European Turbine Network OEM Panel Session

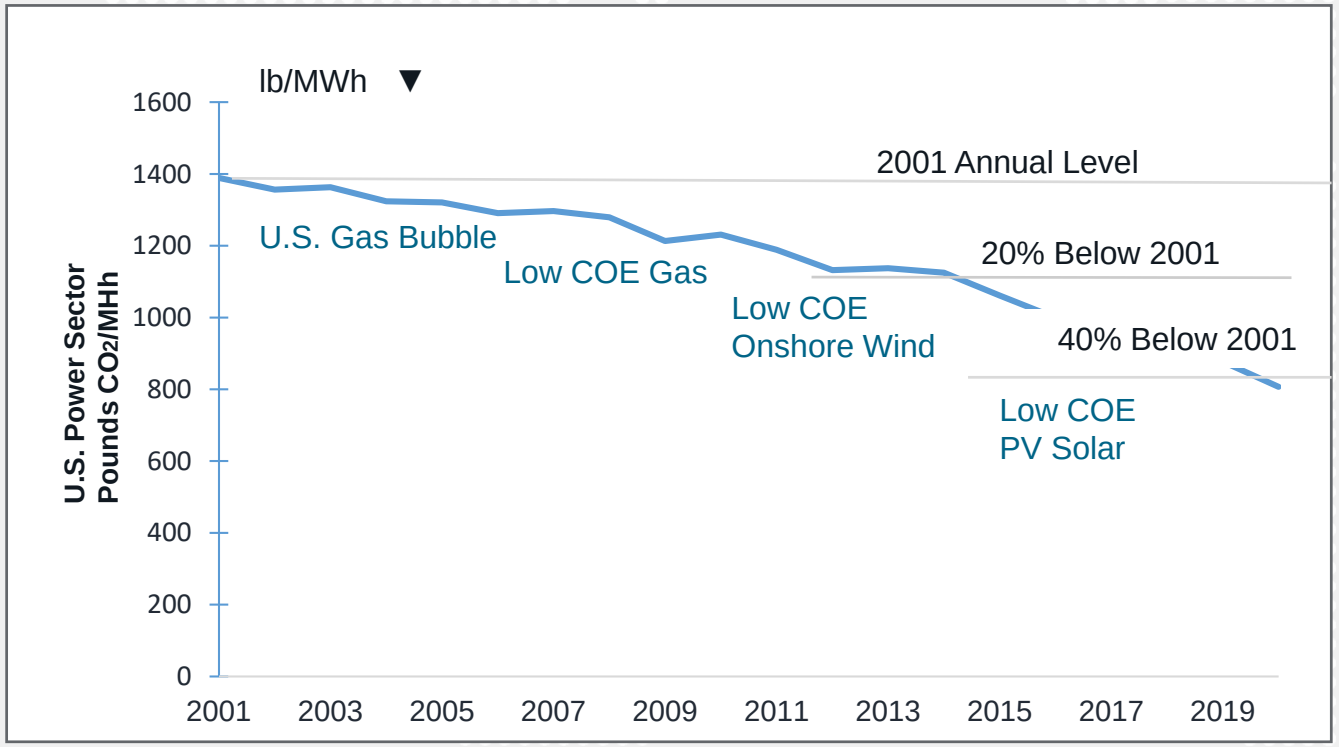
October 15, 2021

Brian F Allen
VP Product Line Management, Mitsubishi Power

U.S. Decarbonization Past

POWER SECTOR CARBON INDEX

US POWER SECTOR CO_2 EMISSIONS INTENSITY



The U.S. Power Sector began decarbonizing in 2001 and the pace of decarbonization has been accelerating.

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U.S. Decarbonization Past & Future

POWER SECTOR CARBON INDEX

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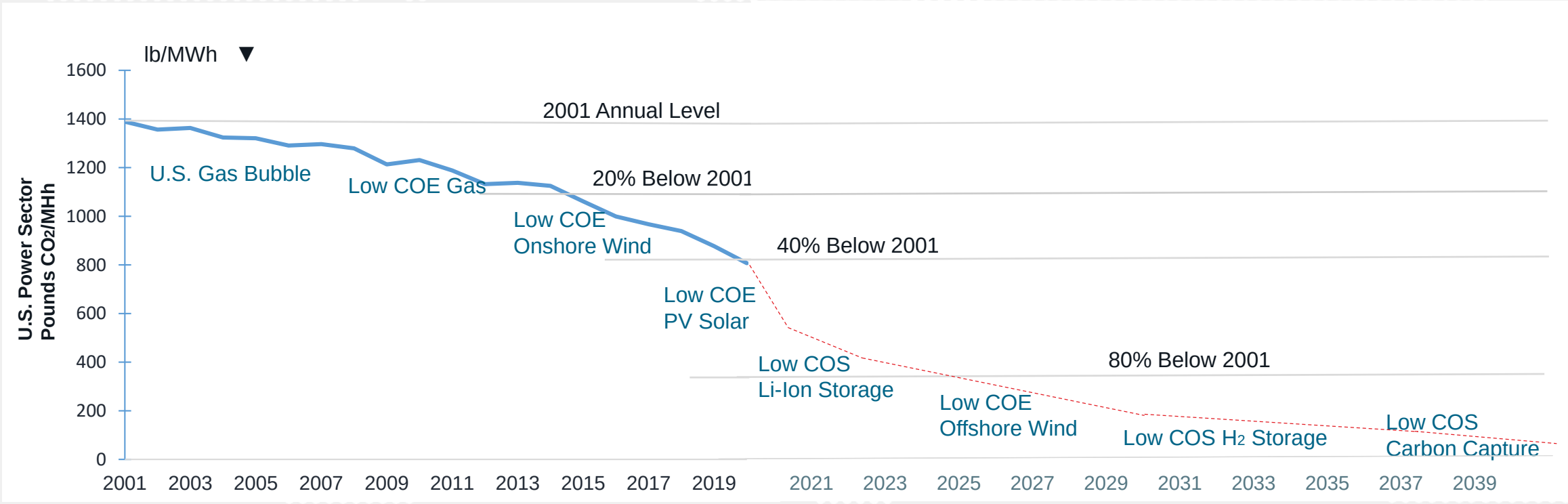

