Intro to Proton Technologies

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We see huge hydrogen potential in Saskatchewan

Shifting Game Rules => Shifting Investor Focus

Risk Tolerance

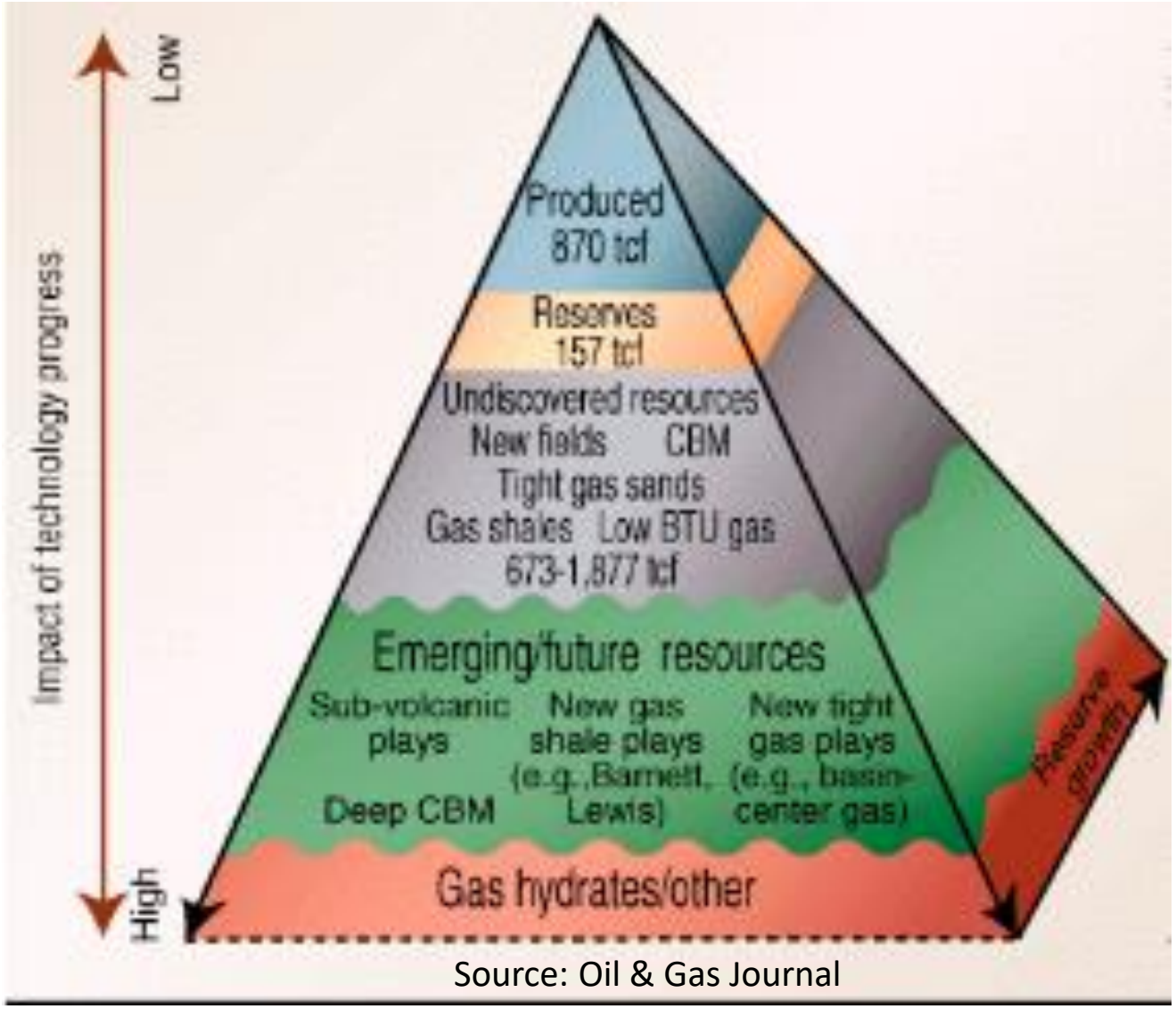
Pre-1973	• Explorationists	Highest (Exploration Portfolio)
’73- 90’s	• Engineers	
90’s-2014	• Accountants/Landmen	
’14-’17	• Litigators/Cost Grinders	
’17-2020	• Regulators	Lowest (Stagnation)
2020+	• Technology	Highest again (Tech Portfolios)

The Resource Pyramid: Fat Bottom

Explorationists are correct:
Resources are unfathomably vast
New large discoveries ongoing

but

Investors gravitate toward:
Simplistic financial models
Cost grinding
Existing assets and infrastructure
Proven models and incumbents
Perceived zero risk



