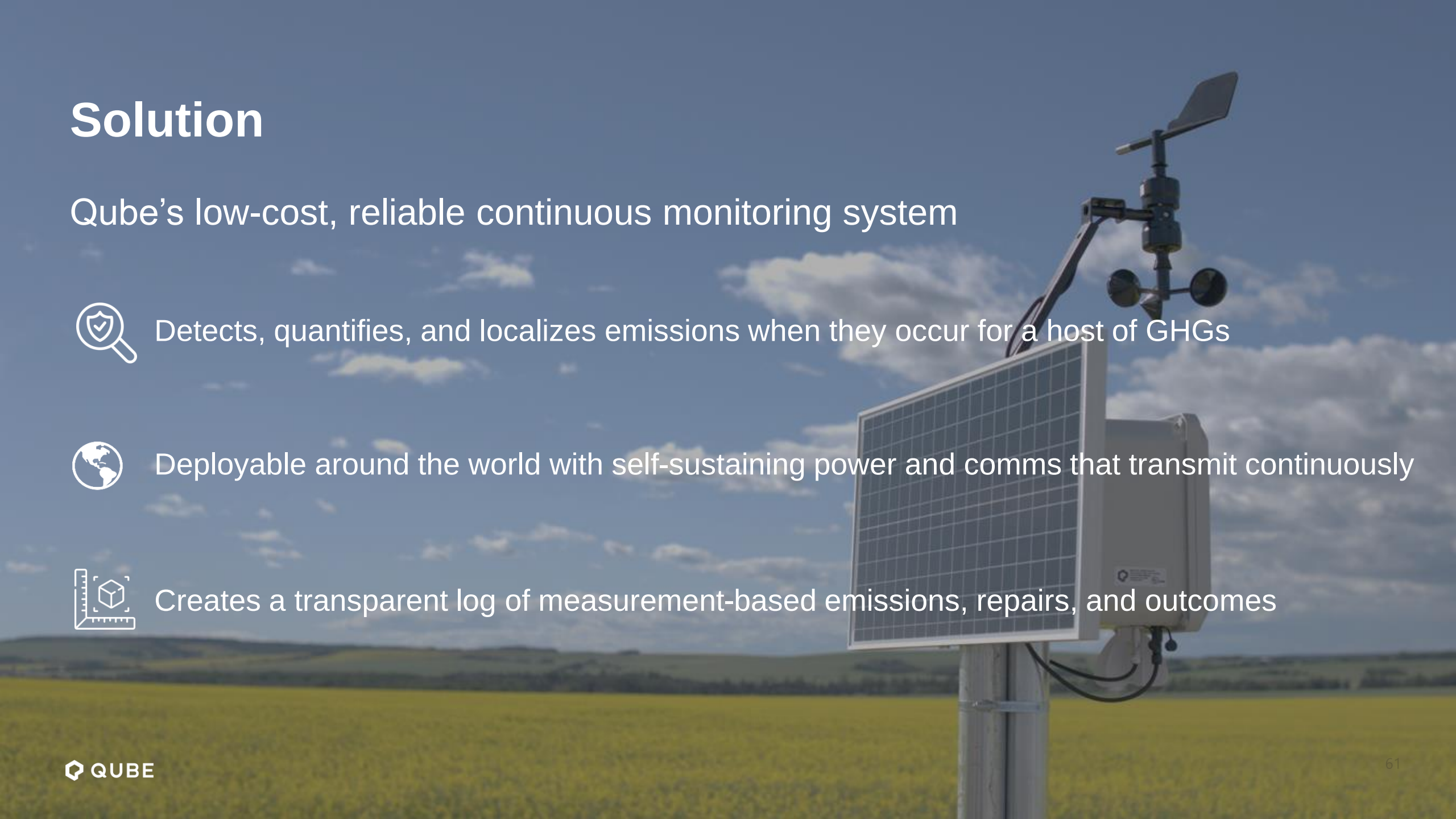
Solution

Qube’s low-cost, reliable continuous monitoring system

Detects, quantifies, and localizes emissions when they occur for a host of GHGs

Deployable around the world with self-sustaining power and comms that transmit continuously

