Intermountain Power Project and the Decarbonization of Los Angeles

October 14, 2021

LADWP Overview

Balancing Authority

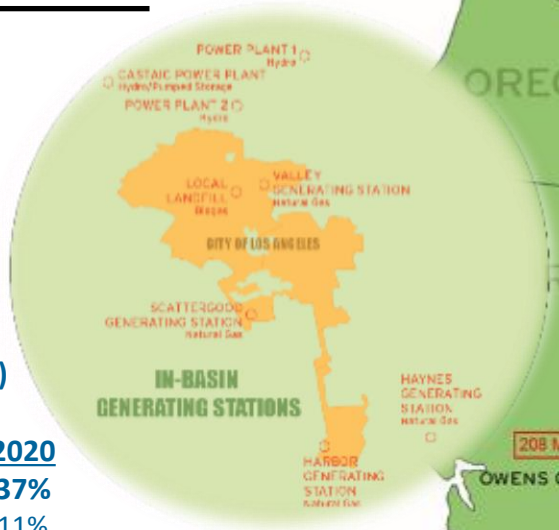
Largest Publicly Owned Utility

1.5 Million Electric Customers

$4.7 Billion Annual Power Budget

Peak Demand of 6,502 MW (8/31/17)

	2019	2020
Renewable Energy	**34%**	**37%**
Wind	10%	11%
Geothermal	9%	10%
Solar	12%	15%
Eligible hydroelectric	3%	1%
Biomass & Biowaste	0%	0%
Natural Gas	**27%**	**29%**
Nuclear	**14%**	**14%**
Large hydro	**4%**	**4%**
Coal	**21%**	**16%**








LA100

ACHIEVING 100% RENEWABLE ENERGY IN LOS ANGELES

LA City Council motions directed LADWP to evaluate:

- What are the **pathways and costs to achieve a 100% renewable electricity supply** while electrifying key end uses and maintaining the current high degree of reliability?
- What are the potential benefits to **the environment** and **health**?
- How might **local jobs** and the **economy** change?
- How can communities shape these changes to prioritize **environmental justice?**

Across All LA100 Scenarios

Electrification
Efficiency
Flexible Load

Customer
Rooftop Solar

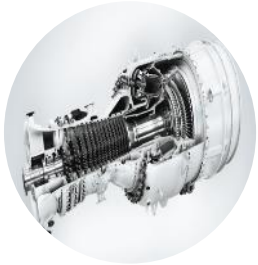
Renewable
Energy

Solar: + >5,700 MW
Wind: + >4,300 MW

Storage

+ >2,600 MW

Transmission,
Distribution



Renewably Fueled
Dispatchable
Turbines

+>2,600 MW
(in basin)

Much More

Natural gas → Biofuel/ hydrogen	
Today: Daily	**Future:** Infrequently

CURRENT INTERMOUNTAIN POWER PROJECT

- LOCATION: DELTA, UTAH
- OWNED BY THE INTERMOUNTAIN POWER AGENCY (IPA)
- 35 PROJECT PARTICIPANTS (23 UTAH AND 6 CALIFORNIA MUNIS, 6 UTAH COOPS)
- TWO COAL UNITS – 1,800 MW NET CAPACITY
- NORTHERN AND SOUTHERN TRANSMISSION SYSTEMS
- CURRENT LADWP WIND INTERCONNECTIONS
  - MILFORD WIND: 287 MW
  - PLEASANT VALLEY: 82 MW
- COAL CLOSURE BY 2025
- LADWP IS THE PROJECT MANAGER AND OPERATING AGENT

IPP Renewed+

Project Necessity

- Dispatchable energy required to maintain system reliability and support 2400 MW HVDC transmission
- Units capable of integrating with renewable resource variability
- Required to meet LADWP's 100% Renewable Goals
- Less reliance on in-basin natural gas units and Aliso Canyon Storage facility