Source: Oil & Gas Journal

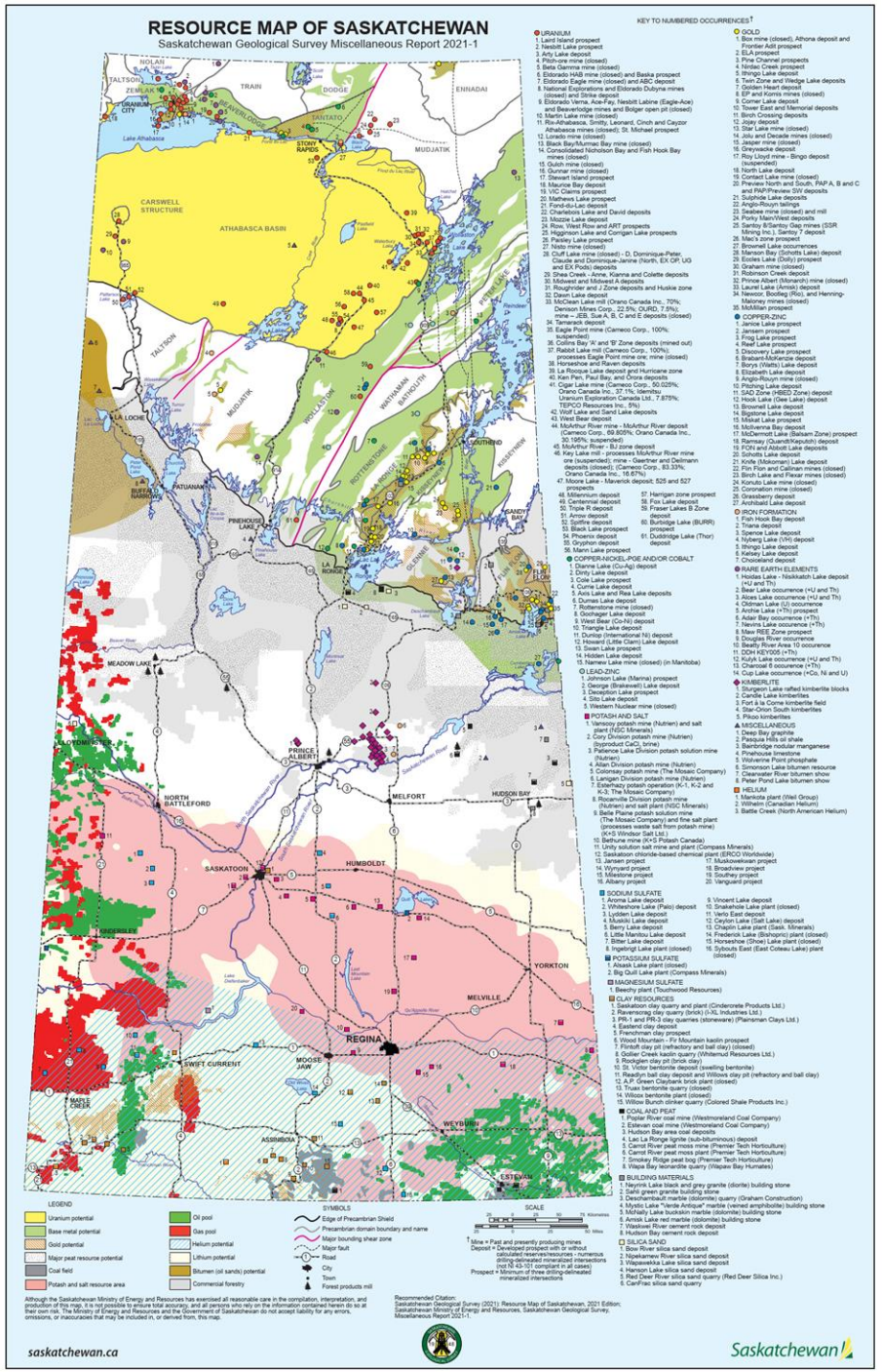
Reality of Huge Canadian Statistical Plays

- High decline or energy (carbon) intensive
- Low average well productivity (mature basin in compression)
- Winter and breakup add delays and costs
- Perceived egress/market challenge
- Political risk: royalty tinkering, changing framework, regulatory uncertainty, CO2 cost, huge government deficits
- Investor shift away from carbon energy products

This is our Gameboard

Main Outline:

- What's the carbon for anyway?
- Highlights of Proton's process
- Future we are building