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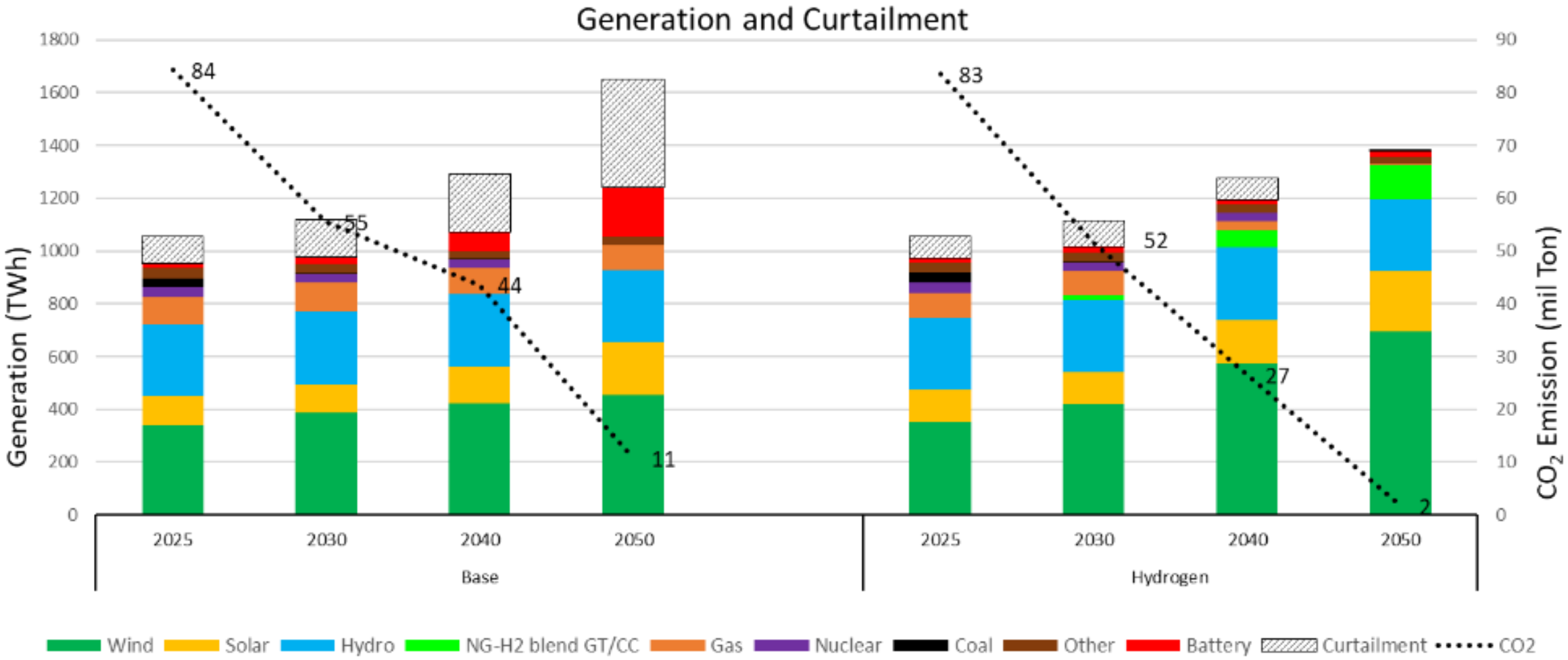
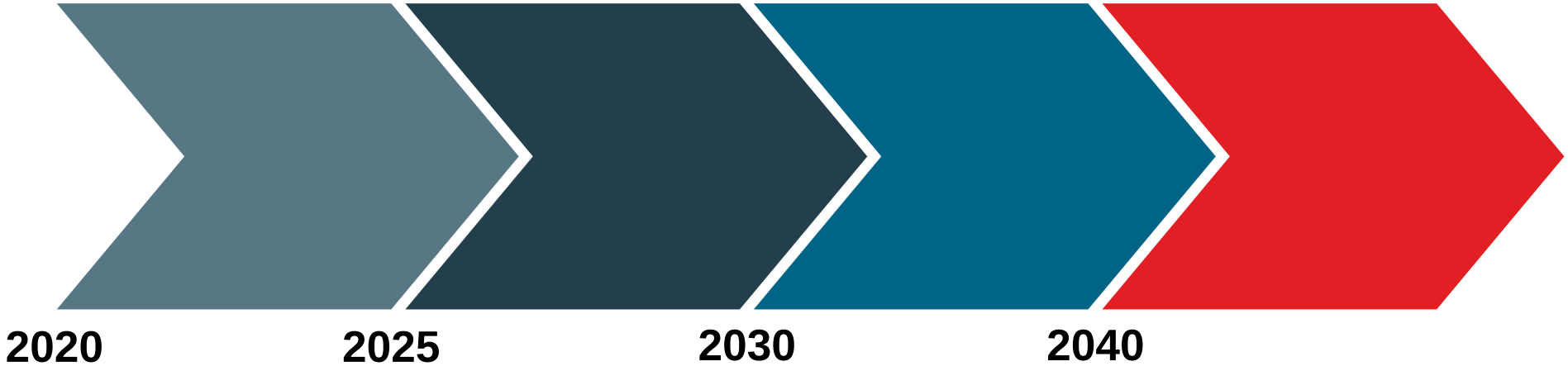
Storing Renewable Power for All Durations Reduces Cost of Net Zero…