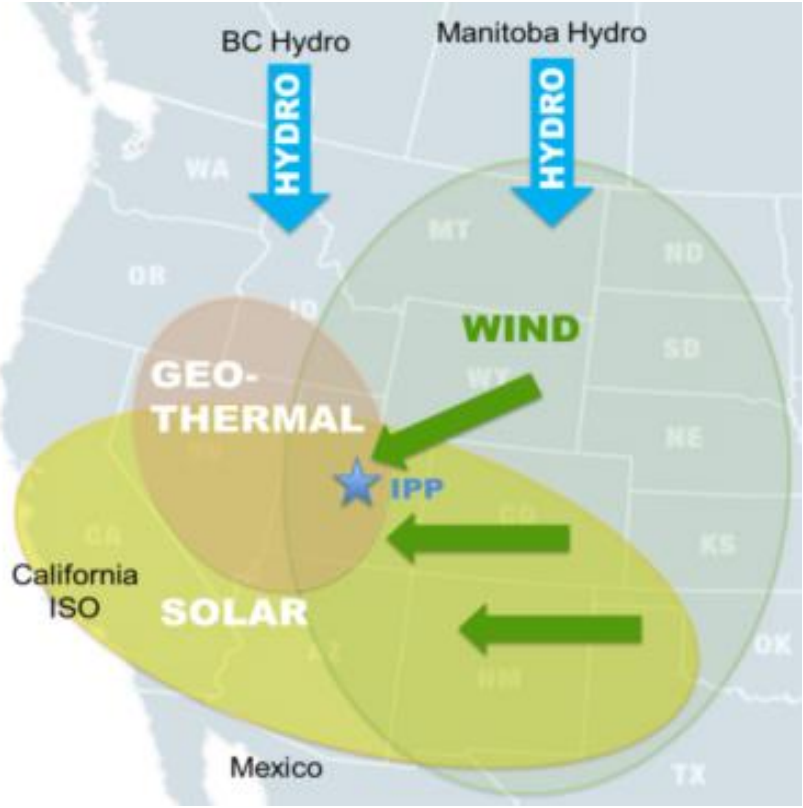
LA DWP

Project Scope

- **840 MW Natural Gas Advanced Class Combined Cycle Facility**
- **2,400 MW HVDC Converter Stations Replacement, Switchyard upgrades and Transmission Support Equipment**
- **Natural Gas Pipeline**
- **Decommissioning of Coal Generators and associated facilities**

