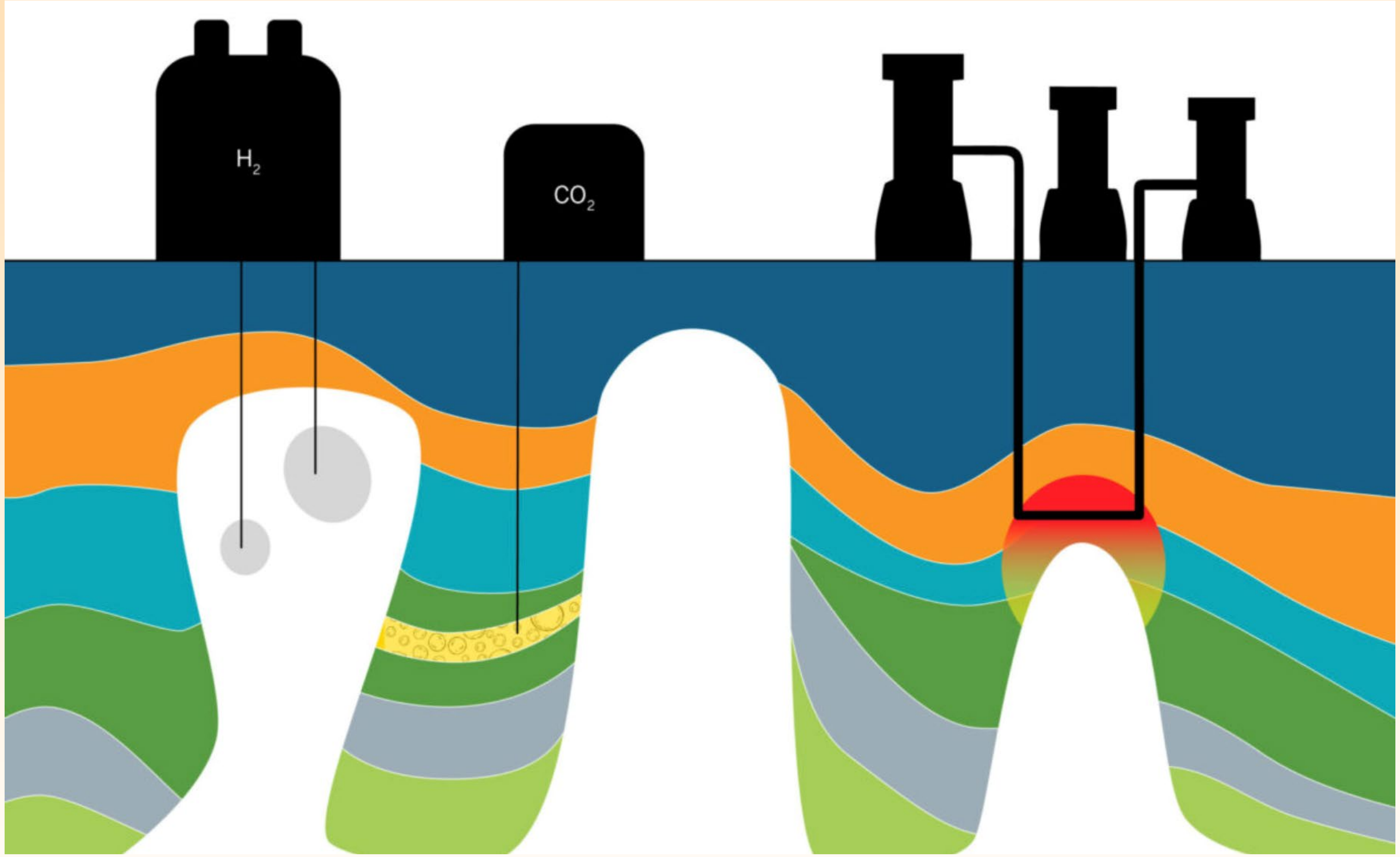

Subsurface H_2 Storage in Texas: Opportunities and Challenges

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State of Texas Advanced Resource Recovery