2050 Case Comparison

400 TWh	38 GW Less Renewables Required	20% Lower System Cost to Reach Net Zero
Curtailment Averted		

Roadmap to Achieve Zero Carbon



Development

Develop, permit, construct initial Hydrogen-ready infrastructure

Deployment

First regional Hydrogen production and power generation hubs, 30% H_2 storage

Scale-Up

Interconnecting all regional hubs, expanding production and storage capacity, 70% H_2 storage

Carbon Zero

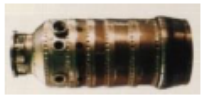
Growing production and storage capacity to achieve 100% H_2 storage

Multi-decade regional development and execution strategy

Range of Hydrogen Combustion Technology

Mitsubishi Power applies 3 types of combustors catering to individual project requirements and hydrogen contents.

Large Frame Gas Turbines

	Type	Low NOx tech	Turbine inlet temperature (˚C)	H_2 contents (volume %)	Schedule
Ready	Type 1: Diffusion 	N_2 dilution, Water/ Steam injection	1200~1400	100%	1970 Cogen/IGCC — 2027 Magnum H_2 conversion
Ready	Type 2: Pre-Mix (DLN) 	Dry	1600	30%	1982 DLN — 2018 30% co-firing test completed
Under development	Type 3: Multi-Cluster (DLN) 	Dry	1650	100% (target)	Mar, 2025 Rig test completion target

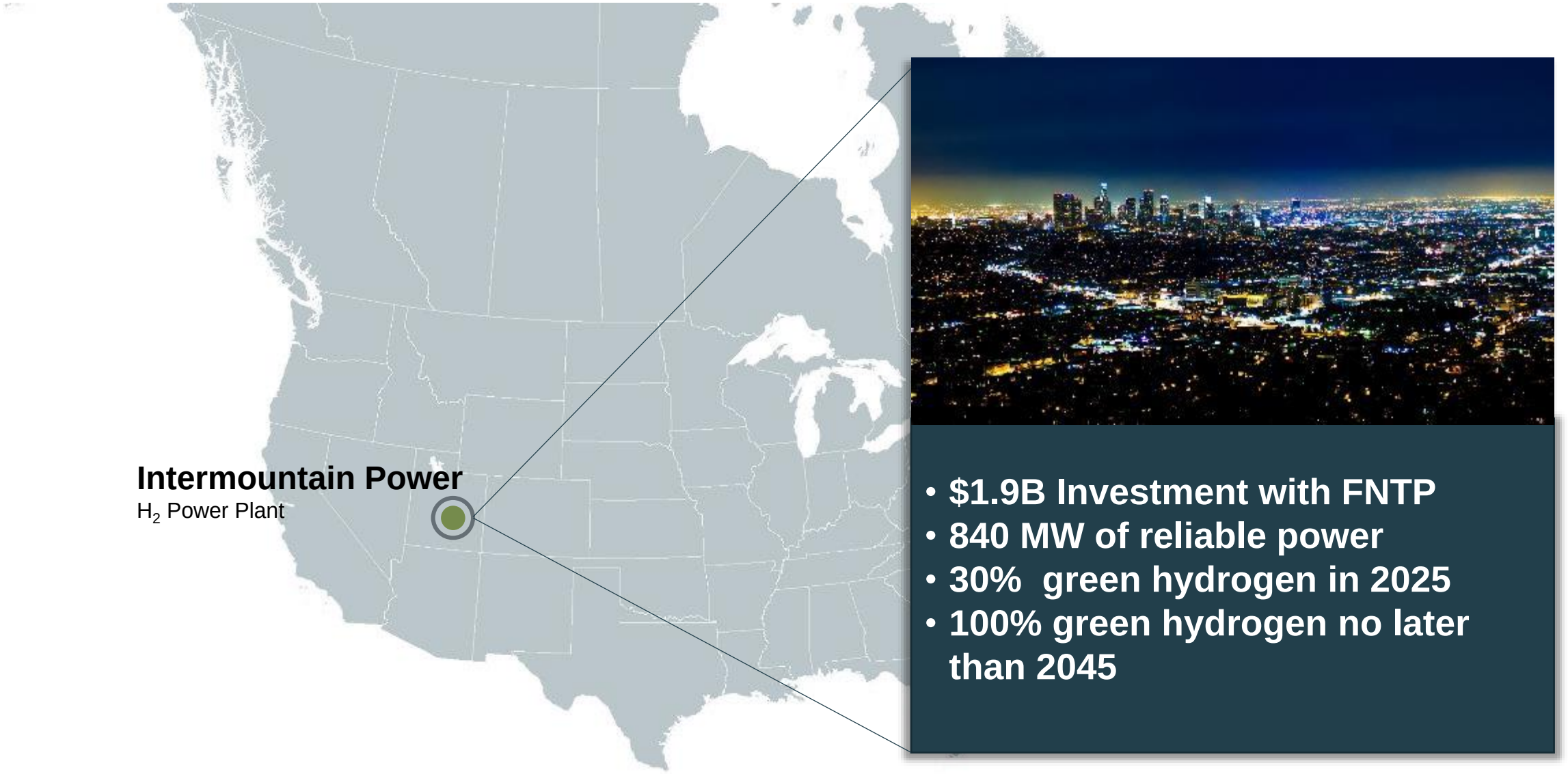
*This presentation is based on results obtained from a project commissioned by NEDO that is a government organization in Japan.
(NEDO: New Energy and Industrial Technology Development Organization)
**DLN : Dry Low NOx