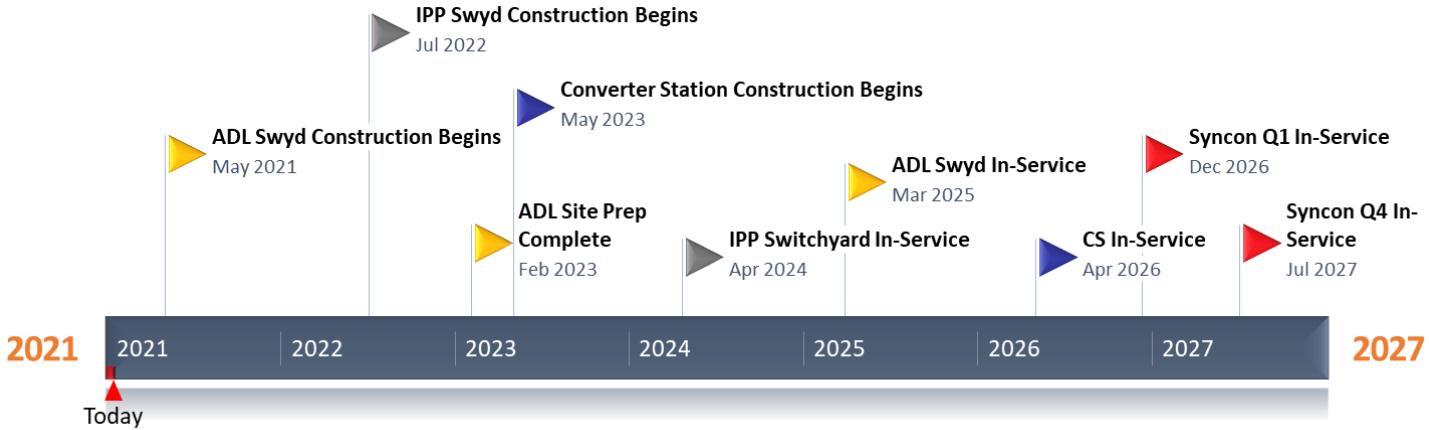
Utah's Renewable Hub

- IPP sits in a confluence of renewable resources
- Currently interconnected about 400 MW of wind generation and geothermal
- 2,300 MW of current solar interconnection requests in queue
- 1,500 MW of Wyoming wind interconnects currently being discussed
- Considered the "Western Renewable Energy Hub"



Transmission

- New converter stations at Intermountain and Adelanto
- AC Switchyard Expansions at Intermountain and Adelanto
- Reactive power equipment at Intermountain



Generation

- Two, advanced class, combined cycle generating units—840 MW net
  - Contract signed with Mitsubishi in February 2020
  - Mitsubishi Power has committed to performance requirements to allow 30% hydrogen fueled units for 2025 and a pathway to 100%
  - These upgrades could be achieved with modest modifications during regular planned maintenance outage
- EPC contractor to build the facilities and install the generating units
  - Construction to begin Q2 2022
  - In-service May 2025

Future Proofing for H2

- What's needed to get to 100%
  - Combustor technology development
  - Modifications to Balance of Plant equipment
  - Infrastructure to support 100% Hydrogen
- What we're doing today
  - Plant layout designed for installation of future H2 equipment
  - Installation of flexible green H2 and natural gas fuel mixing systems
  - Designing the systems to lower the life cycle costs of transition to 100% H2

Green Hydrogen Future

The hydrogen pathway at IPP represents a first-of-its-kind opportunity for the western energy grid. Utilizing its existing transmission capabilities to power hydrogen-generating electrolyzers, the fuel can be either stored in the massive geologic salt formation or burned in the existing combustion generators.

- Solar and wind resources from Wyoming, Utah, Nevada, and California
- NTS and STS required for transmission

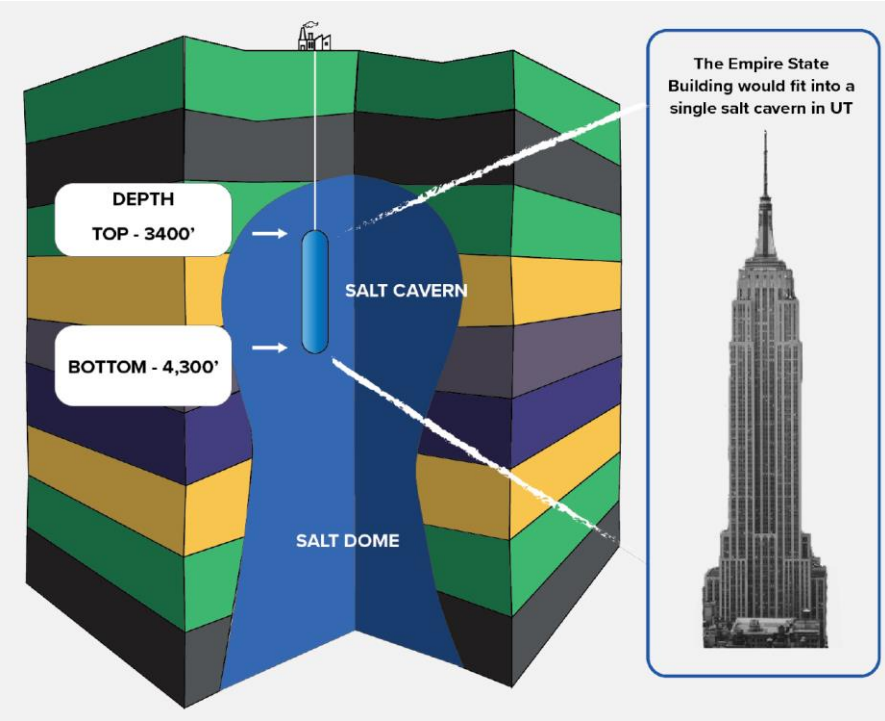
- Using renewable energy, electrolyzers change water into hydrogen gas

