



HYBRID HYDROGEN / NATURAL GAS POWER SOLUTIONS FOR ERCOT

PAUL F. BROWNING, PHD

APRIL 20, 2026





- Executive Chairman, Argon Power Group
- Independent Board Director - Chromalloy (Veritas Capital)
- Lead Operating Partner - Life Cycle Power (Partners Group)
- Former President & CEO, Mitsubishi Power Americas
- Former President & CEO, GE Thermal Products (now called GE Vernova Gas Power)
- Former VP at Solar Turbines (CAT)

Deep experience structuring large capital projects and M&A in power generation, including transactions with utilities, IPPs, infrastructure funds, and private equity sponsors.

Operator's perspective, sector relationships, and a repeatable playbook for value creation in rapidly growing data-center power.

38-year global
power generation
career with multi-
national
companies.

~\$70B career
revenue as CEO



Exponential Load Growth

Today's data center boom is causing unprecedented demand growth:

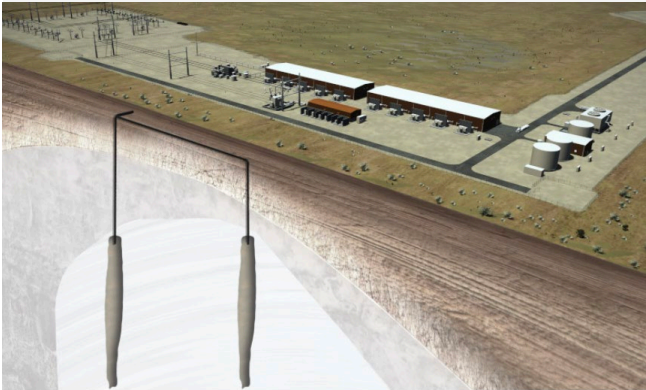
- in front of, and
- behind the meter

xAI Colossus Data Center, Memphis, TN



Delta, Utah

Advanced Clean Energy Storage
(ACES)
220 MW Electrolysis
2 Hydrogen Salt Caverns



Intermountain Power Plant
(IPP)
840 MW CCGT
30 vol% H₂-Capable => 100%



2.4 GW HVDC Transmission
CA Solar + WY Wind



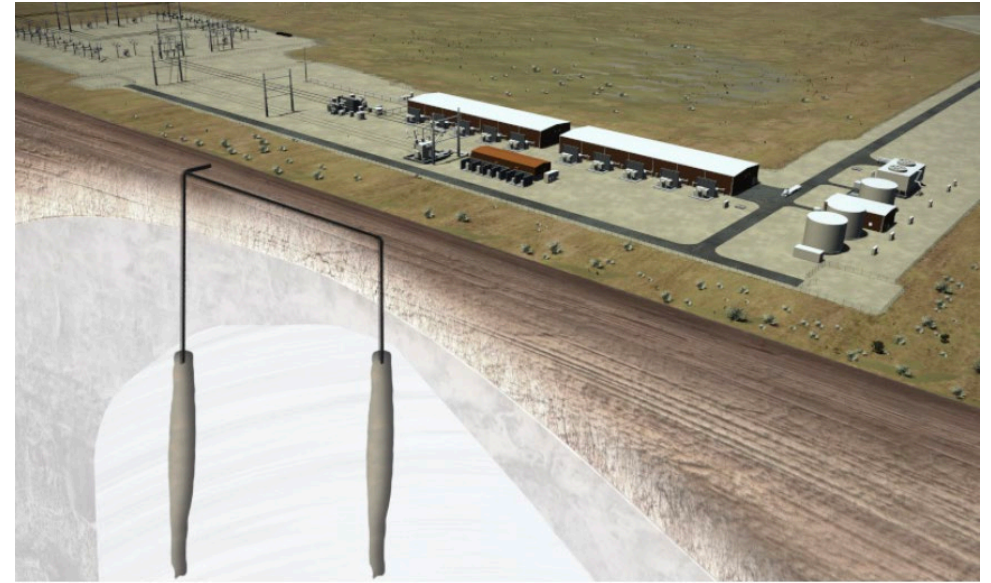
30-yr tolling agreement from IPP to ACES
for electricity supply and hydrogen off-take