Range of Hydrogen Combustion Technology

Middle & Small Gas Turbines

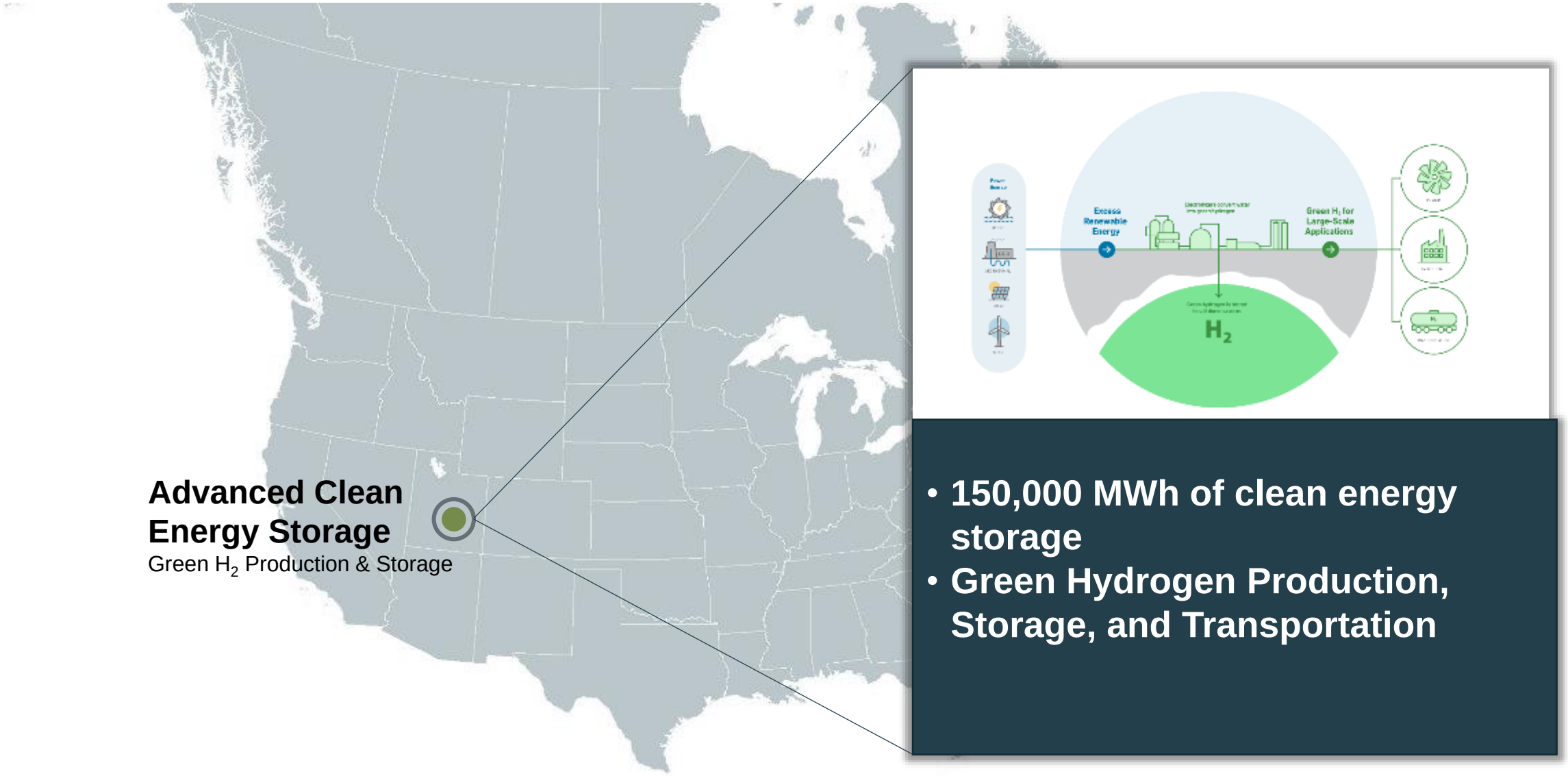
	Combustor Type		Low NOx tech	H_2 contents (volume %)	Schedule
Ready	H-25 Diffusion Combustor		Water/ Steam injection	100%	1990
Under development	H-25 Multi-Cluster		Dry	30%	2016 Product development completed; 2019 30% co-firing test completed
			Dry	100% (target)	2017 IGCC; **2022 60% co-firing test completion target**; **2024 100% firing test completion target**
Ready	H-100 Pre-Mix		Dry	30%	2017 Product development completed
Under development	H-100 Multi-Cluster		Dry	100% (target)	**In the late 2020s test completion target**

