

The background of the slide is a photograph of a large metal power line tower in a field. The sun is low on the horizon, creating a warm, golden glow. In the distance, there are rolling hills and several smaller power line towers. The sky is a mix of blue and orange.

IEMF Webinar Series

Webinar #4:

Tribal Opportunities In The New Energy Market - Blue and Green Hydrogen in Indian Country

Dr. Laura Nelson
Special Advisor
Green Hydrogen Coalition
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Introduction

DR. LAURA NELSON Special Advisor

- Based in Salt Lake City, UT
- Economist
- Lifelong career in energy industry, both public and private sector
- Former Energy Advisor to Governors Herbert and Huntsman of Utah and Executive Director of the Utah office of Energy Development



About the GHC

Mission

Facilitate policies and practices to advance the production and use of green hydrogen in all sectors where it will accelerate a carbon-free energy future

Approach

Prioritize green hydrogen project deployment at scale; leverage multi-sector opportunities to simultaneously scale supply and demand

***The GHC is a 501c3 Tax Exempt Nonprofit Organization**

GHC Supporters

LEADERSHIP CIRCLE



VISIONARY CIRCLE



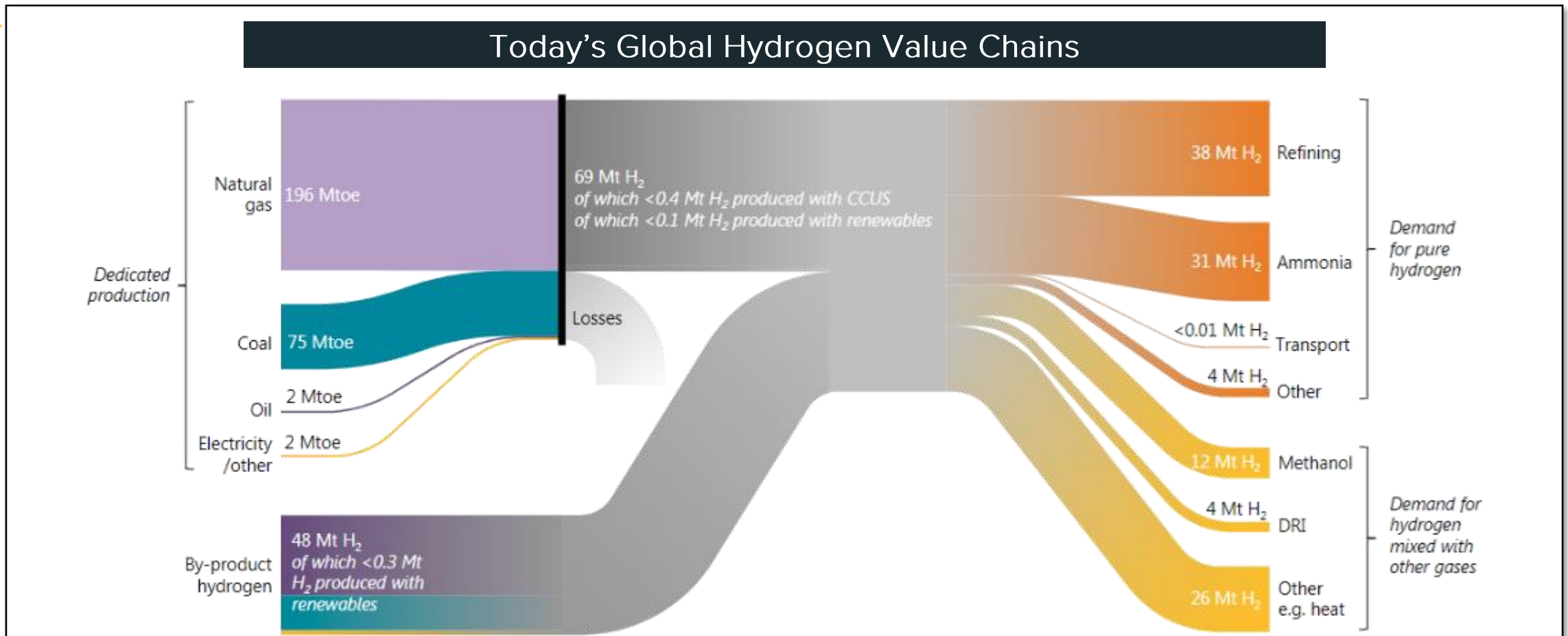
CHAMPION CIRCLE



SUSTAINER CIRCLE



Hydrogen is a mature commodity – but today it is nearly all grey and brown



Source: IEA, 2019. "The Future of Hydrogen: Seizing today's opportunities" Report prepared for the G20, Japan.