300 GWh long duration energy storage
in commercial operation now

xAI Colossus Data Center, Memphis, TN



Advanced Clean Energy Storage (ACES)
300 GWh Long Duration Energy Storage

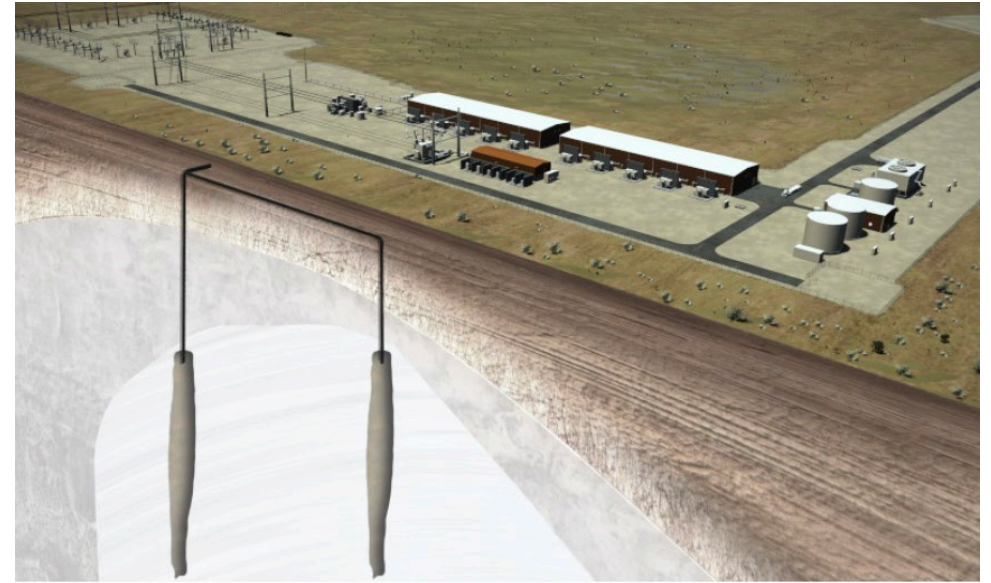


xAI Colossus Data Center, Memphis, TN



Pablo Vegas
President and CEO of
ERCOT

Advanced Clean Energy Storage (ACES)
300 GWh Long Duration Energy Storage



My Presentation Today: Resource Adequacy on Extreme Days

xAI Colossus Data Center, Memphis, TN

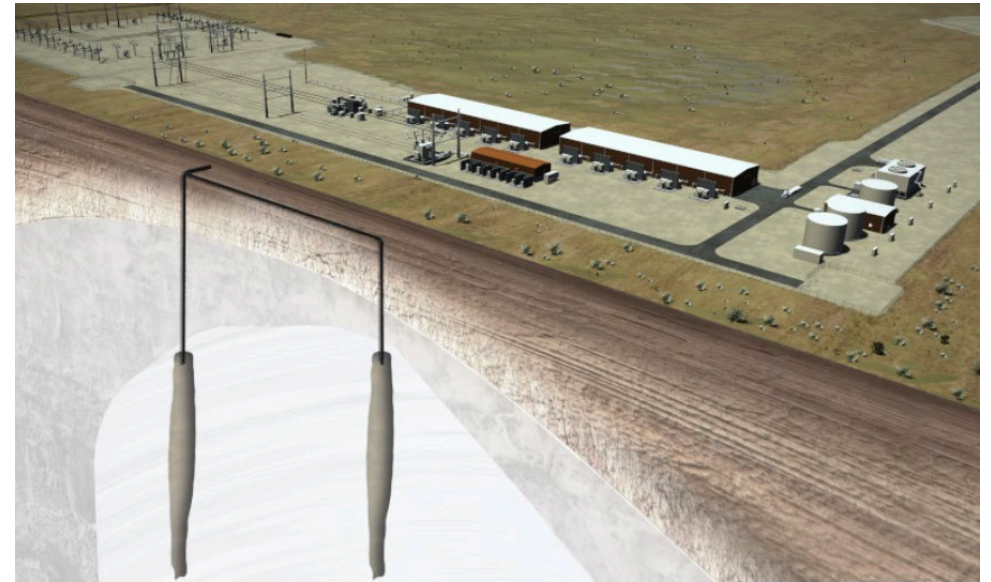


Data Center Demand Growth
In front of, and behind the meter



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Advanced Clean Energy Storage (ACES)
300 GWh Long Duration Energy Storage



Energy Storage
Of All Durations

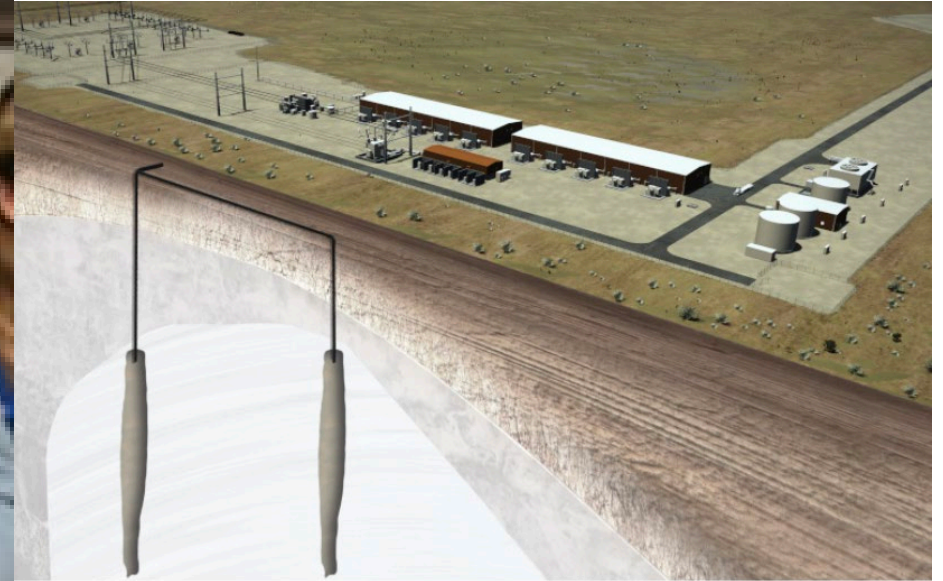
My Presentation Today: Resource Adequacy on Extreme Days

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Marty Adams,
General Manager, LADWP

Advanced Clean Energy Storage (ACES)
300 GWh Long Duration Energy Storage



Data Center Demand Growth
In front of, and behind the meter

Energy Storage
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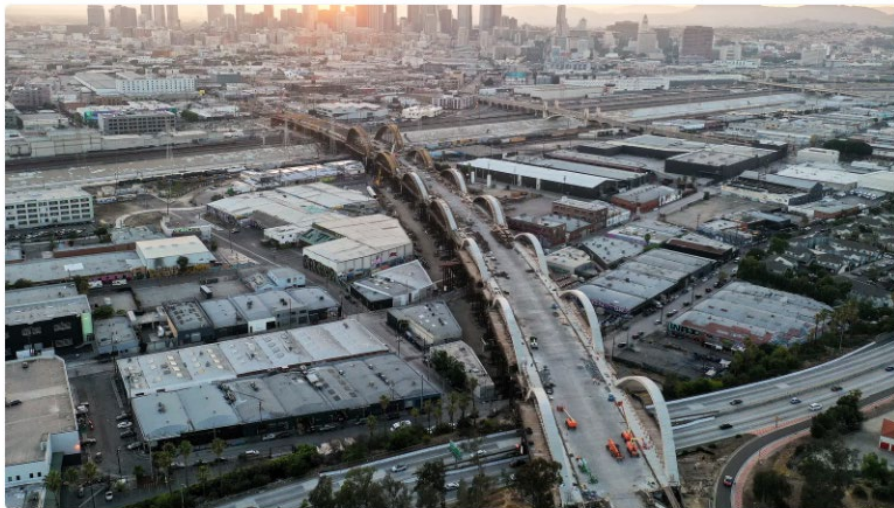
From Policy Mandates...

LA approves 100% clean energy by 2035 target, a decade ahead of prior goal

Published Sept. 2, 2021

By Jason Plautz
Contributor

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<https://www.utilitydive.com/news/la-approves-100-clean-energy-by-2035-target-a-decade-ahead-of-prior-goal/605980/>

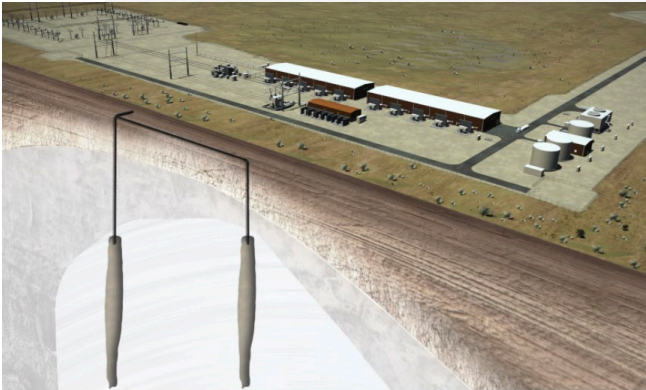
...to Plant Closures

Intermountain Power Plant (IPP):
Retiring California's last coal-fired power plant
1800 MW