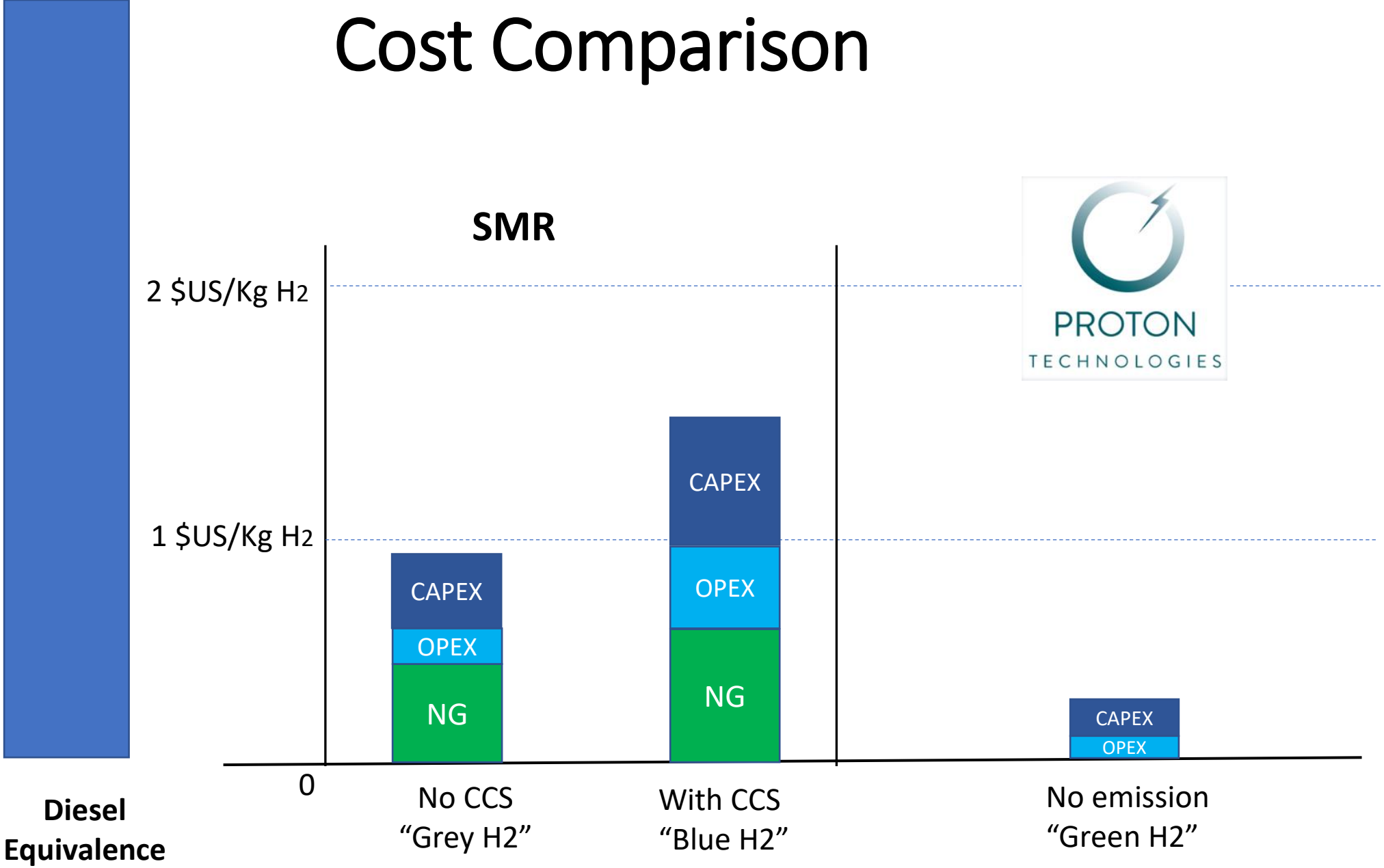
Crude way to do it; inefficiency of carbon How it is still done today

- Find oil that flows or make it flow
- Move it to (usually distant) refinery
- Move natural gas to refinery and burn it to get H2 and heat
- Add H2 into hot crude oil and density separate various kinds
- Transport refined oil a long way to retail fuel station
- Carry refined oil in vehicle tanks and slowly oxidize it within engine cylinders

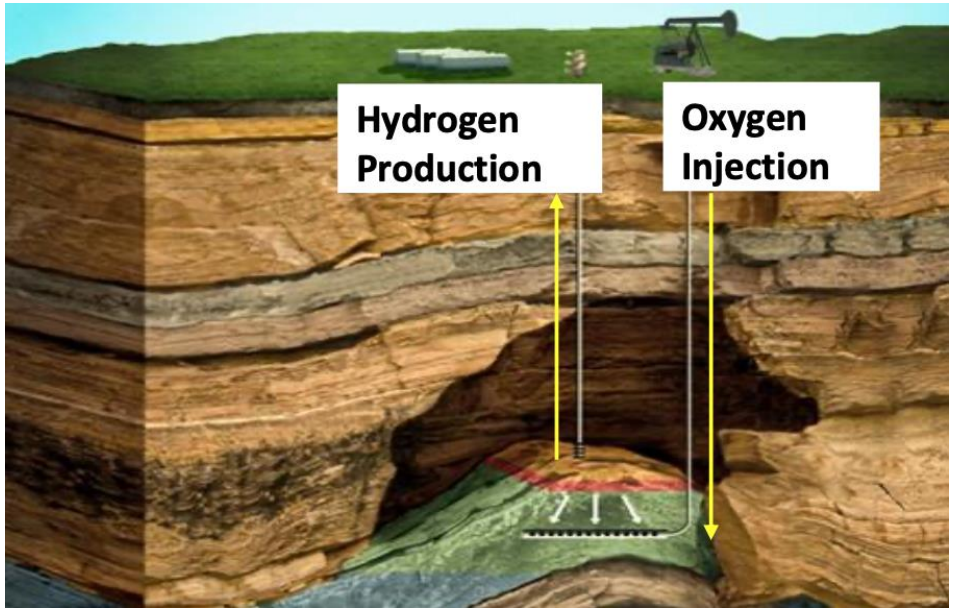
Carbon adds only friction, mass, controversy