GeoH2

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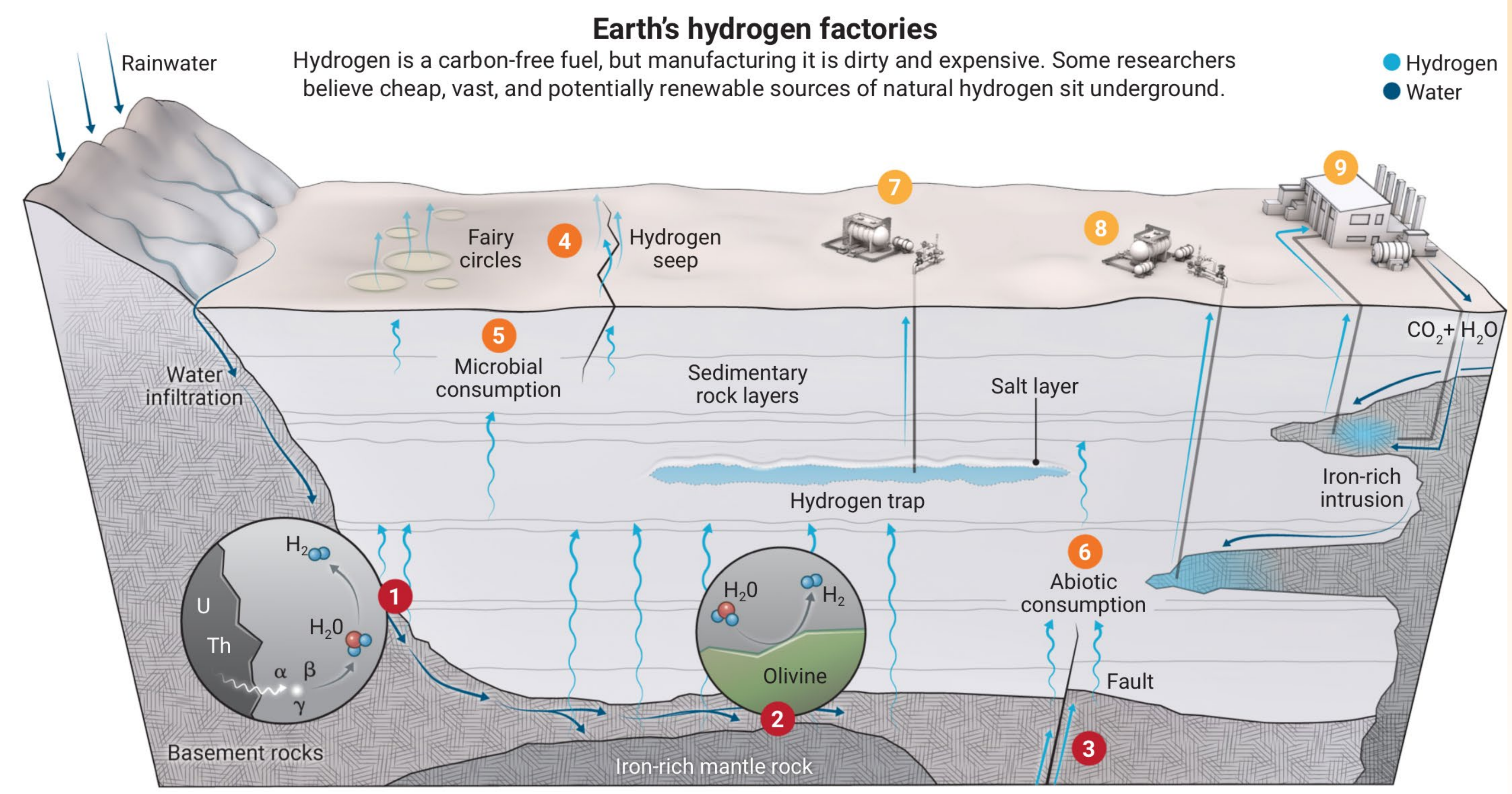
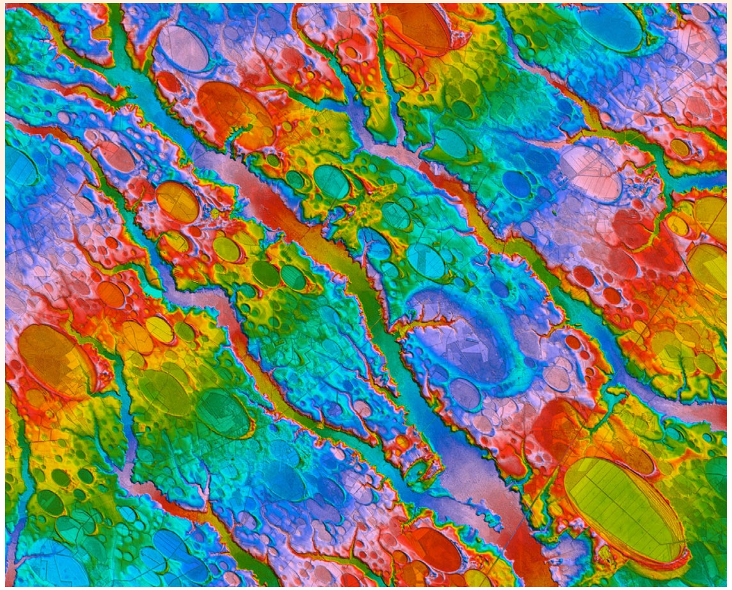
Natural Hydrogen& Geoengineered Hydrogen