Colors of Hydrogen

Feedstock Category	Color	Primary Feedstock	Conversion Process	Result	Carbon Impact (kg CO ₂ /kg H ₂)
Fossil Fuels	Brown	Coal or lignite	Gasification & reformation	Fuel to Hydrogen	- 18 to 20
	Gray	Natural gas	Gasification (SMR)		- 10 to 12
	Blue	Brown or Gray plus CCS	Carbon Capture Sequestration during gasification		- 0.6 to 3.5
Renewables	Green	Biogas or Biomass	Gasification & reformation	Clean Electricity to Hydrogen	- 0
		Water & clean electricity (solar, wind, etc.)	Electrolysis		
Nuclear		Nuclear power & water	Electrolysis		

Source: GHC, 2020



Definition of green hydrogen

Hydrogen produced from non-fossil fuel feedstocks and does not increase greenhouse gases during its production.

Green hydrogen can transform how we power our world and create vibrant clean energy economies with sustainable local jobs



Agriculture



High-heat industrial applications



Transportation



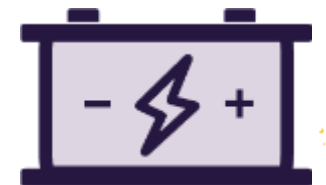
Natural Gas



Power



Mining



Energy Storage



GHC Core Effort

IPP Reimagined:
Conversion of
the Intermountain Power
Project (IPP)



From coal-fired plant to United States' largest green-hydrogen powered generation facility.

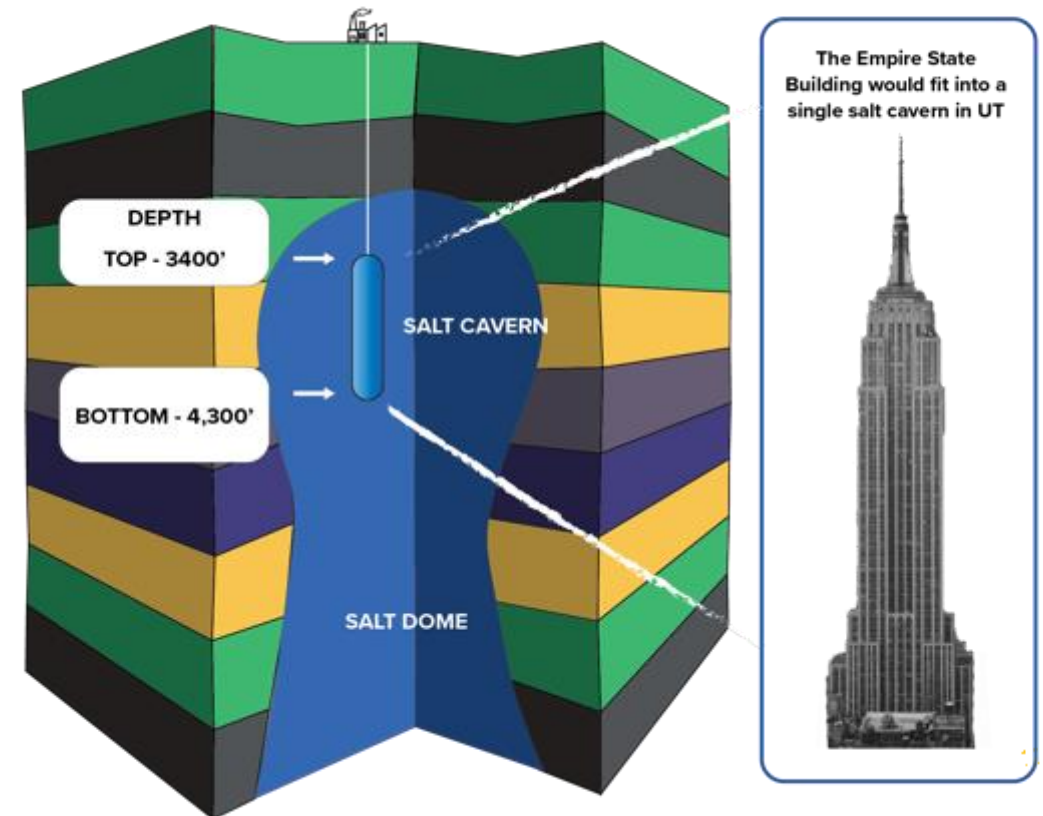
- Located in Delta, Utah
- 2 coal-fired units operating since 1986 (1,800 MW net capacity)
- Two Transmission Systems:
 - STS To Southern California
2400 MW HVDC System
 - NTS To Utah & Nevada
 - Interconnected to 370MW of Wind Generation
- 35 Project Participants, 6 from Southern California
- Coal Units to be retired by 2025; IPP conversion to 840 MW natural gas combined cycle gas facility
- Day 1: run on 30% blend of green hydrogen ramping up to 100% over time