- Hydrogen fuel is stored in underground salt caverns
- Allows for seasonal shifting on renewable energy

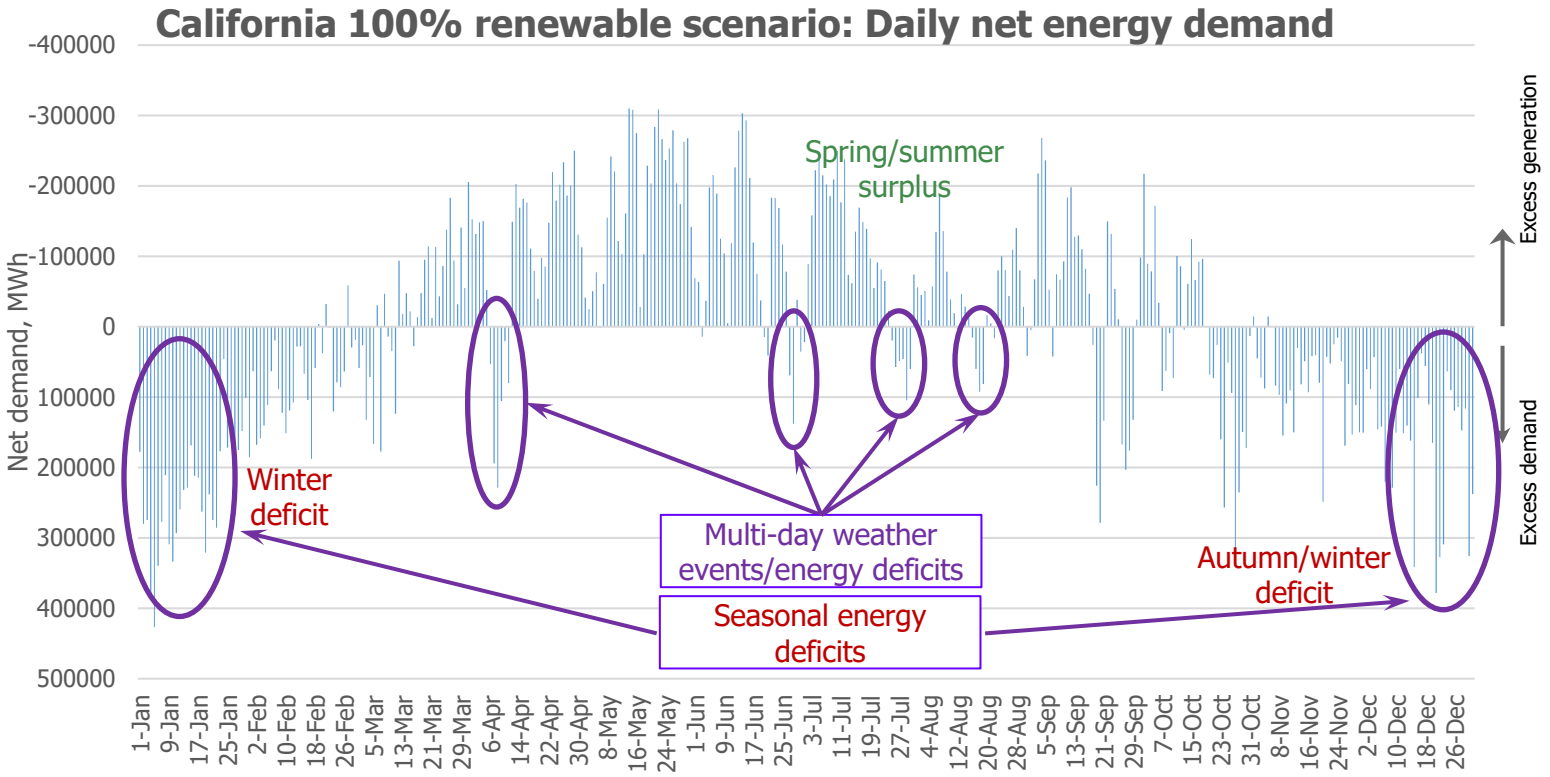
- Combustion technology is capable of mixing hydrogen with natural gas
- New IPP generators will have this capability at 30% on COD