Delta, Utah

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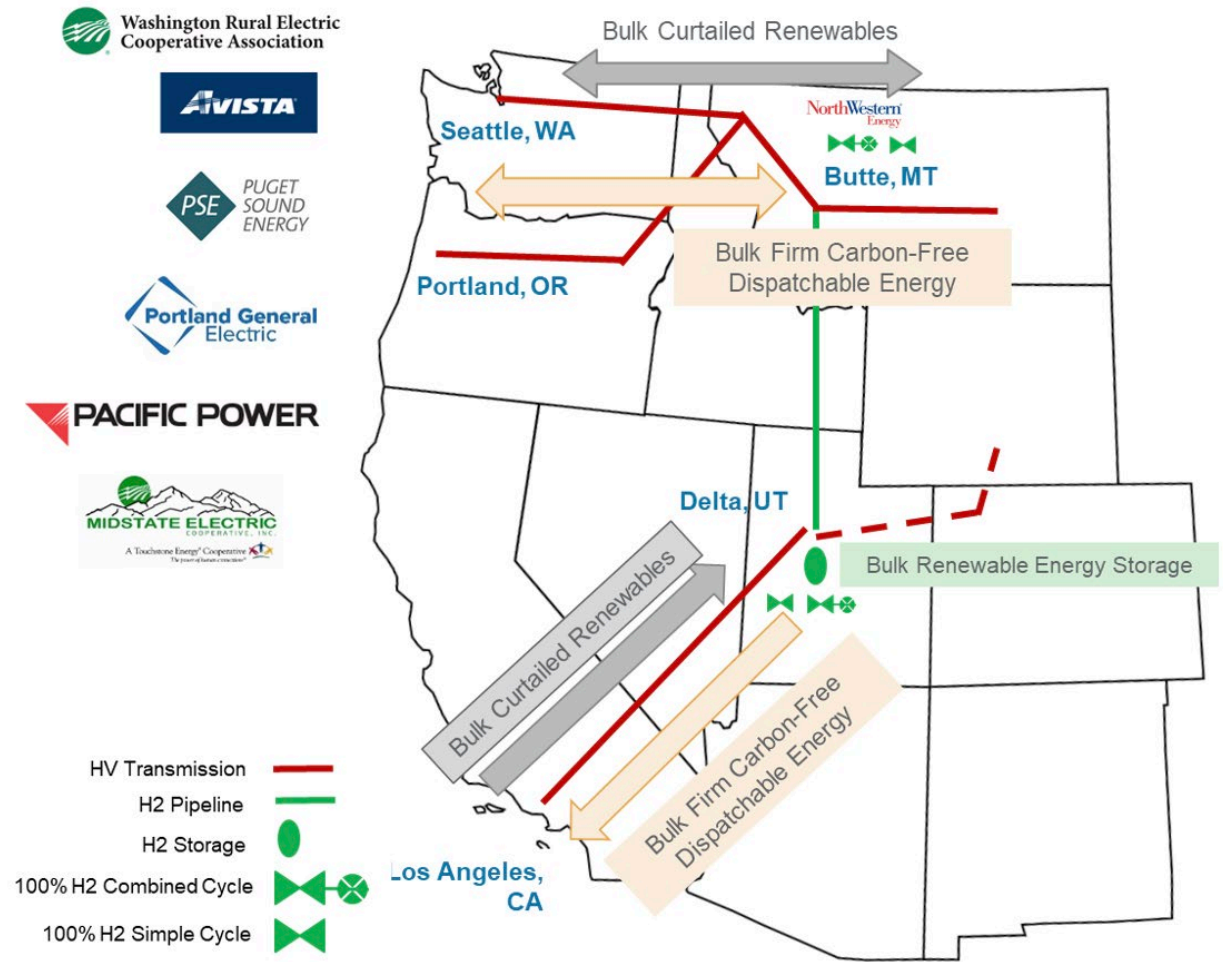
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...to Infrastructure Planning



IPP / ACES Economics

- Retiring coal-fired power plant: \$50-\$55/MWh
- H-class CCGT w/100% natural gas: \$38/MWh
 - *\$4/MMBtu, 64% fuel efficiency, 75% Cf, \$900/kW turnkey*
- H-class CCGT w/100% gH2: \$157/MWh
 - *\$3/kg, 64% fuel efficiency, 75% Cf, \$900/kW turnkey*
- H-class CCGT w/30 vol% gH2: \$51.6/MWh
 - *$\$38/\text{MMBtu} \times 88.6\% + \$157/\text{MWh} \times 11.4 \text{ wt}\% = \$51.6/\text{MWh}$*
 - *68% less CO2/MWh vs. retiring coal-fired power plant*
 - *11% less CO2/MWh vs. CCGT using 100% nat gas*

** See Appendix for more detailed calculations*

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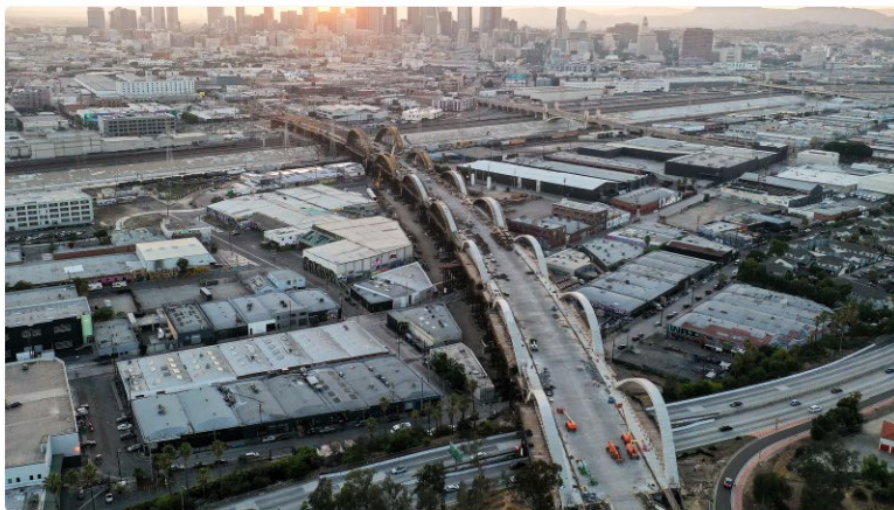
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...to Market Mandates