Plan is that Green H2 will be produced with through electrolysis



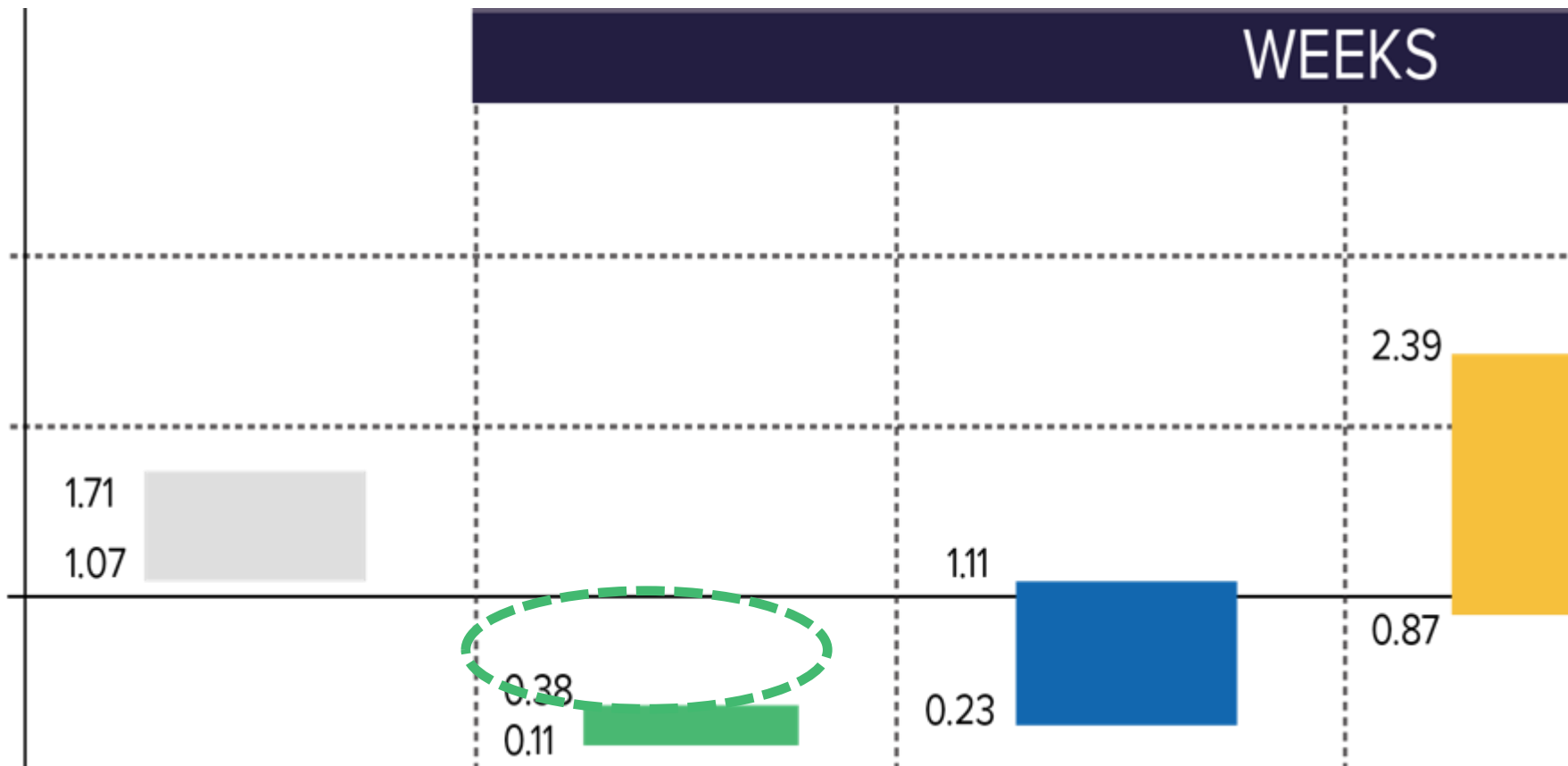
IPP will leverage natural salt domes to store massive amounts of green hydrogen.