Hand (2023) Science Article



Hydrogen Seepage (?) Coastal North Carolina

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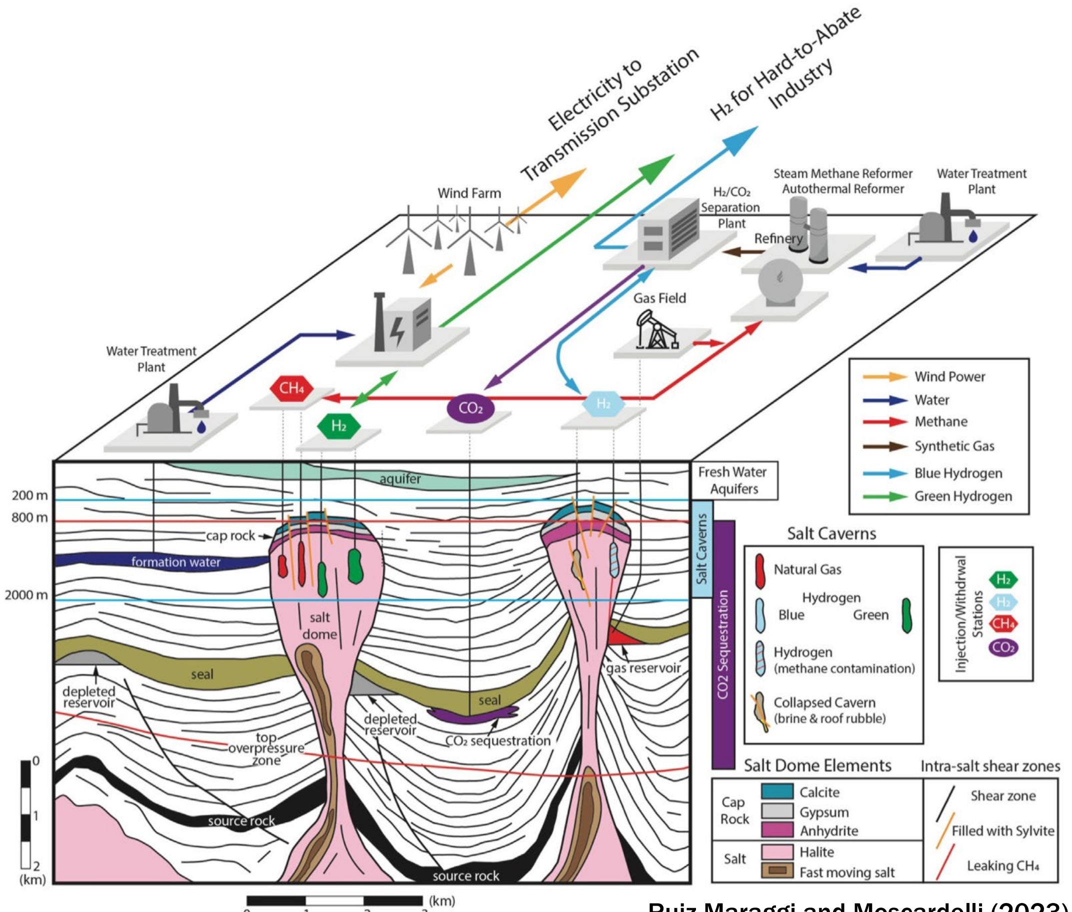
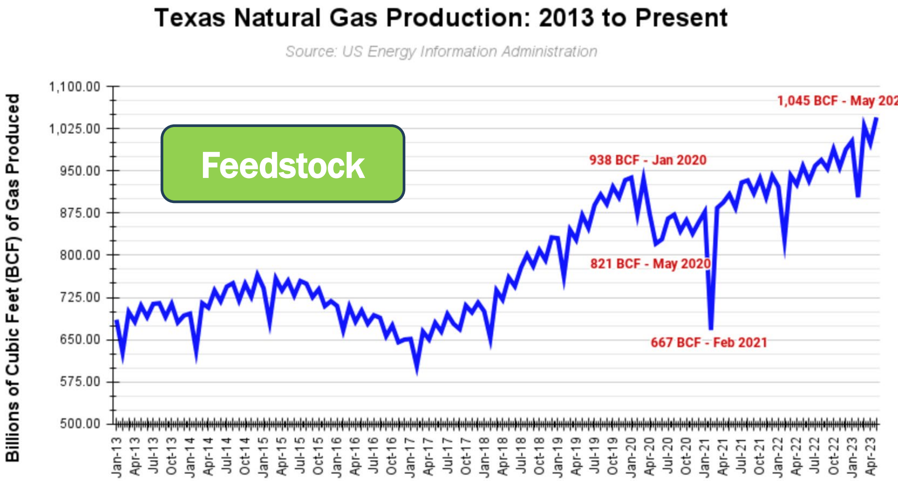
Leveraging Gulf Coast Assets for the Emerging Clean H_2 Economy in TX