Salt Dome at Intermountain: A Unique Opportunity

- Underground salt domes beneath Intermountain
- Suitable for storing green hydrogen
- Created by solution mining
- 1 cavern = 5,500 tons H_2 storage
  - Equivalent to 1 million fuel cell cars
- Over 100 caverns possible near Intermountain
- Allows for seasonal shifting of energy storage

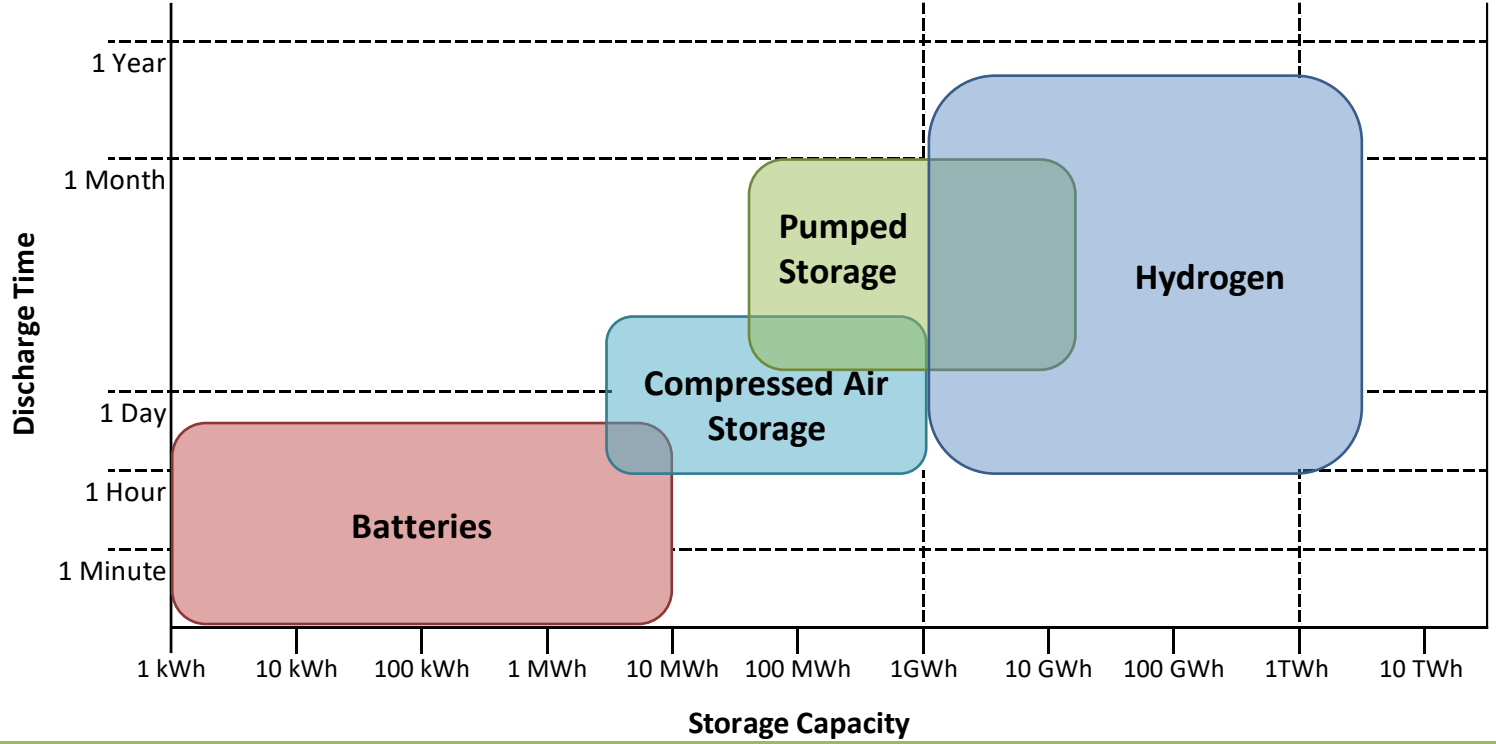


Need for Multi Day and Seasonal Energy Storage



Source: CAISO and Strategen Analysis