Setting Google's 2030 Target

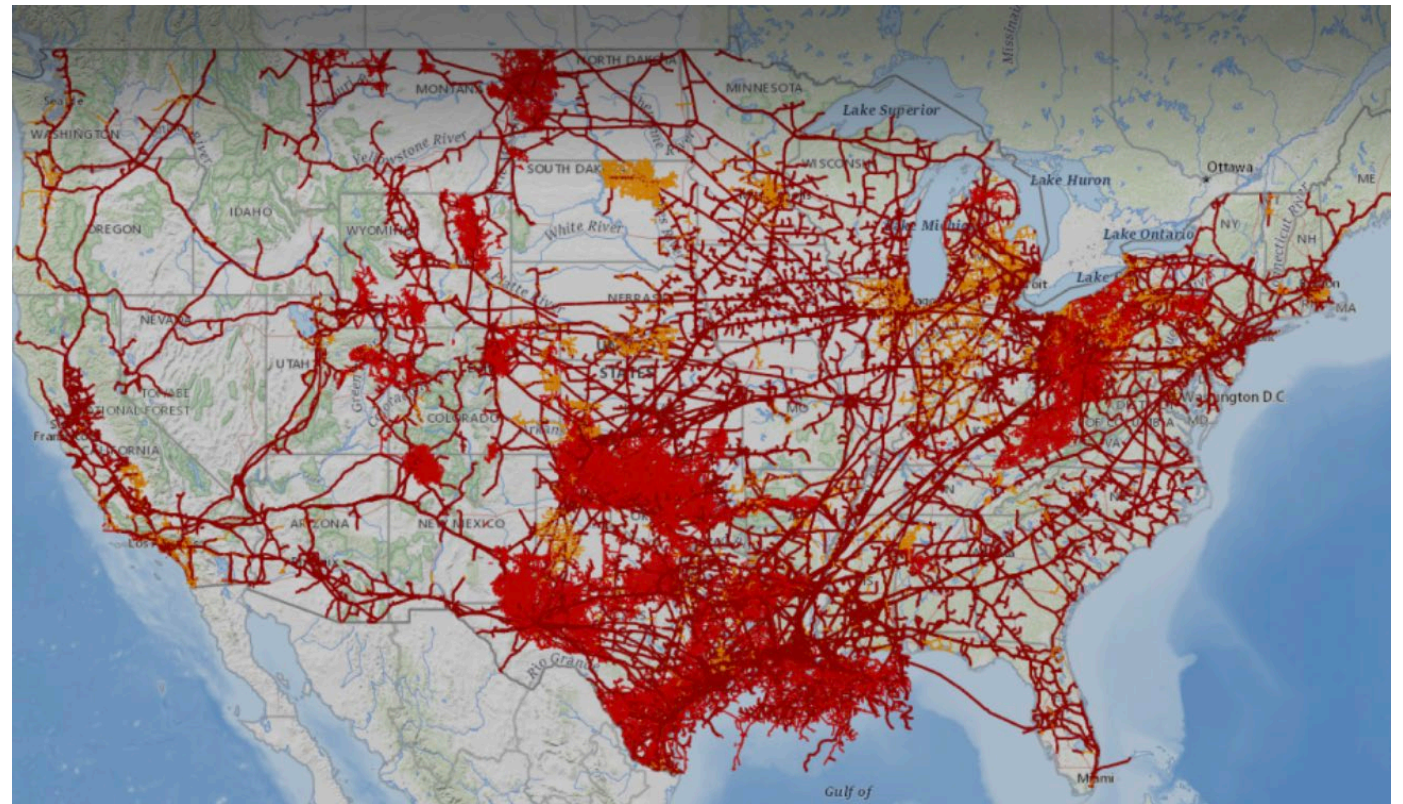


A Roadmap to 24/7 Carbon-free Energy



Texas Knows How to Do This

Permian Fracking Boom pipelines

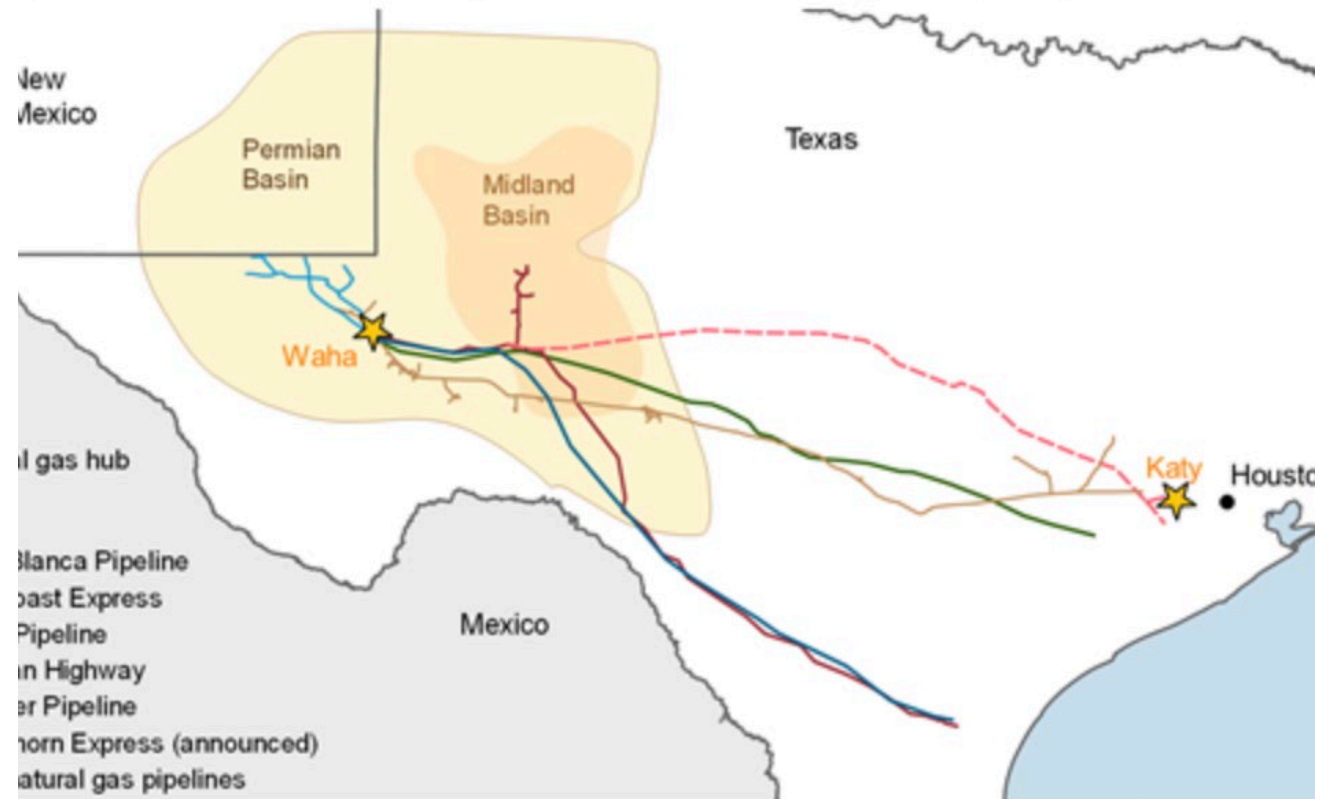


Texas Knows How to Do This

Permian Fracking Boom

Obama Authorizes Export of U.S. Oil

projects announced to expand Permian natural gas capacity