- In great-granny's time, there were no good hydrogen tanks for vehicles
- C is 6 x mass of H in oil
- Moving C all over the place is not needed
- Oil is viscous, needs big pumps vs H2 (low friction)
- Flaring, fugitive emissions, nanoparticles of magnetite

Cost Comparison



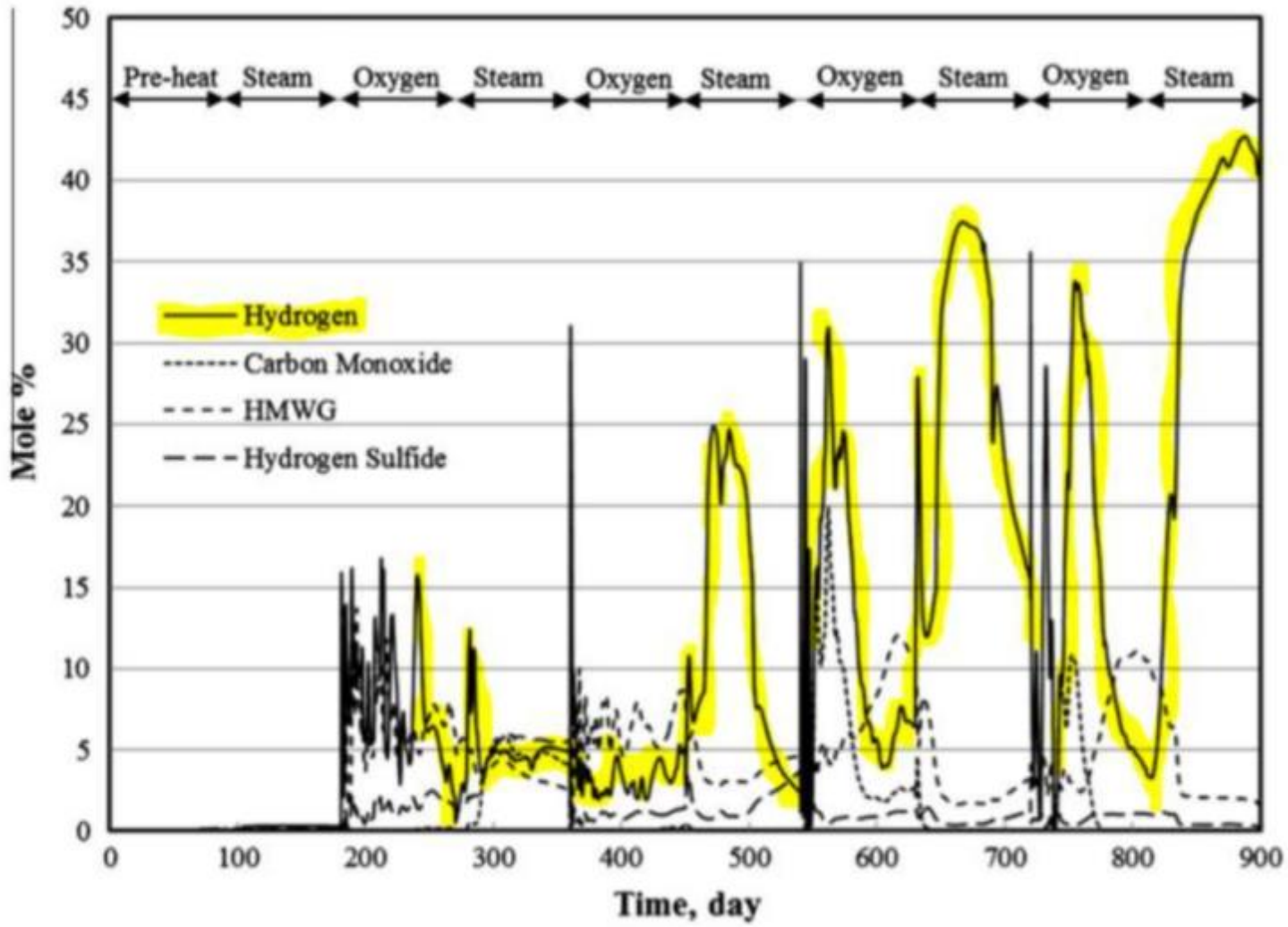
Utilizing Proven Technologies



In-Situ Combustion (ISC)
Reliable technique used for heating oil flows more easily to wells
Always creates H2 underground with examples worldwide (geological H2 losses are calculated)

Steam-Methane Reforming (SMR)
Eighty-five-year-old technique of burning methane with steam and separating H2 using an H2 filter produces CO2, H2 always costs more than the methane using SMR