- A typical cavern size at IPP = 4,000,000 barrels
- 1 cavern = 5,512 tons of H₂ (operational limit)
- This is equivalent to:
 - 200,000 hydrogen buses
 - 1,000,000 fuel cell cars
 - 14,000 tube trailers used for delivery
- Over 100 caverns can be constructed in the Magnum salt dome
- Storing H₂ in salt caverns is already done commercially around the world



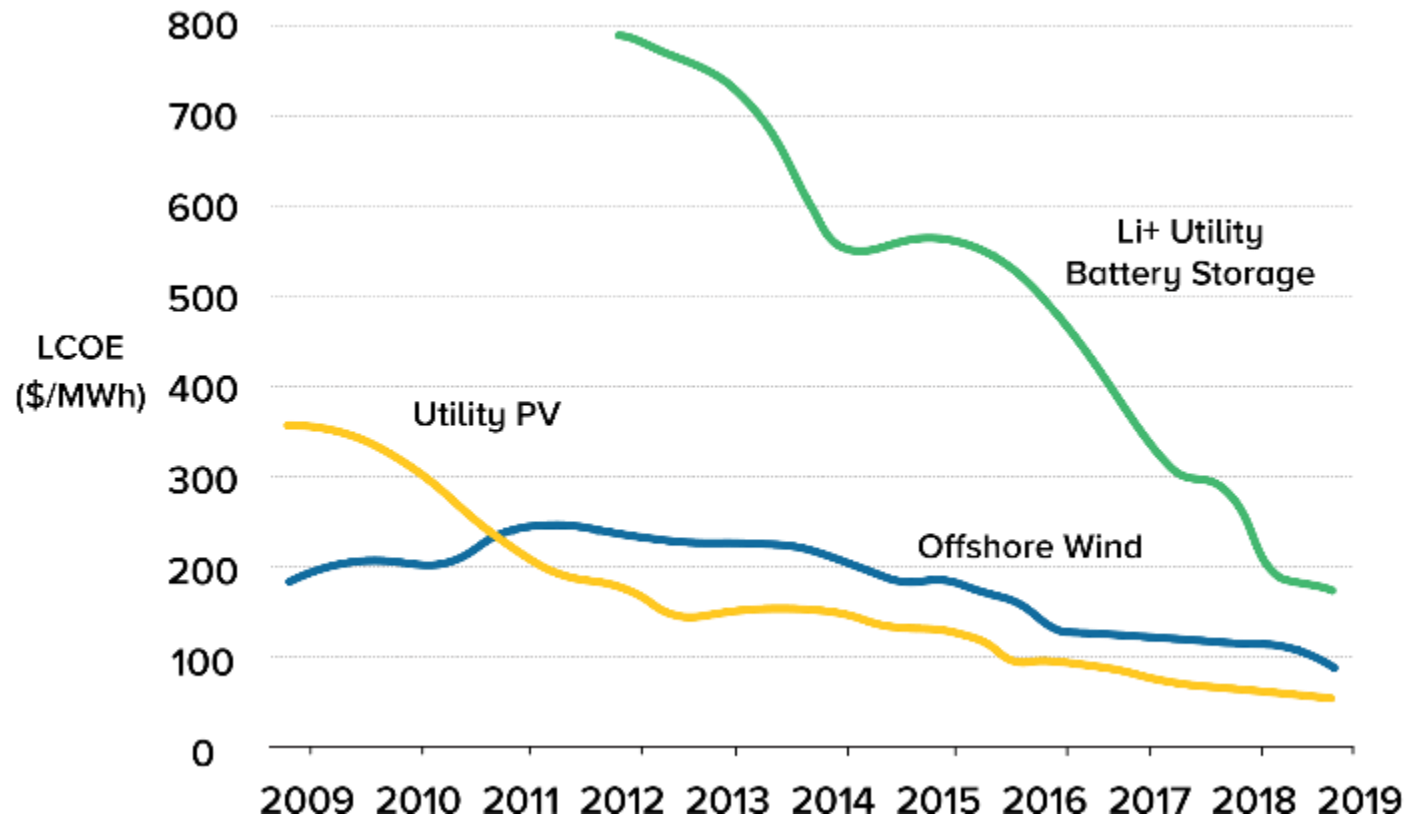
The cost of hydrogen storage varies according to technology and scale