Hydrogen Infrastructure



- **$1.9B Investment with FNTP**
- **840 MW of reliable power**
- **30% green hydrogen in 2025**
- **100% green hydrogen no later than 2045**

Hydrogen Infrastructure

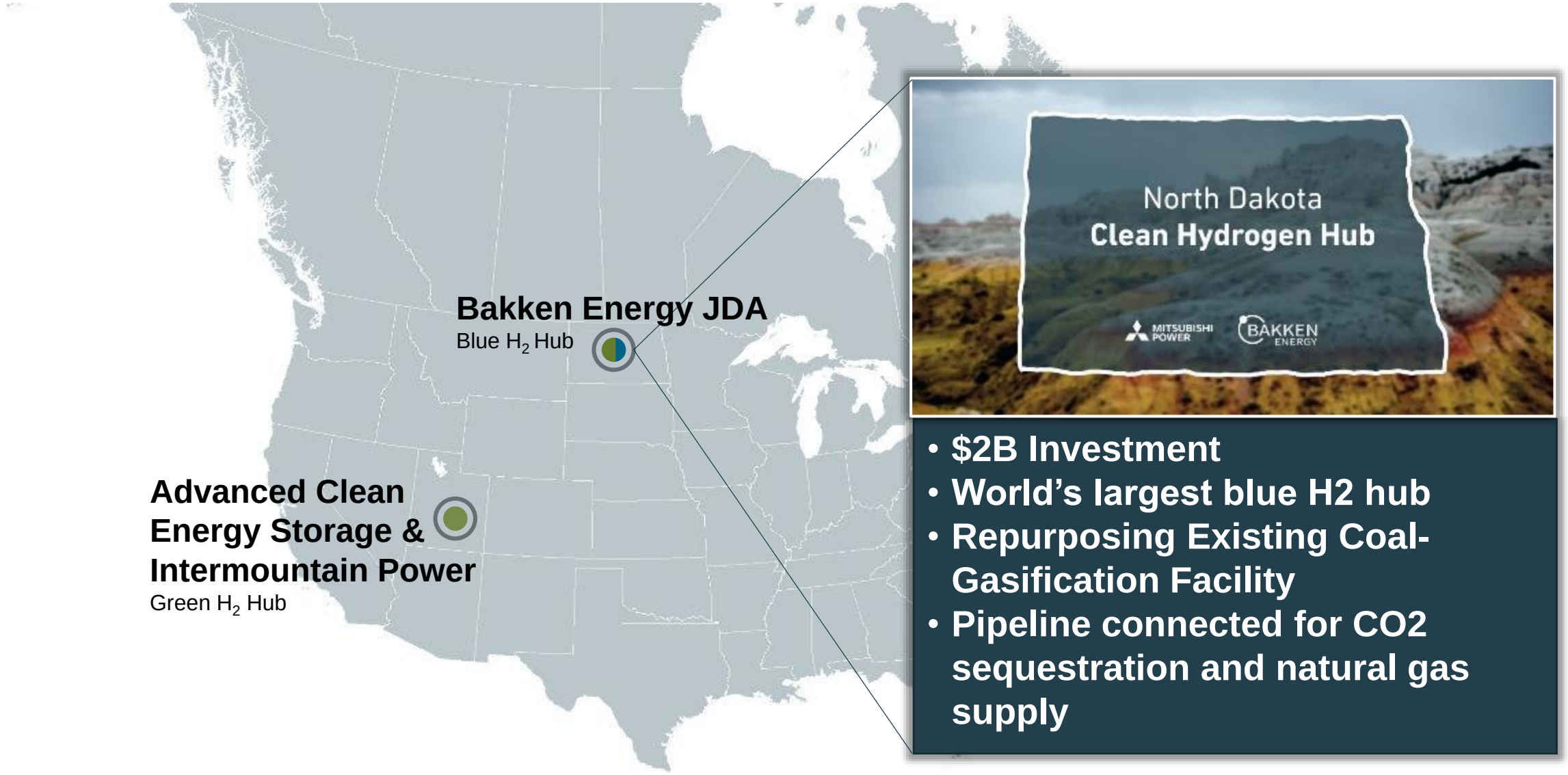