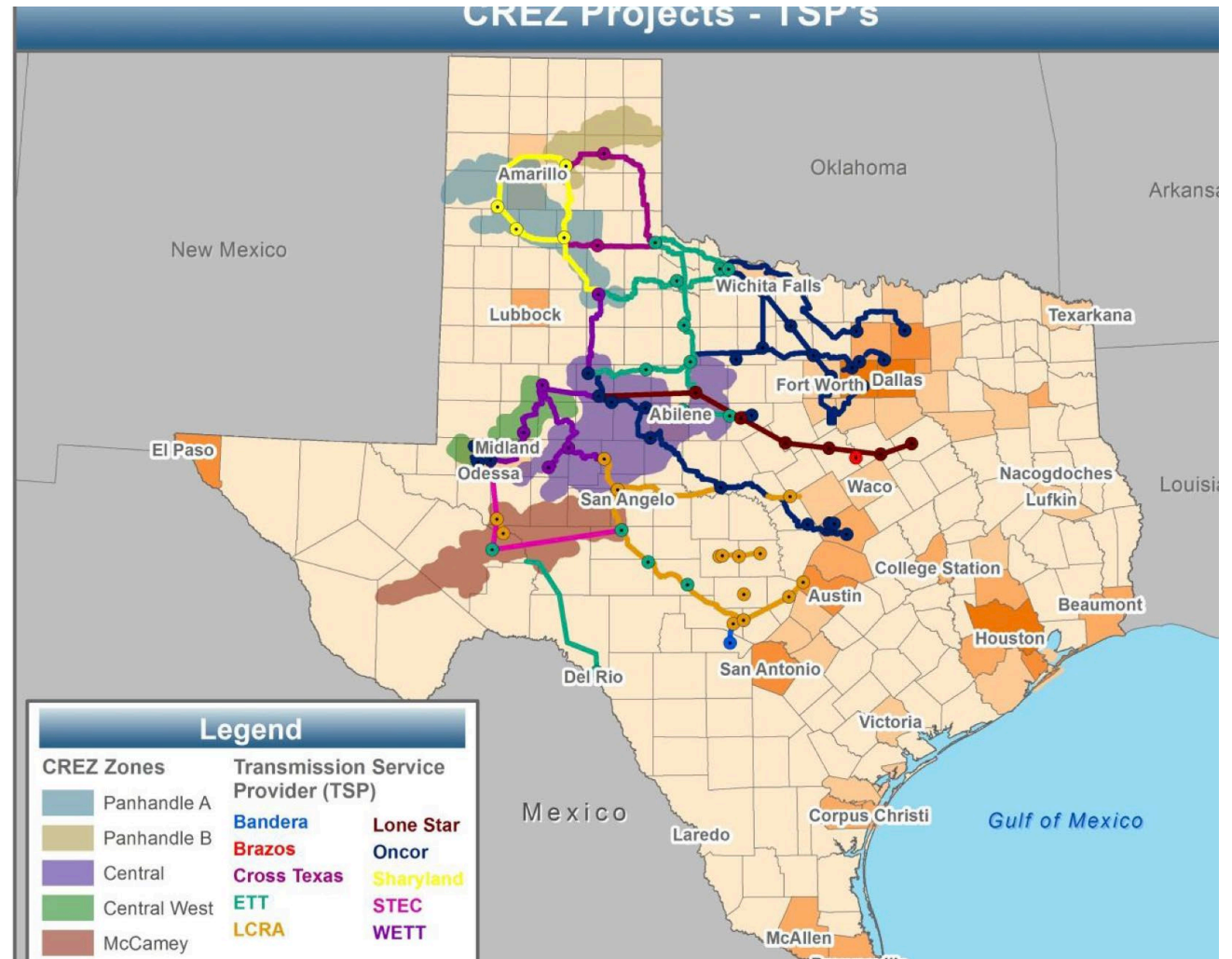
Source: U.S. Energy Information Administration, [Natural Gas Pipeline Project Track](#)

Texas Knows How to Do This

Permian Fracking Boom

Obama Authorizes Export of U.S. Oil

CREZ - West Texas Wind Boom



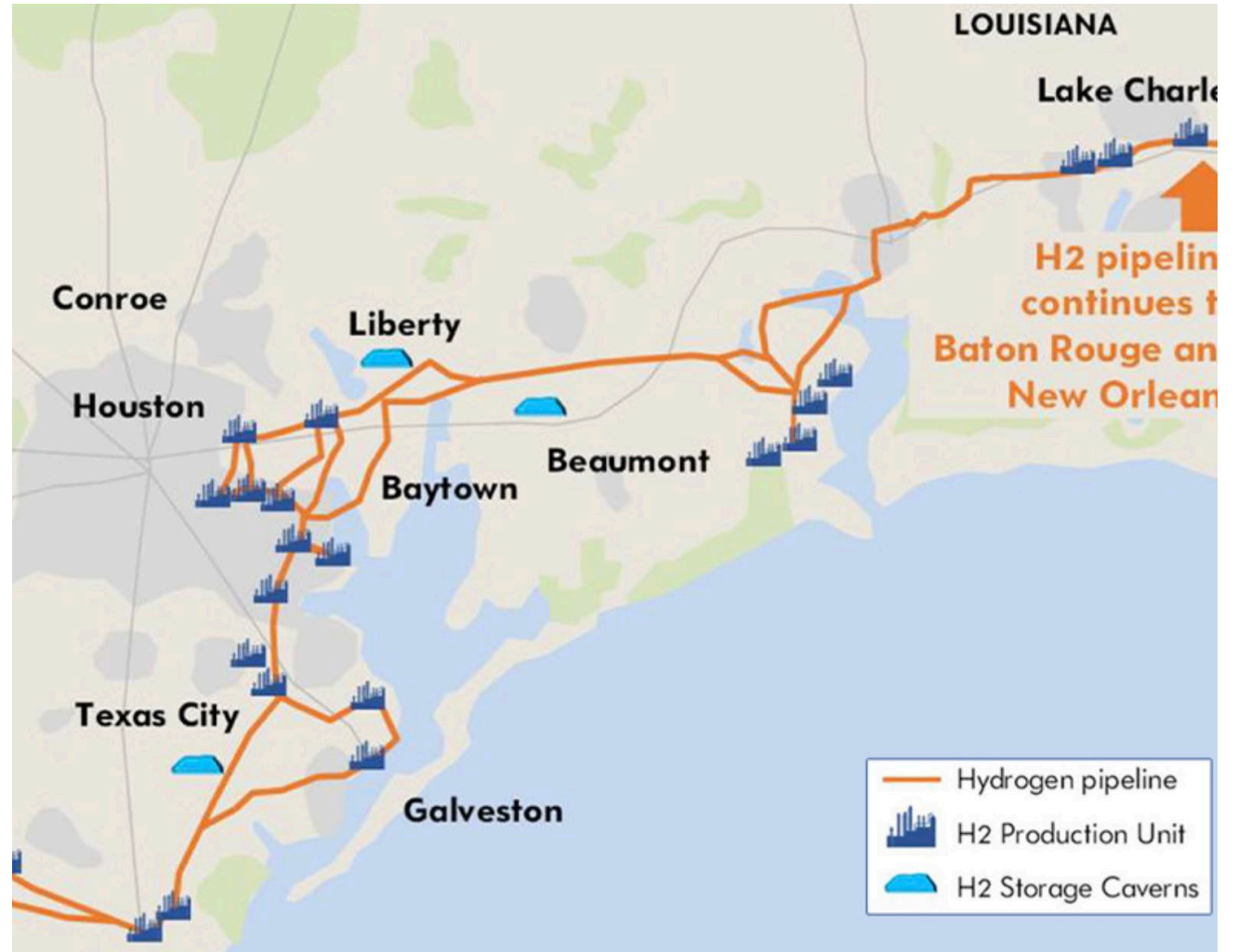
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Hydrogen Use by Refiners