Levelized Cost of Bulk Hydrogen Storage



We know from decades of experience that renewable energy technology costs fall precipitously with scale

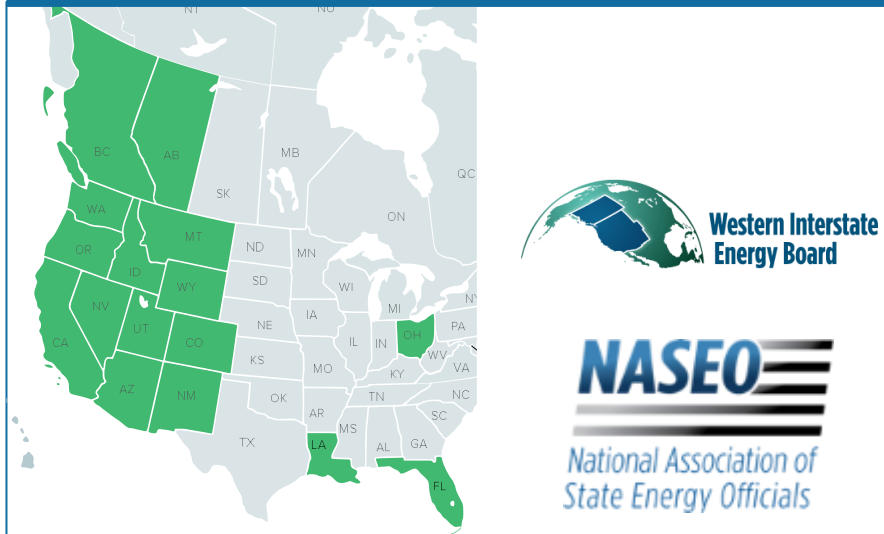
Clean Energy Technology Costs Decline with Scale



Source: BloombergNEF

The Green Hydrogen Coalition is laser-focused on accelerating the adoption of green hydrogen at scale to create momentum in the clean energy economy