Advanced Clean Energy Storage

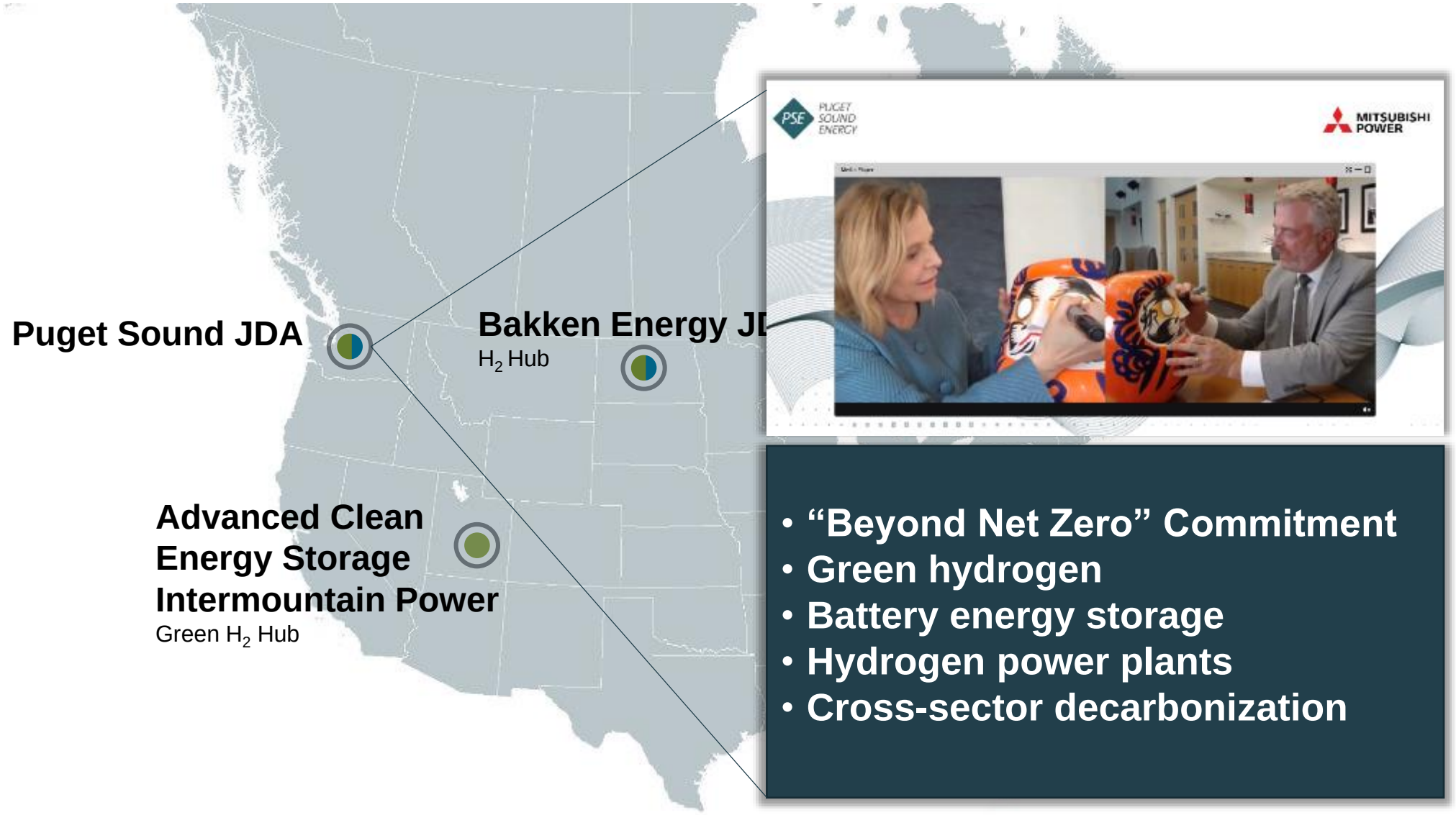
Green H_2 Production & Storage

- **150,000 MWh of clean energy storage**
- **Green Hydrogen Production, Storage, and Transportation**