Don’t take my word for it
Marguerite Lake 1983



The Oxygen Plant

Turbo-expander required to cool air until O_2 becomes liquid

O_2 warms up and tries to turn back into a gas

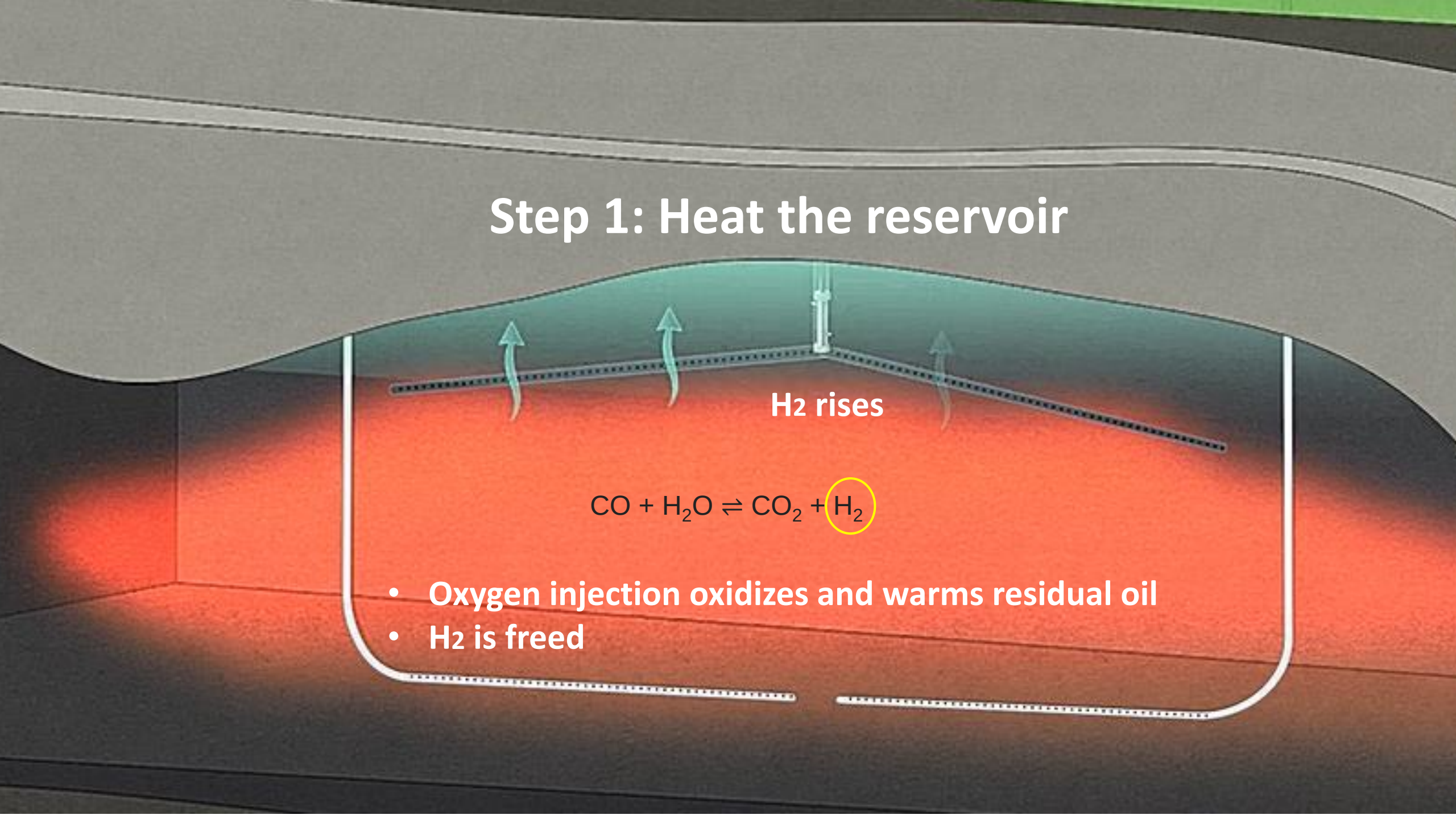
Volume expansion is what pressures the O_2 down the well into the reservoir