Initiative 1: Western Green Hydrogen Initiative



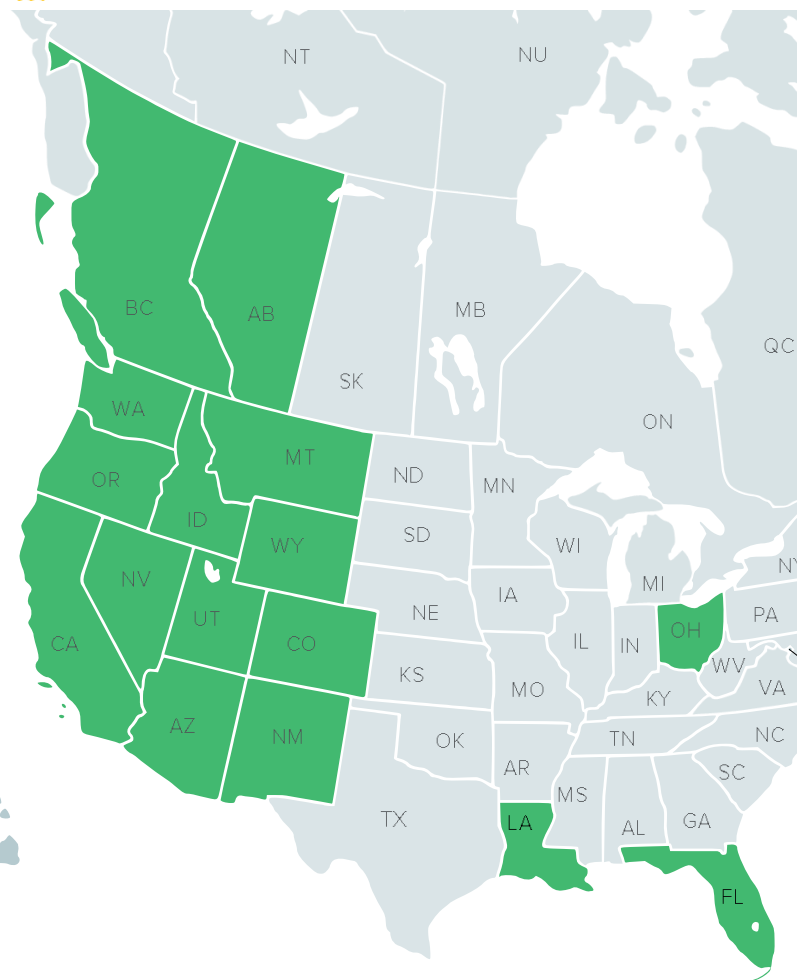
Establish a regional green hydrogen strategy for the West by providing decision-makers with the information, tools, and policy support to deploy projects that advance energy reliability, decarbonization, and economic growth.

Initiative 2: HyDeal North America



Develop high-volume supply chains to achieve \$1.50/kg delivered green hydrogen costs in strategically targeted locations.

Western Green Hydrogen Initiative (WGHI)



Objective: Through multi-state and stakeholder collaboration, WGHI will serve as a steering committee to assist states in developing Comprehensive Regulatory, Policy and Commercialization Roadmaps and advance GH2 projects at scale

Key Players: State Policy Offices, NASEO, WIEB, regulators and policymakers, and initiative funders

Funding: Mitsubishi Power, WIRAB, SoCal Gas

Projects: IPP, MT GH2 production, I-15 corridor infrastructure, and others identified by states

Public Partners



Private Partners and Funders



HyDeal North America

Accelerate progress by bringing together...

- **key ecosystem stakeholders**, including policy makers, developers, and multi-sectoral off takers
- in **strategically targeted locations**
- to **plan and develop** the competitive, **high-volume supply chain** necessary
- to **achieve a \$1.50/kG delivered green hydrogen cost** for large off takers

First stop: HyDeal Los Angeles

Architecting the Green Hydrogen Ecosystem For a Deeply Decarbonized LA

Steering Committee Funders



Los Angeles will become America's first green hydrogen industrial hub

LA will be the first in North America to...



Achieve 100% renewable electricity affordably and reliably



Decarbonize fuel refining and move to renewable fuels



Provide green ammonia fueling to maritime goods movement (and for fertilizer production)