Texas Knows How to Do This

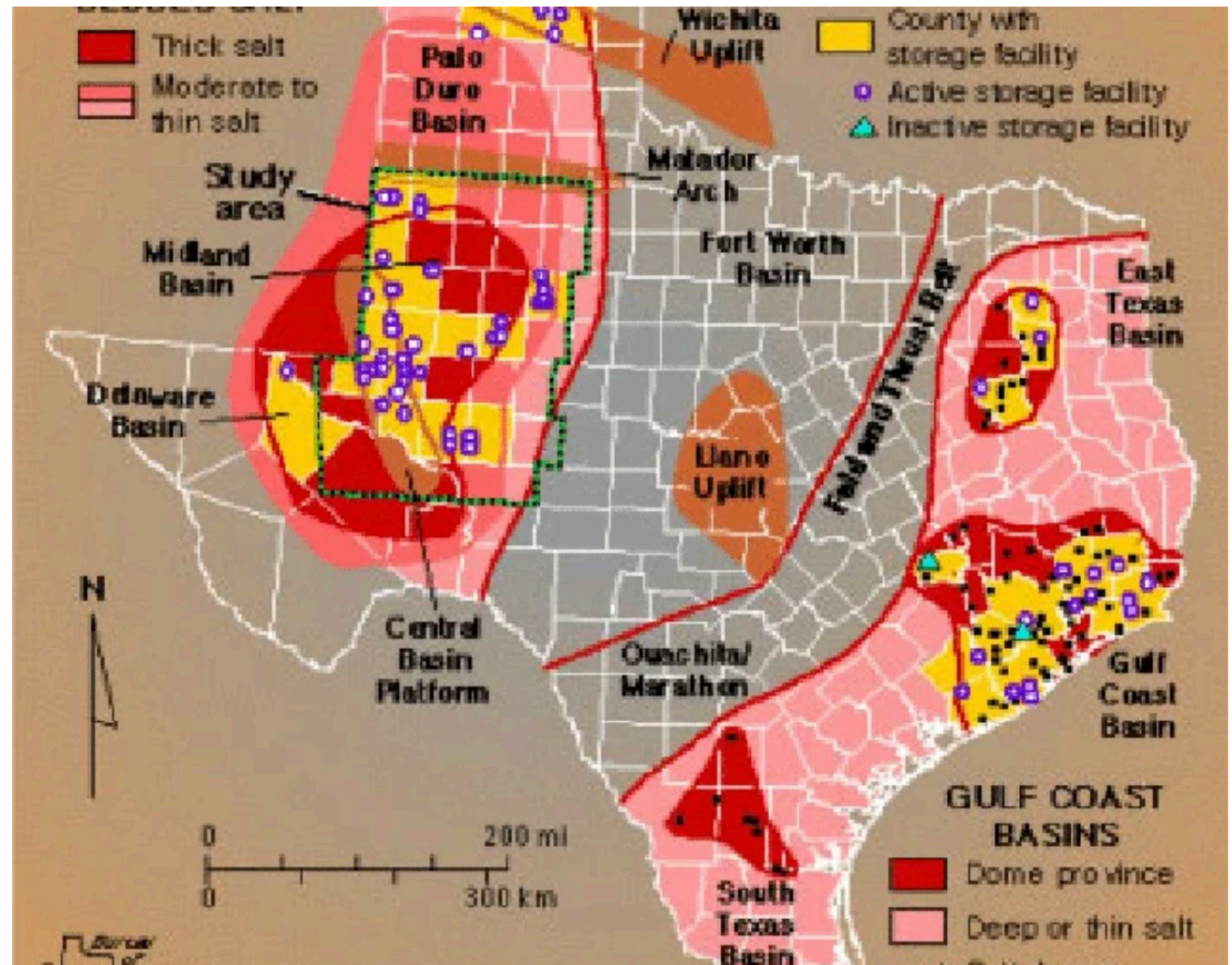
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Hydrogen Use by Refiners

Salt Dome Bounty



Texas Knows How to Do This

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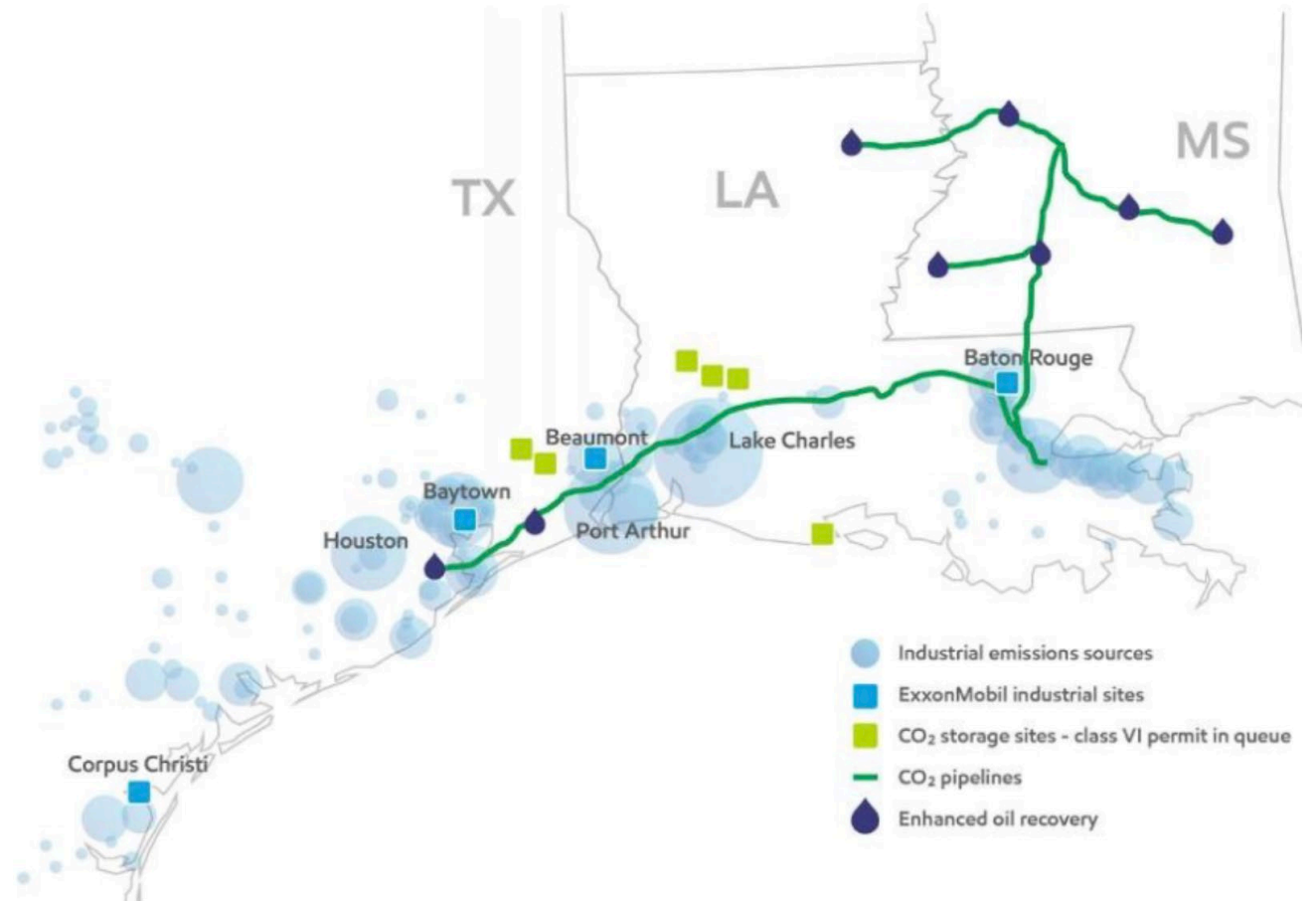
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Hydrogen Use by Refiners