O_2 production is powered by our H_2

Main reactions

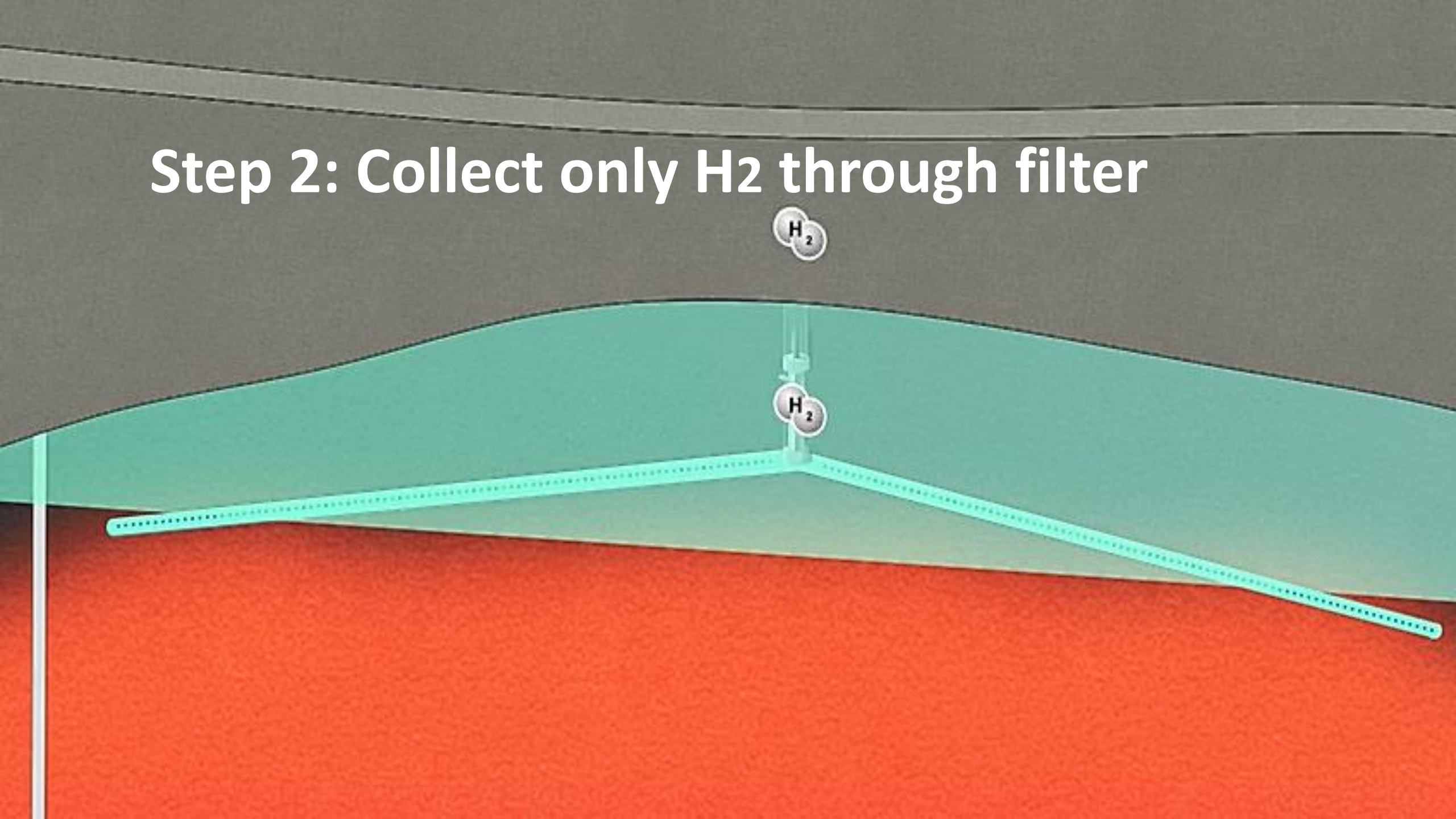
- **Partial oxidation**
- Aquathermalysis
- Pyrolysis
- Thermal decomposition
- **Gasification**
- **Water Gas Shift**

Step 1: Heat the reservoir



- Oxygen injection oxidizes and warms residual oil
- H_2 is freed

Step 2: Collect only H_2 through filter



CO2 volume in reservoir

- If Blue H2 advocates aren't worried, why should I be?

- Dissolves in bottom water
- miscible or immiscible within oil
- Forms carbonic acid
- Precipitates as carbonate rock