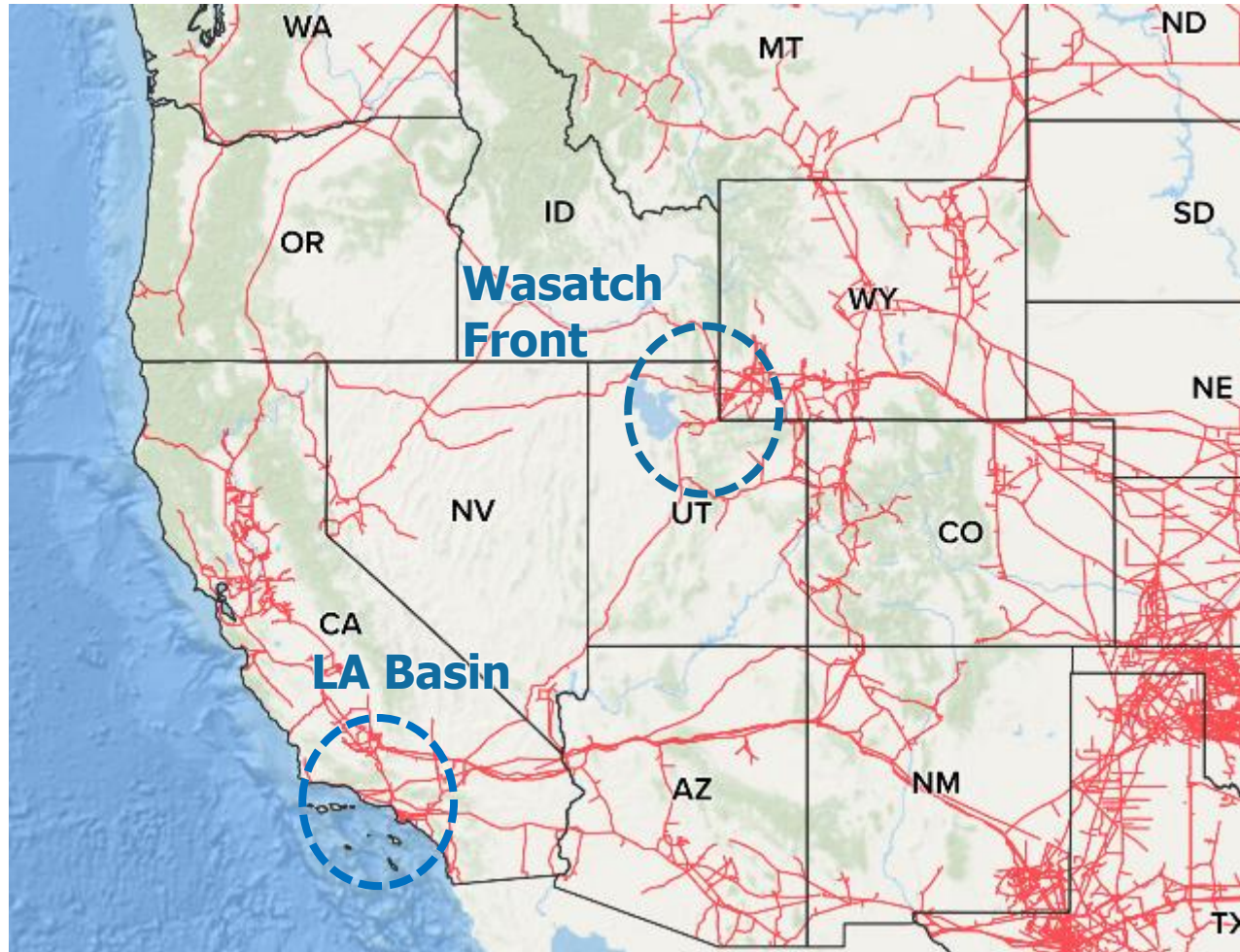


Demonstrate green hydrogen fuel cell passenger flight (e.g. Long Beach Airport to Sacramento)