Salt Dome Bounty

Carbon Capture Infrastructure



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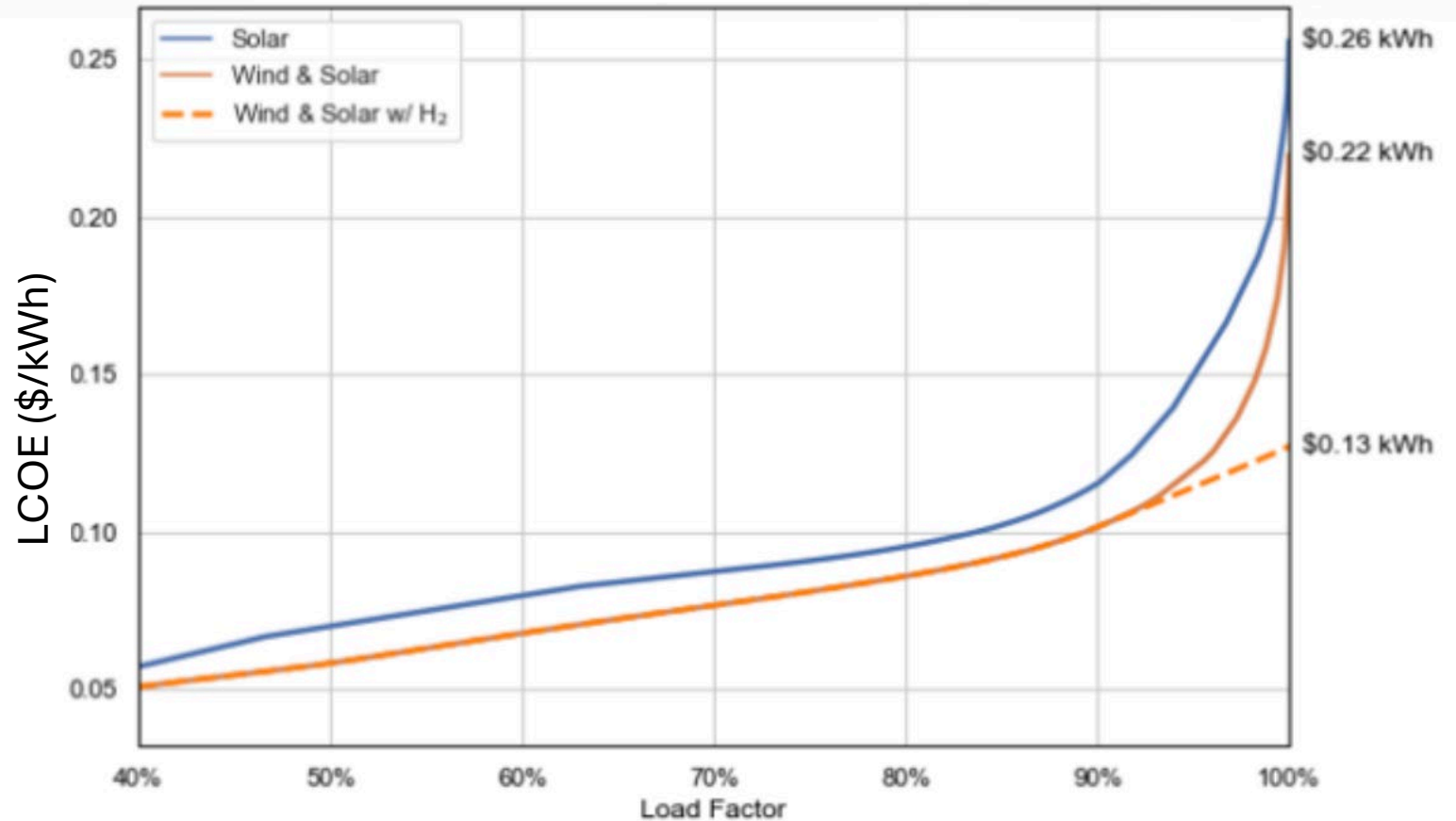
Salt Dome Bounty

Carbon Capture Infrastructure

Renewables Leadership

BESS Leadership

LCOE vs. Load Factor



Powering hyperscale AI data centers with solar, battery, and hydrogen

Authors: Anil Singh Bika, Brian Setzler, Paul Browning, Vrishank Mechineni, Rebekah Marks, Karen Miedlinger, Ajay Prasad, and Yushan Yan, 2025

Green H2 is not a base load fuel

- It is an extreme day fuel
 - Trickle-charge LDES using cheap and curtailed power
 - Store on-site using salt cavern storage
 - Dispatch power on extreme days



Silas Ray / Brownsville Peaker Plant

- LM6000 gas turbine – simple cycle
- 2-8% capacity factor
- Variable cost:
 - Fuel (\$4/MMBtu natural gas): \$40/MWh
 - O&M: \$6/MWh
- Capital cost (@5% Cf and \$1500/kW):
 - \$342/MWh
- Total cost:\$388/MWh

- LM6000 gas turbine – simple cycle
- 2-8% capacity factor
- Variable cost:
 - Fuel (\$1.8/kg blue H2): \$150/MWh
 - (\$4/MMBtu natural gas + ATR + CCS)
 - O&M: \$6/MWh
- Capital cost (@5% Cf and \$1500/kW):
 - \$342/MWh
- Total cost: \$498/MWh
 - (\$438 w/45Q tax credit)