- Follow Directive 86 or equivalent

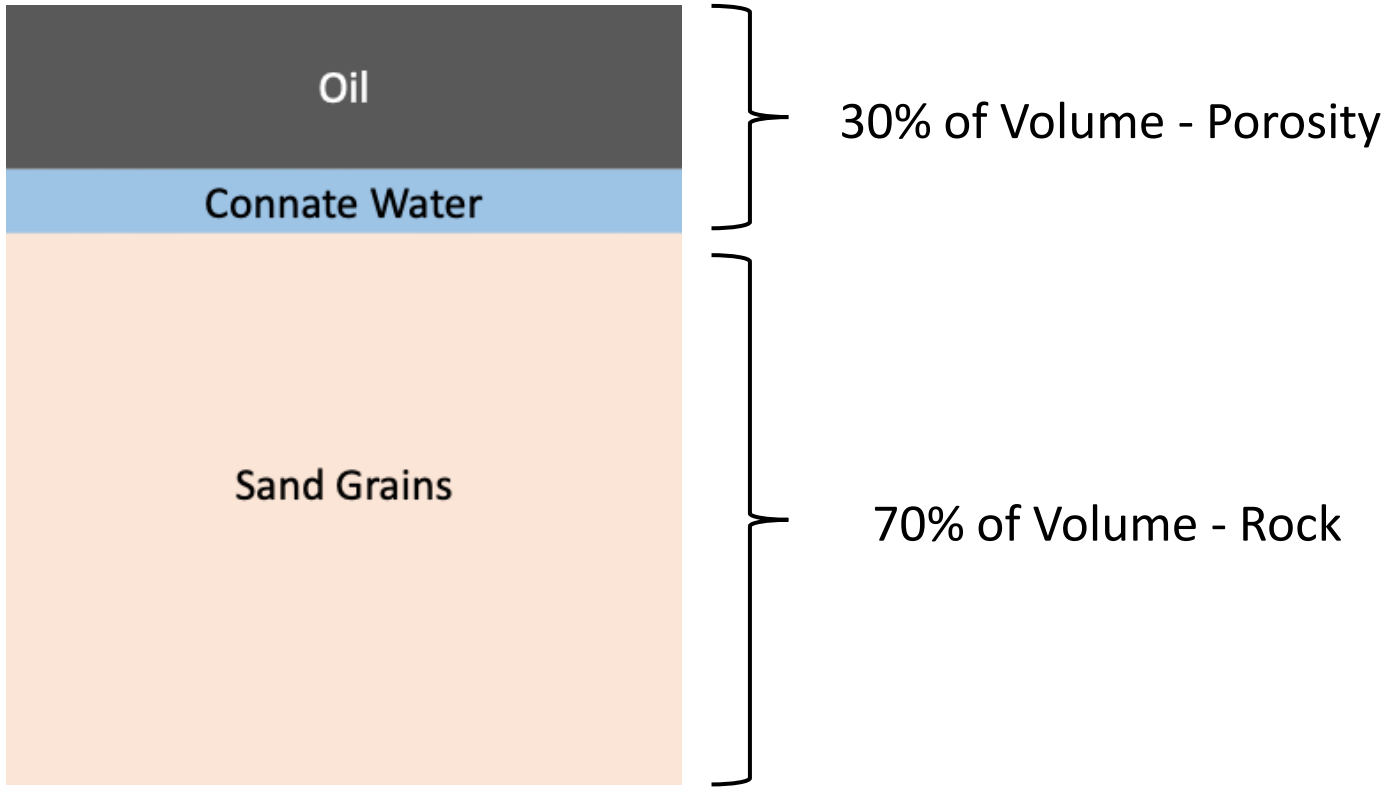
Iceland turns carbon dioxide to rock for cleaner air

JEREMIE RICHARD
AGENCE FRANCE-PRESSE

On the Hengill Volcano, Iceland / Fri, May 10, 2019 / 01:01 am

Reservoir Breakdown

200 Million Bbl in Place
=
Roughly 50 Years at 500 Tonne/Day H_2



Heating the Reservoir take 9% of Energy Released,
Leaving 91% of Energy for Generating H_2

Energy Balance

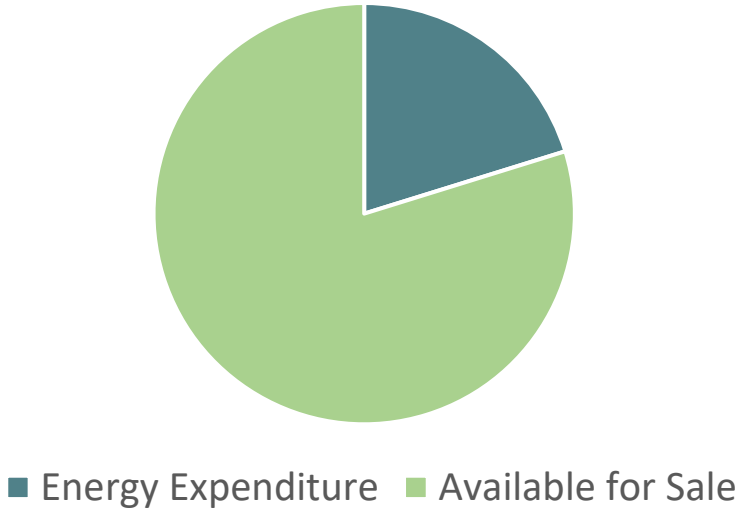
Combustion

Releases 70,000 GJ/Day of Thermal Energy, ***Assuming*** *140 GJ/Tonne H_2*

Output

500 Tonne/Day H_2

5500 Tonne/Day CO_2, (Stoichiometry)



<u>Available for Sale</u>

60,000 GJ/Day H2

<u>Energy Expenditure</u>

10,000 GJ/Day Running Turbo Expander

5200 GJ/Day Separating and Injecting O_2

PROTON TECHNOLOGIES

Lab Demo Outcome

Lab tests confirmed hydrogen flux rates through proton membrane, producing 99.99% pure hydrogen flame