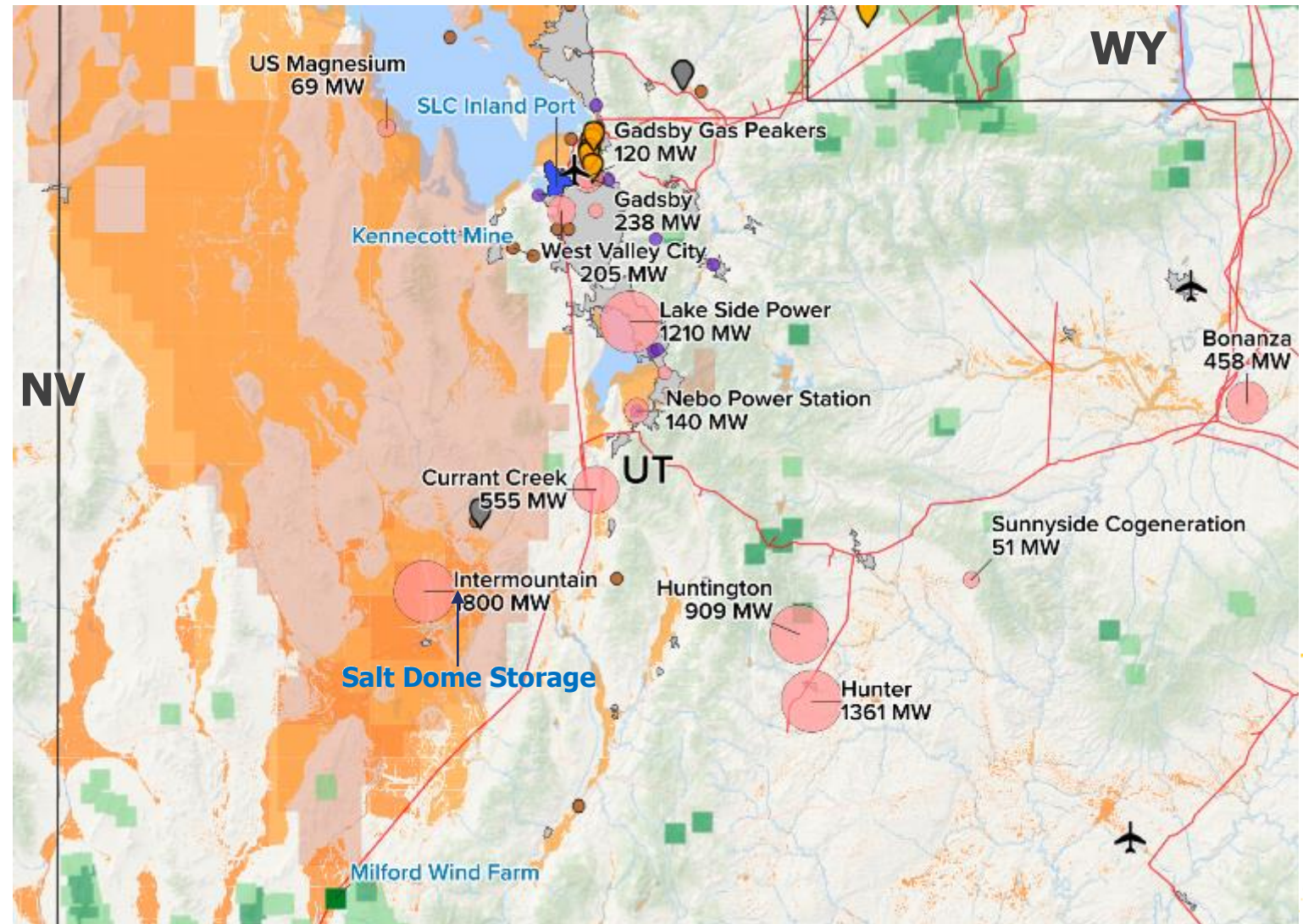
Export low-cost green hydrogen at scale

This replicable platform will connect the Port of Los Angeles to the American West



My hometown of Salt Lake City, Utah has many of potential resources & uses for green hydrogen

- Wind Resource
- Solar Resource
- Geothermal Resource
- Power Plants
- Oil Refineries
- ✈ Airport
- Inland Port (proposed area)
- Backup Generators
- Mines
- └ Natural Gas Pipelines



Significant green hydrogen projects are being announced around the world

Austria, 2019

H2Future, 6MW



Source: Power engineering, 2019

Denmark, 2019

H2RES Project, 2MW



Source: Green Car Congress, 2019

Germany, 2019

Heide Oil Refinery,
700MW



Source: Westküste 100, 2020

Canada, 2020

Chetwynd Hydrogen,
3% pipeline injection



Source: Fuel Cells works, 2020

Belgium, 2020

Port of Oostende, 50MW



Source: DEME, 2020

Saudi Arabia, 2020

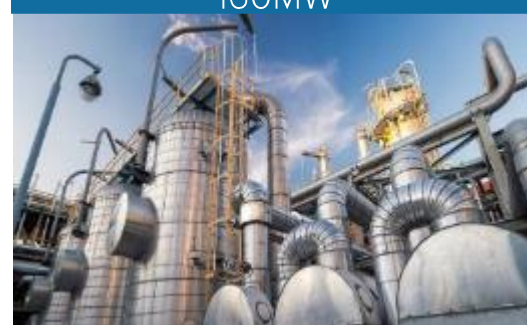
Future City of Neom, 2GW



Source: GreenTech Media, 2020

West Australia, 2020

Arrowsmith Project,
160MW



Source: Petrofac, 2020

Netherlands, 2020

NorthH₂ Project, 1GW



Source: NS Energy, 2020

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