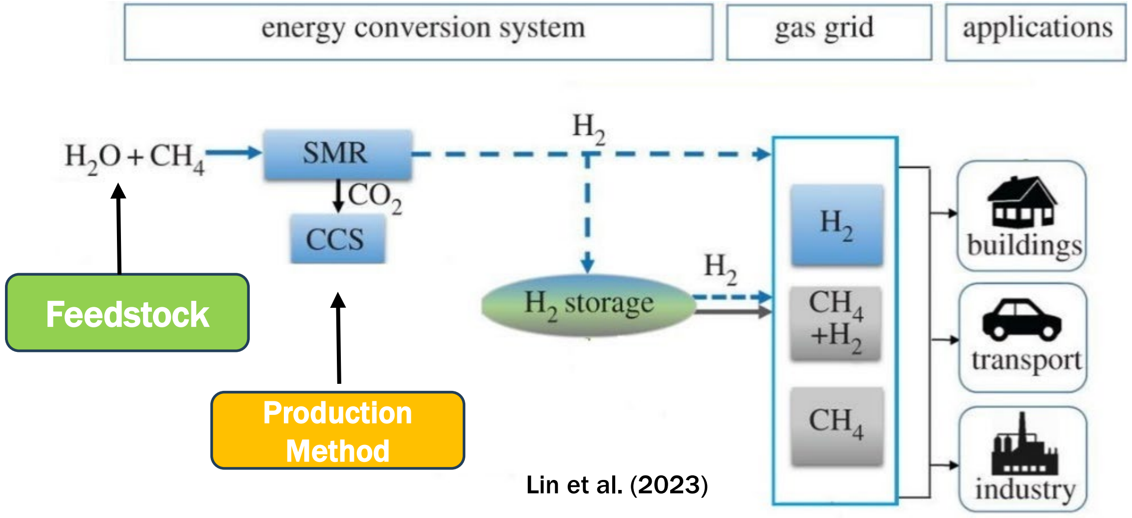
Hydrogen Value Chain

Feedstock | **Production Method** | **Storage** | **Transportation** | **Market**



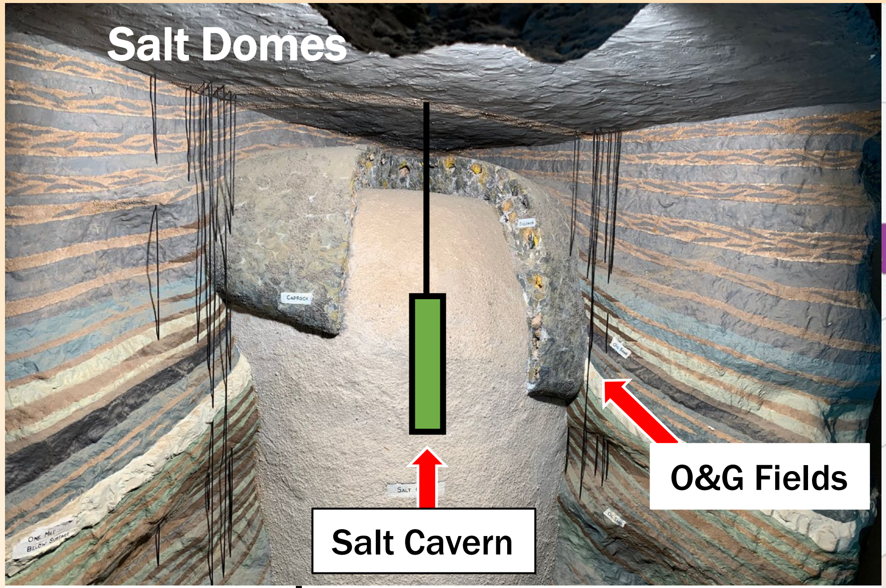
Ruiz Maraggi and Moscardelli (2023)