Silas Ray / Brownsville Peaker Plant

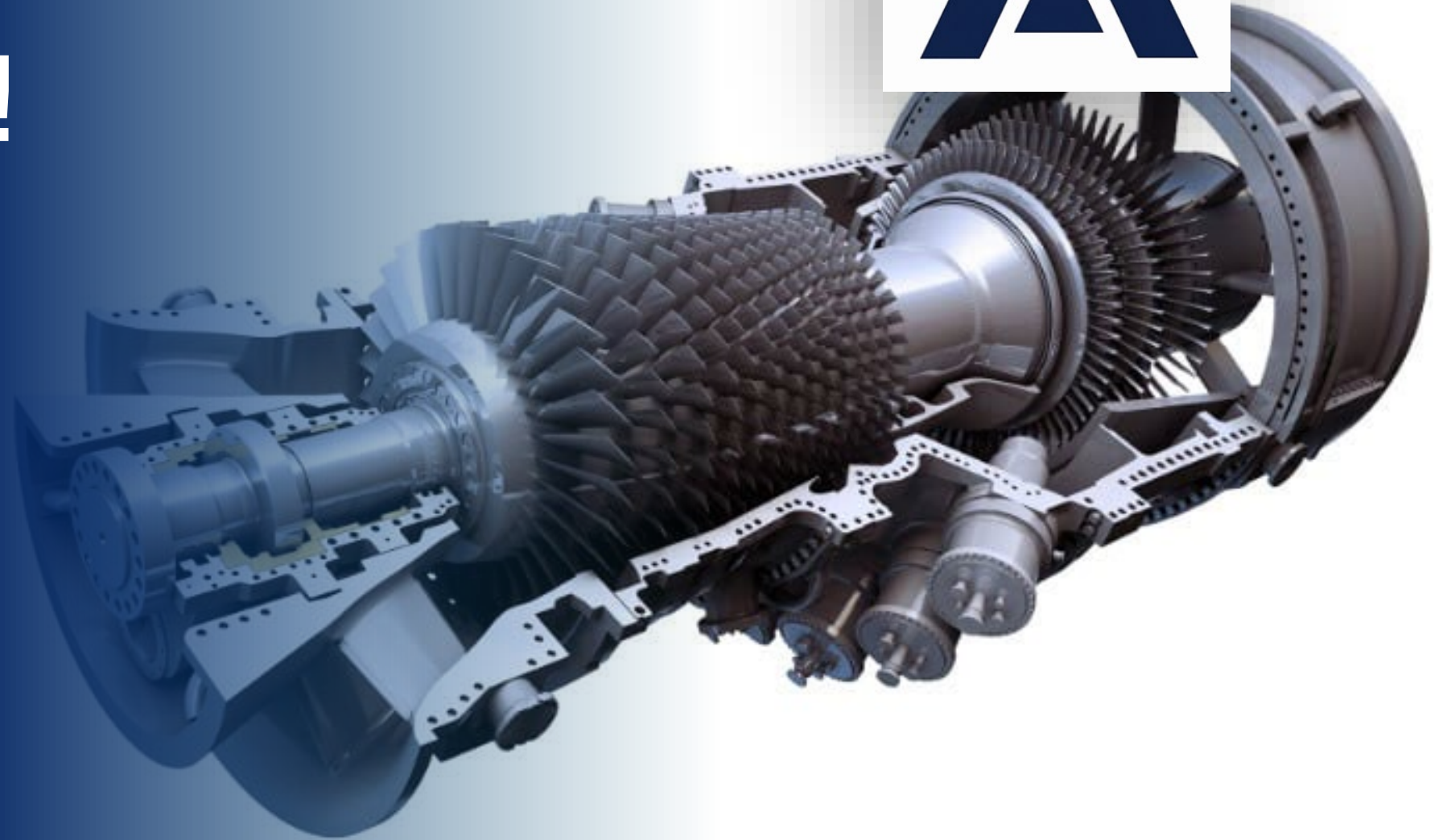
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 - O&M: \$6/MWh
- Capital cost (@5% Cf and \$1500/kW):
 - \$342/MWh
- Total cost:\$388/MWh

Flexible Hydrogen-Capable CCGT

- H-class gas turbine – combined cycle
- 15% capacity factor
- Variable cost:
 - Fuel (\$3/kg green H₂): \$125/MWh
 - (\$20/MWh power @ 90% Cf for electrolysis)
 - O&M: \$6/MWh
- Capital cost (@15% Cf and \$2500/kW):
 - \$200/MWh
- Total cost: \$331/MWh



THANK YOU!



Appendix

Acronyms

- ACES: Advanced Clean Energy Storage Project
- BESS: Battery Energy Storage System
- CCGT: Combined-Cycle Gas Turbine Power Plant
- Cf: Capacity Factor
- CO₂: Carbon Dioxide
- GWh: Gigawatt-hour
- H₂: Hydrogen
- HVDC: High Voltage Direct Current Transmission
- IPP: Intermountain Power Plant
- kW: Kilowatt
- kWh: Kilowatt-hour
- LADWP: Los Angeles Department of Water & Power
- LCOE: Levelized Cost of Electricity
- LDES: Long Duration Energy Storage
- MMBtu: Million British Thermal Units
- MW: Megawatt
- MWh: Megawatt-hour
- O&M: Operations and Maintenance
- vol%: Volume Percent
- wt%: Weight Percent

CO2 Reduction Calculations

- Standard EIA CO2 coefficients:
 - Coal: 1700 lb CO2/MWh
 - Natural Gas: 52.91 kg CO2/MMBtu
 - @64% fuel efficiency = 5.33 MMBtu/MWh
 - 282 kg CO2/MWh = 620 lb CO2/MWh
- $(1700 \text{ lb CO}_2/\text{MWh} - 620 \text{ lb CO}_2/\text{MWh}) / 1700 \text{ lb CO}_2/\text{MWh} = 63\% \text{ reduction}$

IPP Retiring Coal-Fired Power \$/MWh

- Fuel Cost:
 - \$2-2.50/MMBtu coal
 - 10,500 Btu/kWh heat rate
 - \$20-26/MWh fuel cost
- Capital Cost (largely depreciated)
 - Built in 1980's for \$4.5B
 - 70% capacity factor
 - \$10/MWh capital cost
- O&M Cost
 - \$20/MWh typical
- Total: \$50-\$55/MWh

IPP CCGT Power Cost

- Natural Gas Fuel Cost:
 - 3.412 MWh/MMBtu
 - Fuel Efficiency: 64%
 - Fuel Input: $3.412/0.64 = 5.33$ MMBtu/MWh
 - Fuel Cost = 5.33 MMBtu/MWh x $\$4$ /MMBTu = $\$21.3$ /MWh
- Capital Cost:
 - 75% Capacity Factor x 8760 hr/yr = 6.57 MWh/yr per kW
 - 8% carry charge:
 - $\$900/\text{kW} \times 0.08 = \$72/\text{kW-yr}$
 - $\$72/6.57 = \$11/\text{MWh}$
- O&M Cost:
 - Fixed O&M: $\$15/\text{kW-yr}$
 - $\$15/6.57 = \$2.3/\text{MWh}$
 - Variable O&M: $\$3/\text{MWh}$
- Total Cost:
 - $\$21.3 + \$11 + \$2.3 + 3 = \$37.6/\text{MWh}$
- Hydrogen Fuel Cost:
 - $\$3/\text{kg}$
 - Fuel Efficiency: 64%
 - Fuel Input: $33.3 \text{ kWh/kg LHV} \times 0.64 = 21.3 \text{ kWh/kg}$
 - Fuel Cost = $1000 \text{ MWh/kWh} / 21.3 \text{ kWh/kg} = 46.9 \text{ kg/MWh}$
 - $46.9 \times \$3 = \$140.7/\text{MWh}$
- Capital Cost:
 - 75% Capacity Factor x 8760 hr/yr = 6.57 MWh/yr per kW
 - 8% carry charge:
 - $\$900/\text{kW} \times 0.08 = \$72/\text{kW-yr}$
 - $\$72/6.57 = \$11/\text{MWh}$
- O&M Cost:
 - Fixed O&M: $\$15/\text{kW-yr}$
 - $\$15/6.57 = \$2.3/\text{MWh}$
 - Variable O&M: $\$3/\text{MWh}$
- Total Cost:
 - $\$140.7 + \$11 + \$2.3 + 3 = \$157/\text{MWh}$