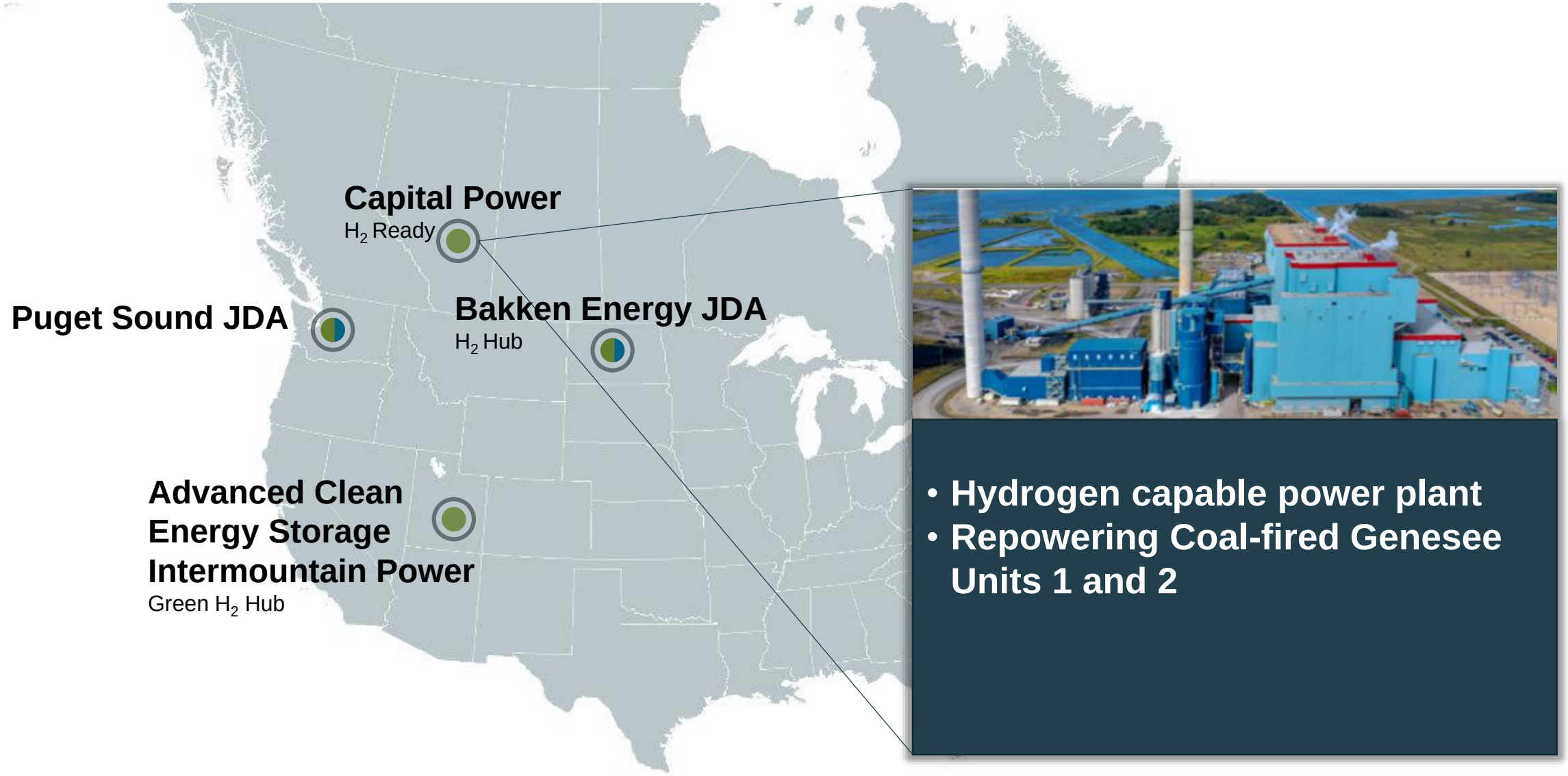
Hydrogen Infrastructure



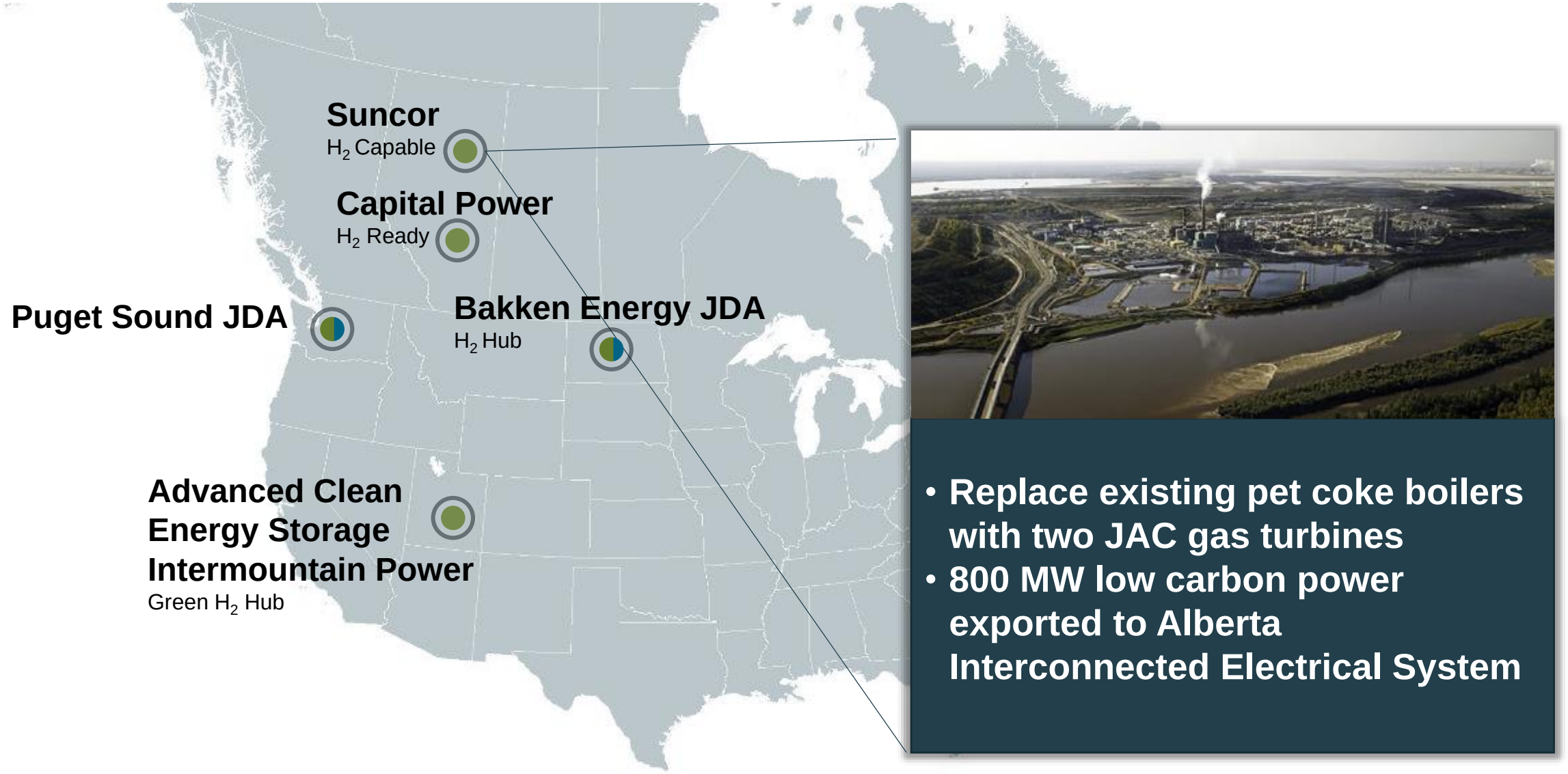
Hydrogen Infrastructure



Hydrogen Infrastructure

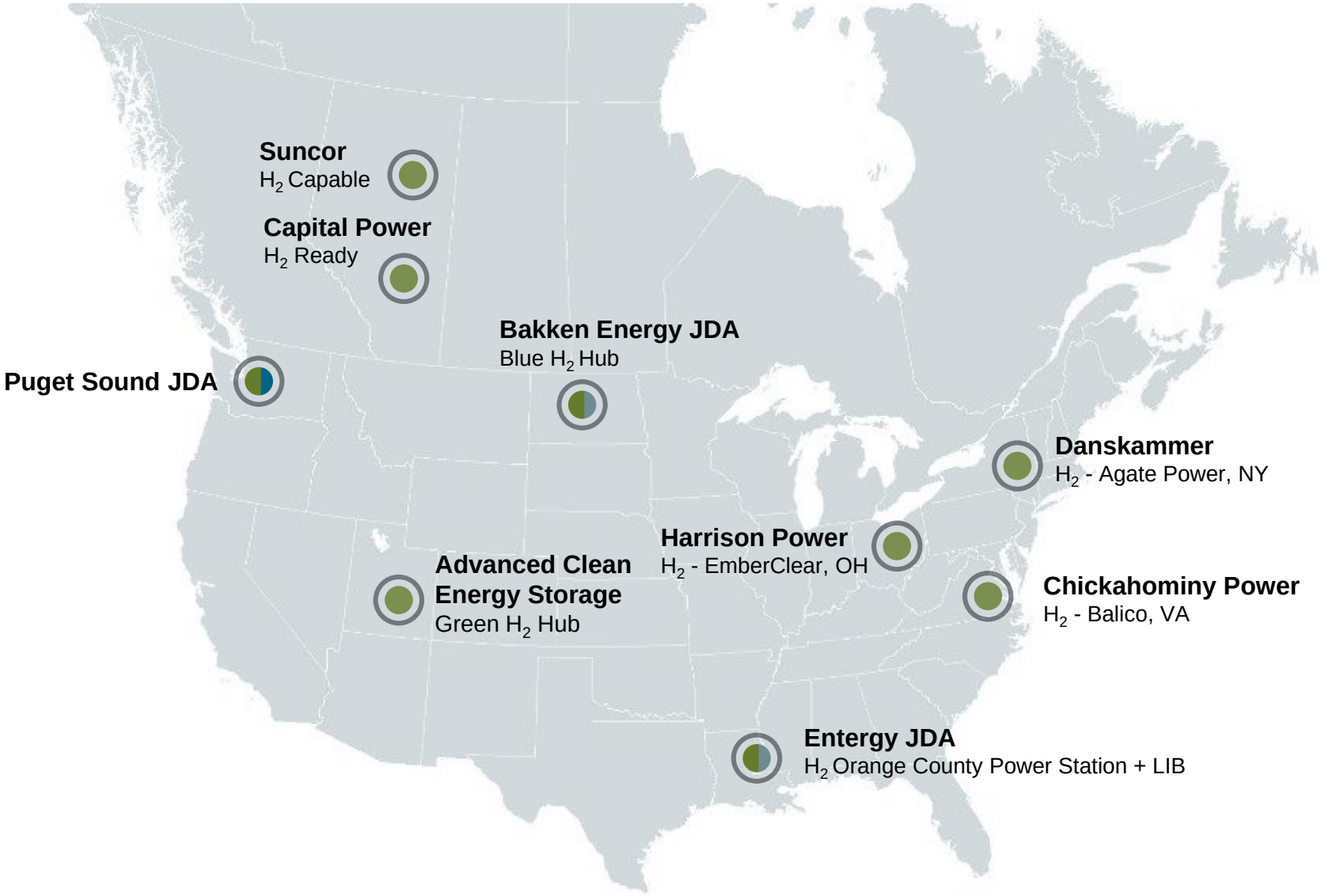


Hydrogen Infrastructure



- **Replace existing pet coke boilers with two JAC gas turbines**
- **800 MW low carbon power exported to Alberta Interconnected Electrical System**

Current Energy Storage Projects in US and Canada

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