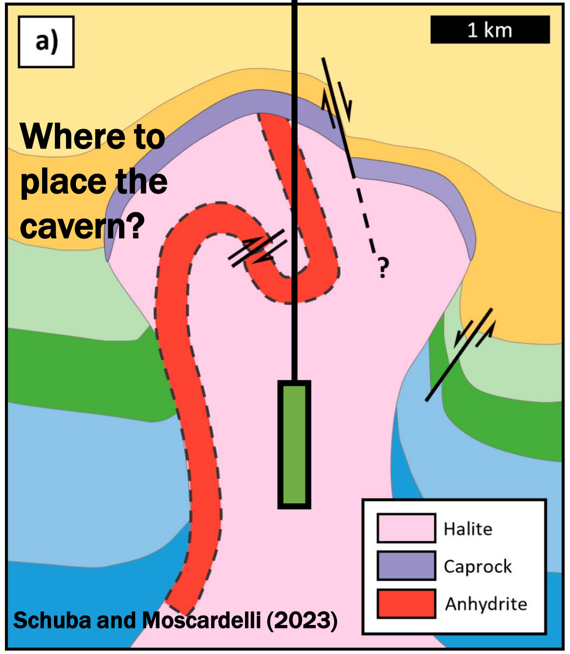


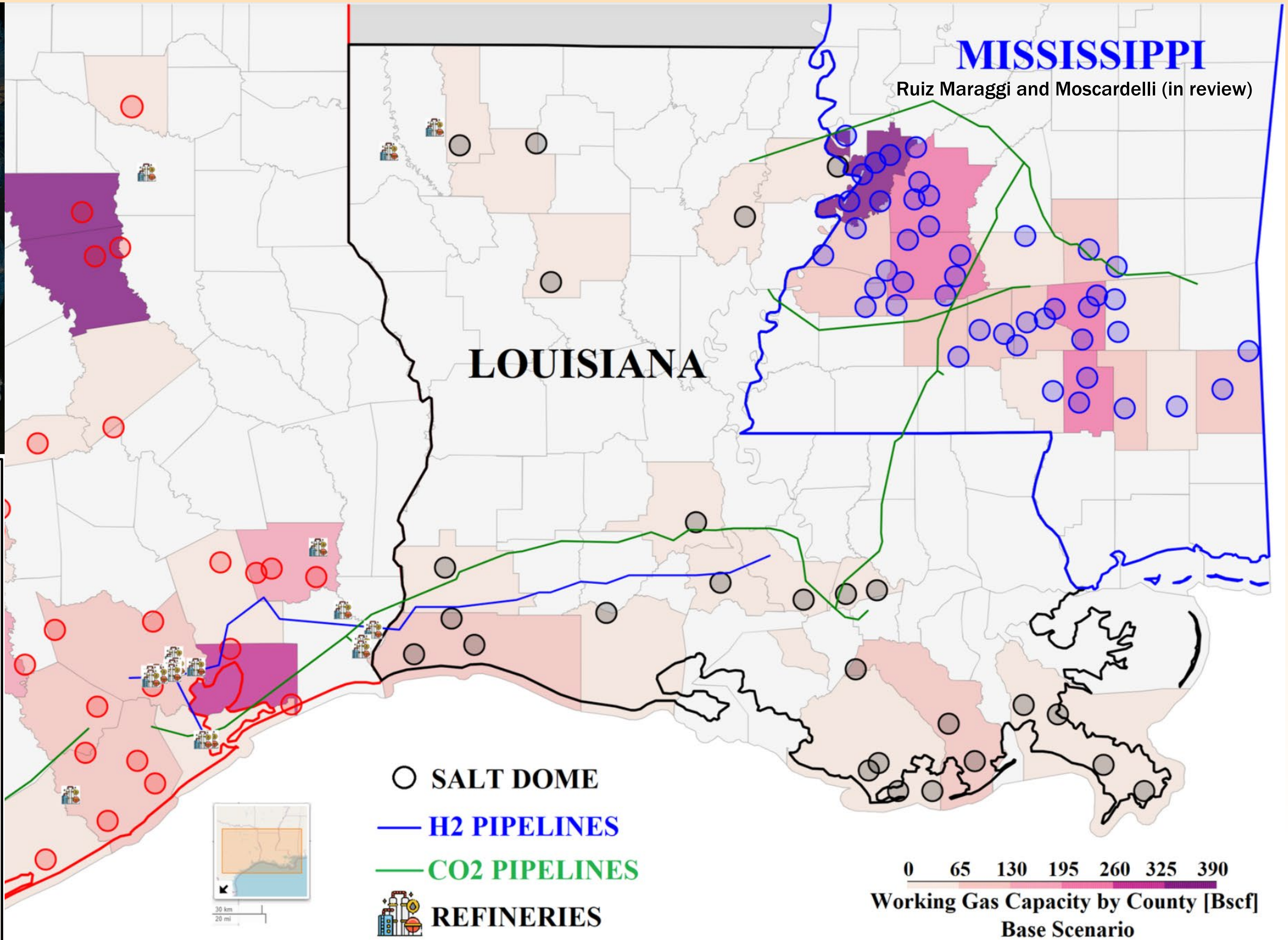


Lin et al. (2023)