Creates a transparent log of measurement-based emissions, repairs, and outcomes

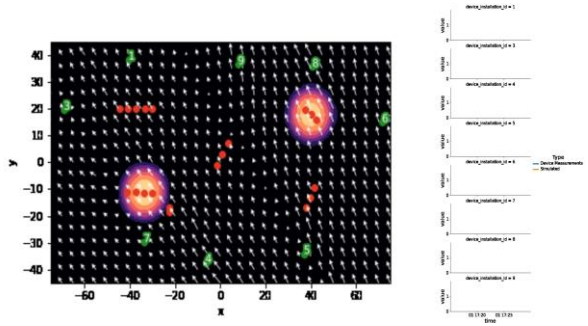


Quebe Provides

Hardware

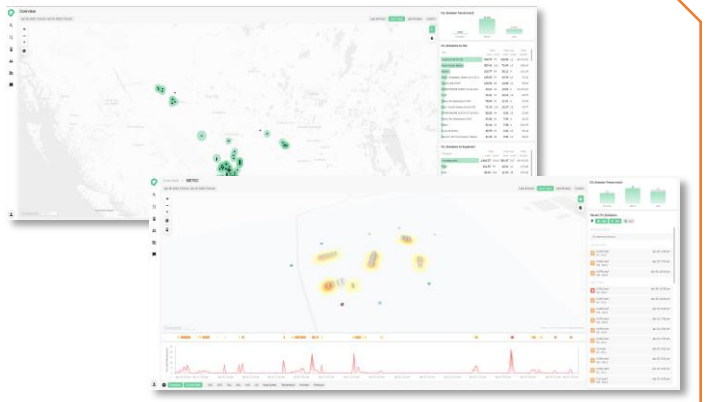
Reliable and low cost

Analytics



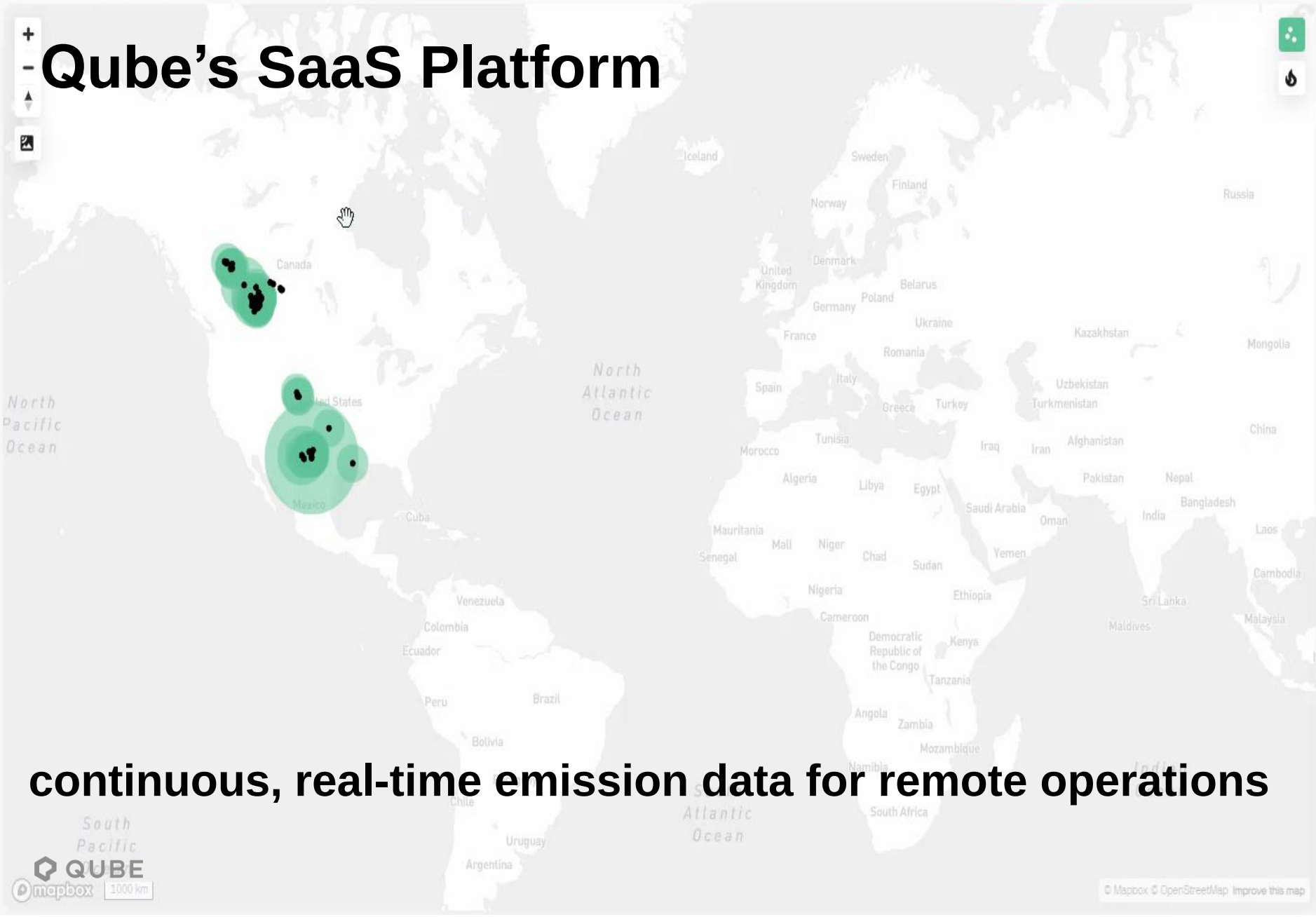
Accurately quantify emissions with AI

SaaS Platform



Investigate, manage and report in real-time

Qube's SaaS Platform



continuous, real-time emission data for remote operations

CH_4 Emission Trends (mscf)

CH_4 Emissions by Site

Site	Total mscf	Total count	Daily Avg mscf	Daily Avg count	Peak mscf/d
Hans Gruber Battery	114.11	15	114.11	15	308.14
Hunt - Strategery State Unit 4 23 C...	32.36	1	32.36	1	32.36
Edson	28.16	9	28.16	9	101.09
7-12	19.33	14	19.33	14	68.77
14-20-038-07W5	15.70	8	15.70	8	34.90
Texas Ten Deavenport E39	10.19	1	10.19	1	33.82
Texas Ten 39-40H	7.01	35	7.01	35	21.62
Texas Ten Deavenport W39	6.59	2	6.59	2	10.84
1-24 Battery	5.70	11	5.70	11	19.32
Gas Storage	5.28	2	5.28	2	55.67
STRATHMORE SOUTH 07-16-023-...	4.77	14	4.77	14	7.60
Crawford 38-7H TB	4.69	28	4.69	28	29.25

CH_4 Emissions by Equipment

Category	Total mscf	Total count	Daily Avg mscf	Daily Avg count	Peak mscf/d
Uncategorized	264.33	329	264.33	329	308.14
Tank	14.90	36	14.90	36	297.68
Separator	3.31	24	3.31	24	23.87
Flare	2.41	11	2.41	11	23.87
Compressor	1.58	3	1.58	3	70.81
Heater	0.90	6	0.90	6	3.54
Wellhead	0.53	5	0.53	5	6.06
Blowdown Vent	0.39	3	0.39	3	42.27
Treater	0.17	1	0.17	1	2.03