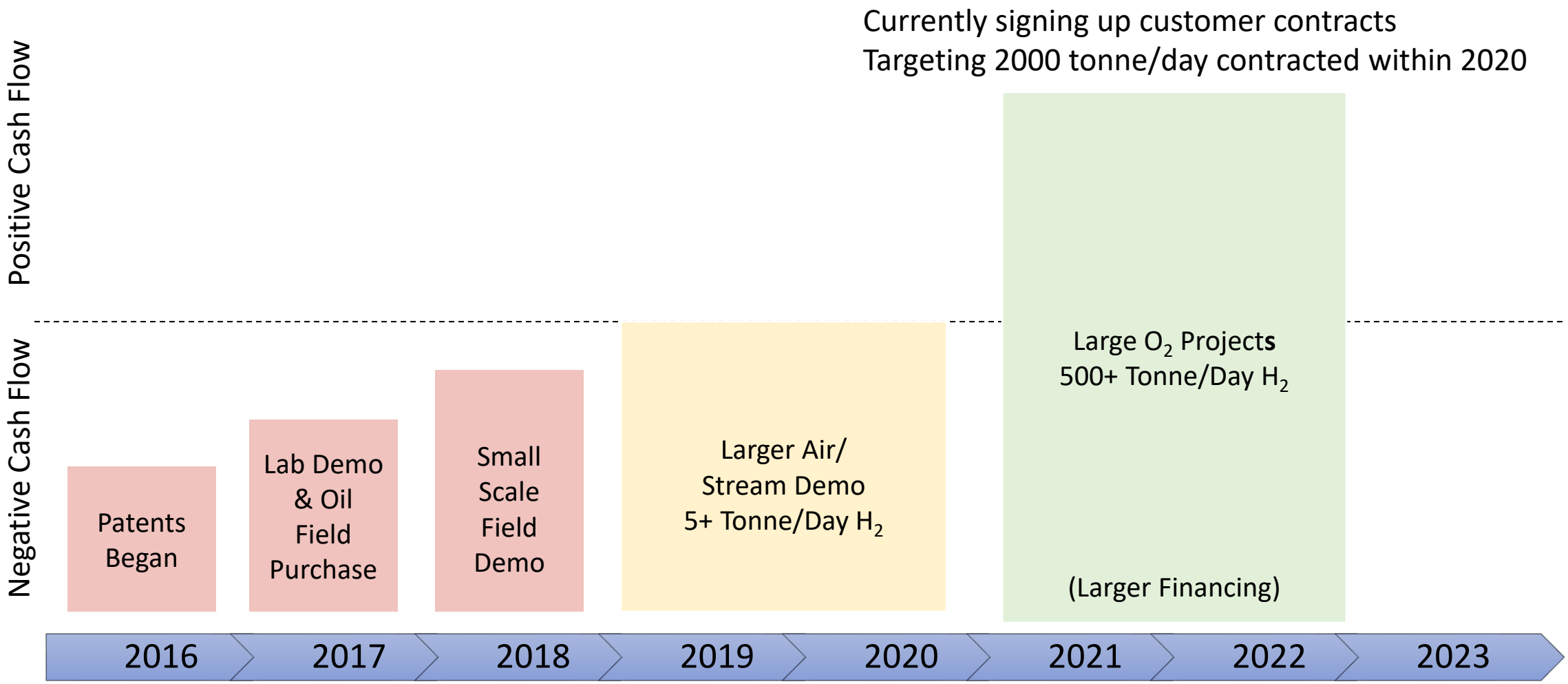
Flux rates were then applied to reservoir simulation models

Field Demo Outcome

Membrane unit worked with field produced gas (H_2S)

H_2 production rates confirmed lab test results

Growth Trajectory (Canada)



Sask Resource Potential?

40 billion barrels can give 100,000 tonne/d H2 for 50 years

- Even a small fraction of this clean energy potential is clearly worth pursuing to fix our economy, restore jobs, and attract capital

Advisory Board

Dr Ian Gates

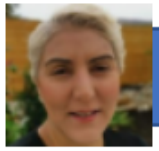
Ex-Imperial Co-Founder of Gushor, Solideum and Proton.
Serial Entrepreneur
Former Dept. Head of Chemical Engineering

Jingyi (Jacky) Wang

Chemical Engineering
U of C Research

Dr Harrie Vredendurg

Professor/Scholar on Governance, Strategy, Sustainable Development
Suncor Chair at Haskayne School of Business



Dr Diana Marcano

Petro-physicist
German Researcher on Membrane Separation

John Howard

Ex-CNRL
VP Production for Up to 150,000 Bbl/Day of Heavy Oil

Brian Harschnitz

Ex-Imperial Oil
On JACOS BOD, Recently Retired From JACOS as EVP 30,000 Bbl/Day Bitumen

Mark Bishop

KE Risk Group, Ex Transalta (trading) and CIBC (Energy Derivatives)

Calvin Johnson

Ex-CNRL, Athabasca, Facility Engineering, Project Management

Population of Earth is 7.8 billion people

Organic carcinogens and
nanoparticles of magnetite
build up in our brains and bodies

Air pollution has a 1/1000 chance
of killing any one of us
in any given year

Beyond tailpipe deaths:
dementia, cancer, reduced IQ,
stunted growth, chronic inflammation,
poor immune function…

https://www.theworldcounts.com/challenges/planet-earth/air/air-pollution-deaths-per-year/story