Leveraging Gulf Coast Assets for the Emerging Clean H_2 Economy in TX

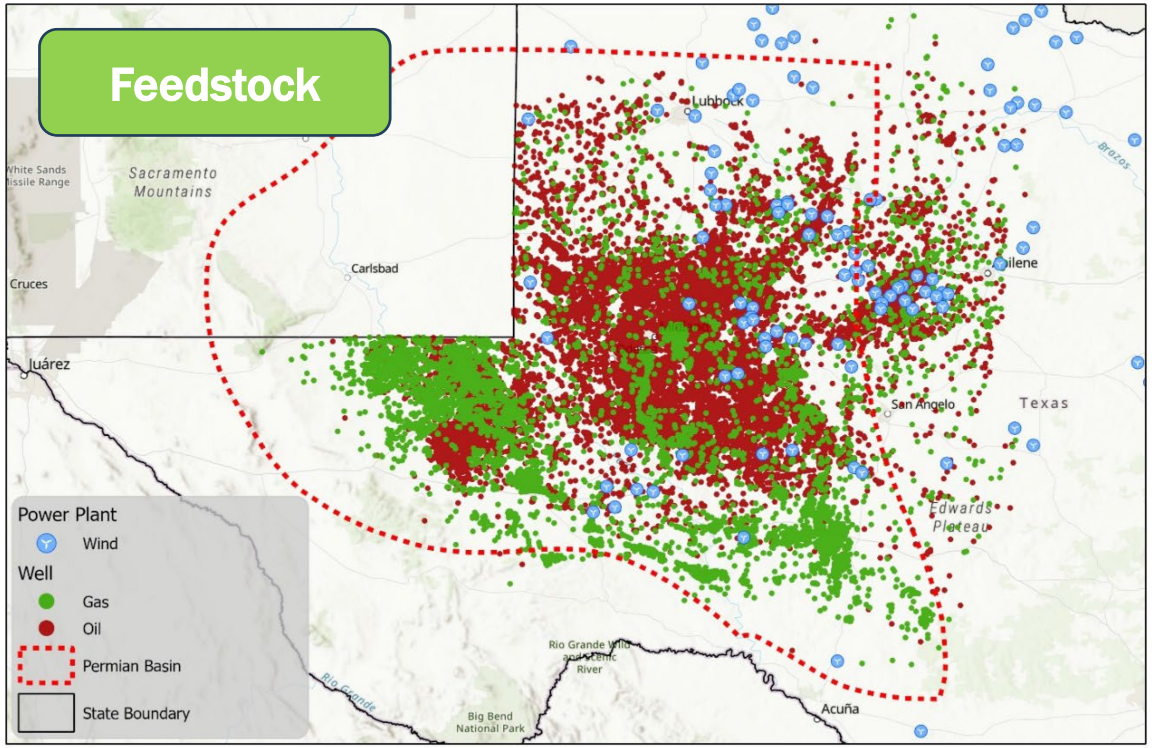






Leveraging Permian Basin Assets for the Emerging Clean H_2 Economy in TX

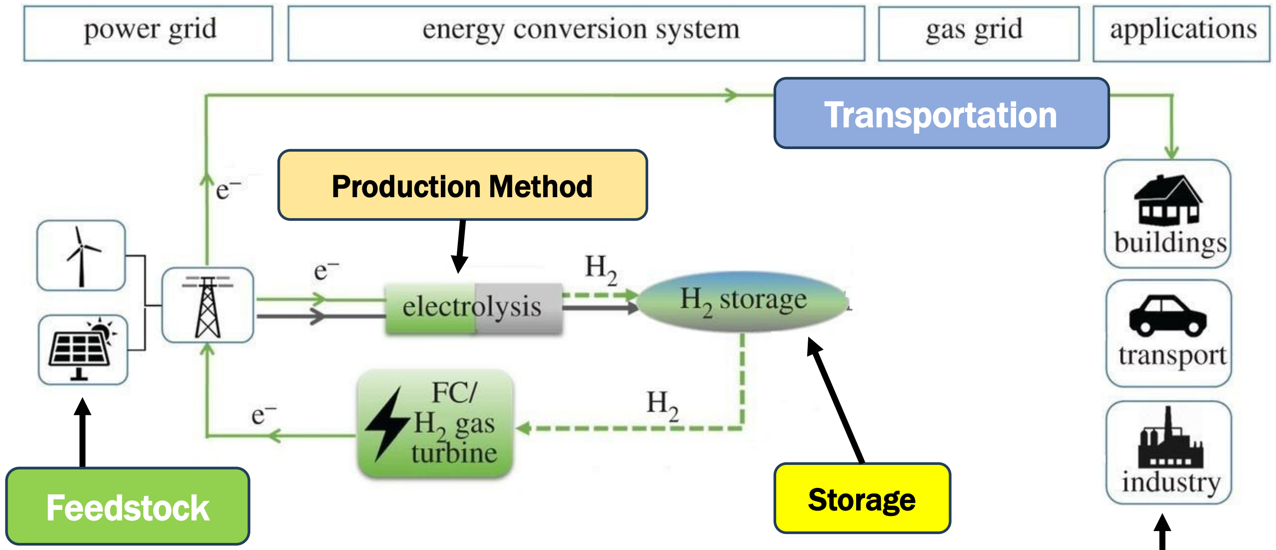
O&G + Renewable Energy

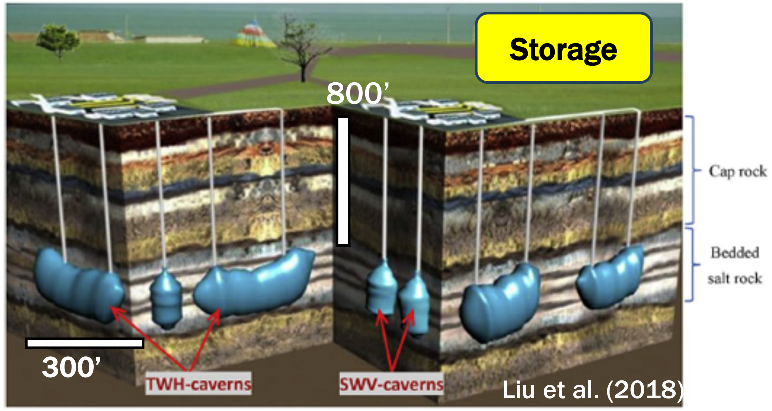


Production Tax Credit

Carbon Intensity ($kg\ CO_2e$ per $kg\ H_2$)	Max Hydrogen Production Tax Credit ($\$/kg\ H_2$)
4–2.5	\$0.60
2.5–1.5	\$0.75
1.5–0.45	\$1.00
0.45–0	\$3.00

Lin et al. (2023)





Market

?

ERCOT
Heavy Trucking
Fertilizers
To Houston ...
To Corpus ...

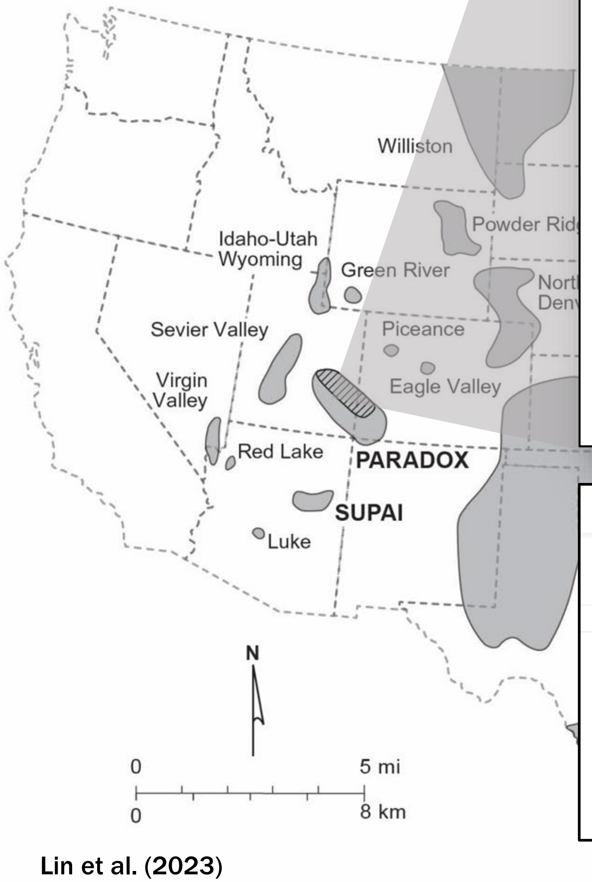
The Permian Basin of West Texas has several favorable conditions to develop a hydrogen economy

Bureau of Economic Geology

GeoH₂

Hydrogen Stora Advantages and Disadvantages

There are geographic limitations to H_2 storage in salt caverns



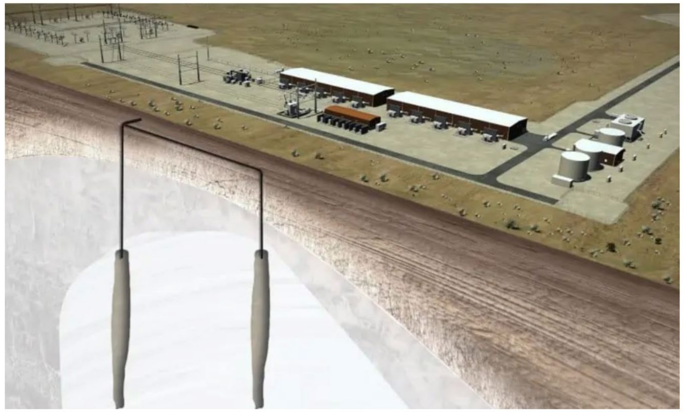
Lin et al. (2023)

World's largest underground hydrogen storage project

Mitsubishi Power Americas and Magnum Development are set to begin construction on a 300 GWh underground storage facility in the US state of Utah. It will consist of two caverns with capacities of 150 GWh, to store hydrogen generated by an adjacent 840 MW hydrogen-capable gas turbine combined cycle power plant.

AUGUST 4, 2022 EMILIANO BELLINI

ENERGY STORAGE HIGHLIGHTS HYDROGEN TECHNOLOGY AND R&D UTILITY SCALE STORAGE UNITED STATES



The project will use Utah's unique geological salt domes to store green hydrogen in two massive salt caverns.

Image: Mitsubishi Power

MITSUBISHI POWER

Mitsubishi Power Americas

PRODUCTS

HOME - NEWS - MITSUBISHI POWER WELCOMES CHEVRON AS PARTNER IN THE ADVANCED CLEAN ENERGY STORAGE PROJECT

NEWS

Mitsubishi Power Welcomes Chevron as Partner in the Advanced Clean Energy Storage Project

2023-09-12

TABLE 20.2 Metrics of Hydrogen Caverns in the United States and the United Kingdom [10]

	Teesside (UK)	Clemens Dome, Texas (USA)	Moss Bluff, Texas (USA)	Spindletop, Texas (USA)
Salt formation	Bedded salt	Salt dome	Salt dome	Salt dome
Operator	Sabic Petrochem.	Chevron Phillips Chemical Comp.	Praxair	Air Liquide
Commissioned	1972	1986	2007	information not available
Geometrical volume/m^3	210 000	580 000	566 000	906 000
Mean cavern depth/m	365	1 000	1 200	1 340
Pressure range/10^5 Pa (bar)	45	70–137	55–152	68–202
Net energy stored/GW h	27	81	123	274
Amount of H_2/t	810	2 400	3 690	8 230
Net volume/m^3 (std)	9.12×10^6	27.3×10^6	41.5×10^6	92.6×10^6

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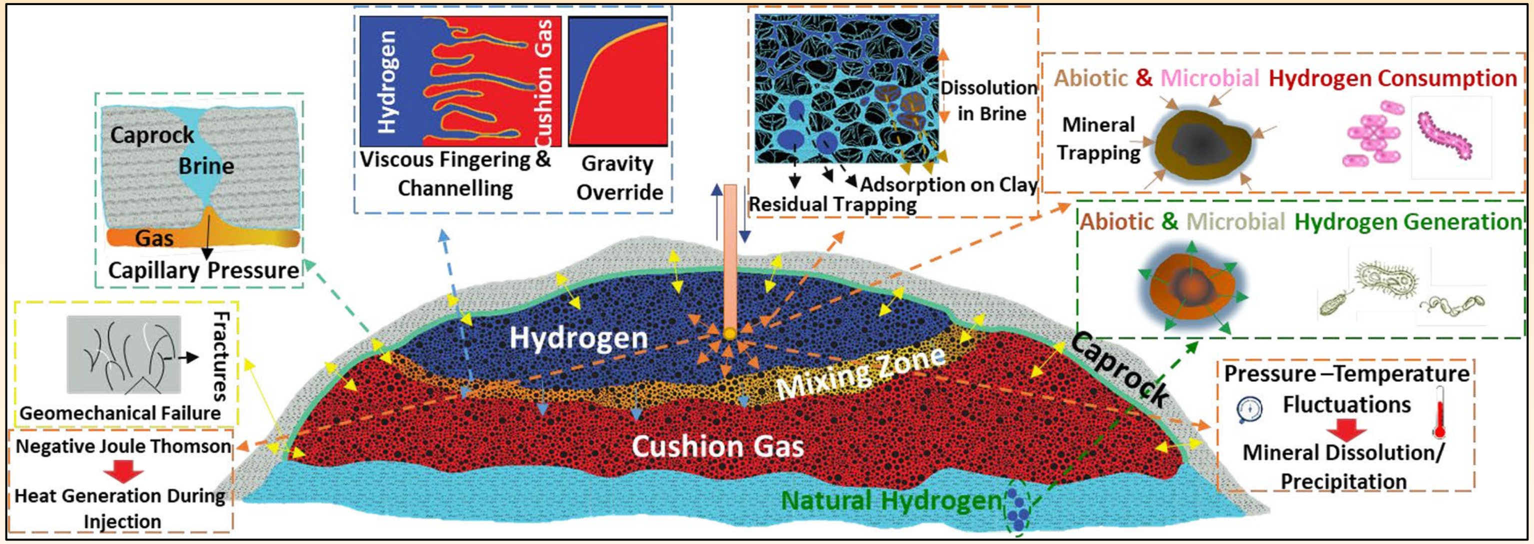
Porous Media Offers the Best Option for H_2 Storage
In terms of geography and storage volume

However …



Hassanpouryouzband et al. (2021)

Ren (2021)

There are many factors that make H_2 storage in porous media more challenging but in the longer term this will likely be the best option in areas where salt formations are absent.

We need geoscientists and engineers!

Bureau of Economic Geology GeoH2 STARR