Energy Storage Potential

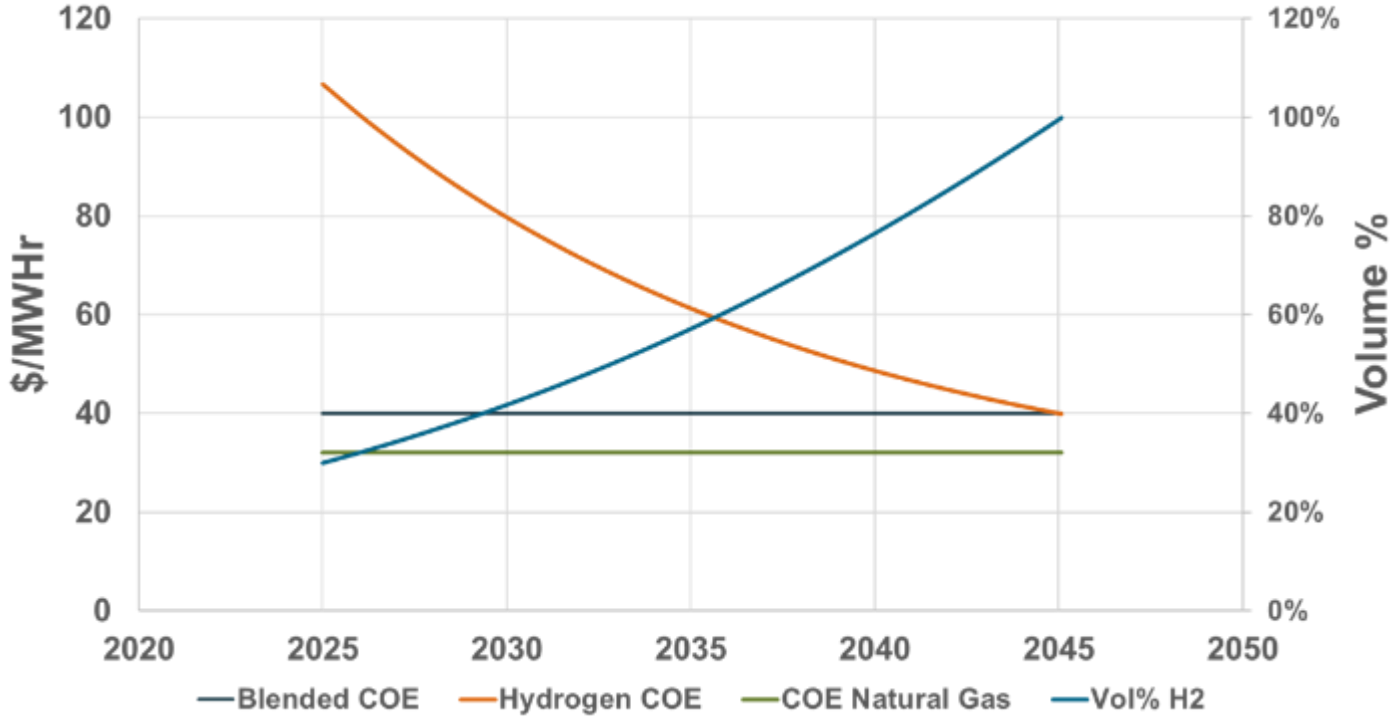


STORAGE IN ONE CAVERN AT IPP IS 84 TIMES THE STORAGE CAPACITY OF THE 1,200 MWH ELAND BATTERY SYSTEM

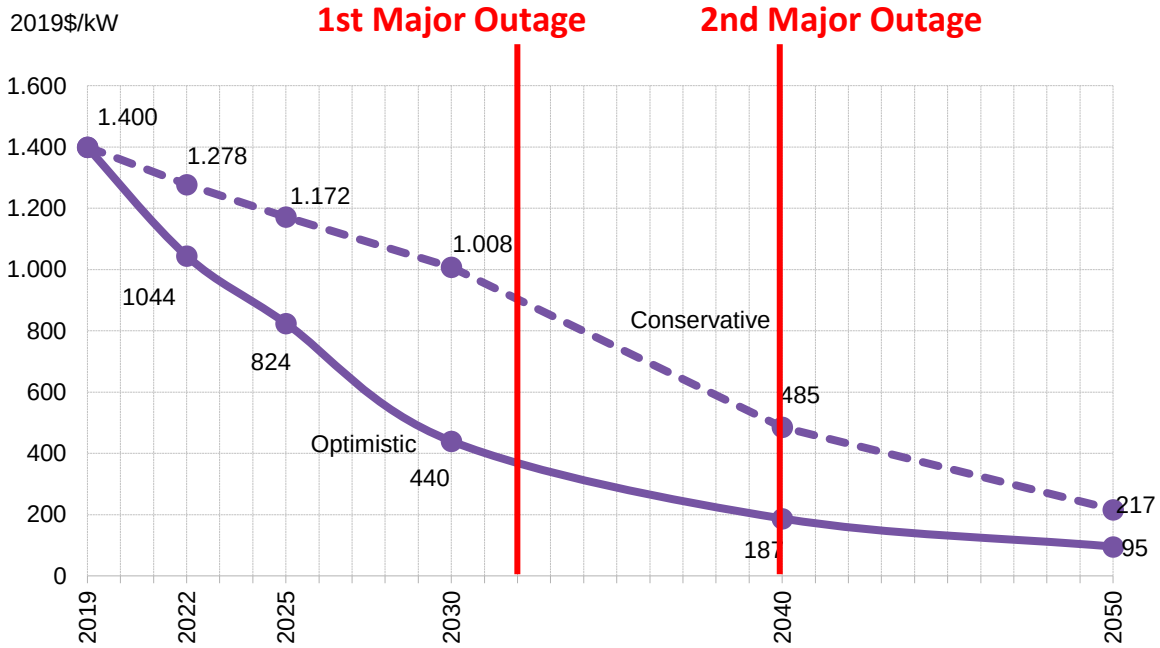
Green Hydrogen Fuel Supply

- "Multi-Stage" Request for Proposal advertised through IPA in June 2020
  - Stage 1 responses received and evaluated
  - Developing Stage 2 to dive deeper into technical, commercial arrangements
- Explore capability of industry to bring green hydrogen to IPP:
  - Hydrogen Generation capabilities
  - Identifying renewable energy resources
  - Transportation and Storage
  - Commercial structures
- Currently in negotiations with the Advanced Clean Energy Storage, LLC (ACES)

Cost of Electricity Over Time for an Increasing Blend of Green Hydrogen



Electrolyzer Costs Expected to Drop



Source: BloombergNEF. Note: Assumes system size of 4MW in all years.

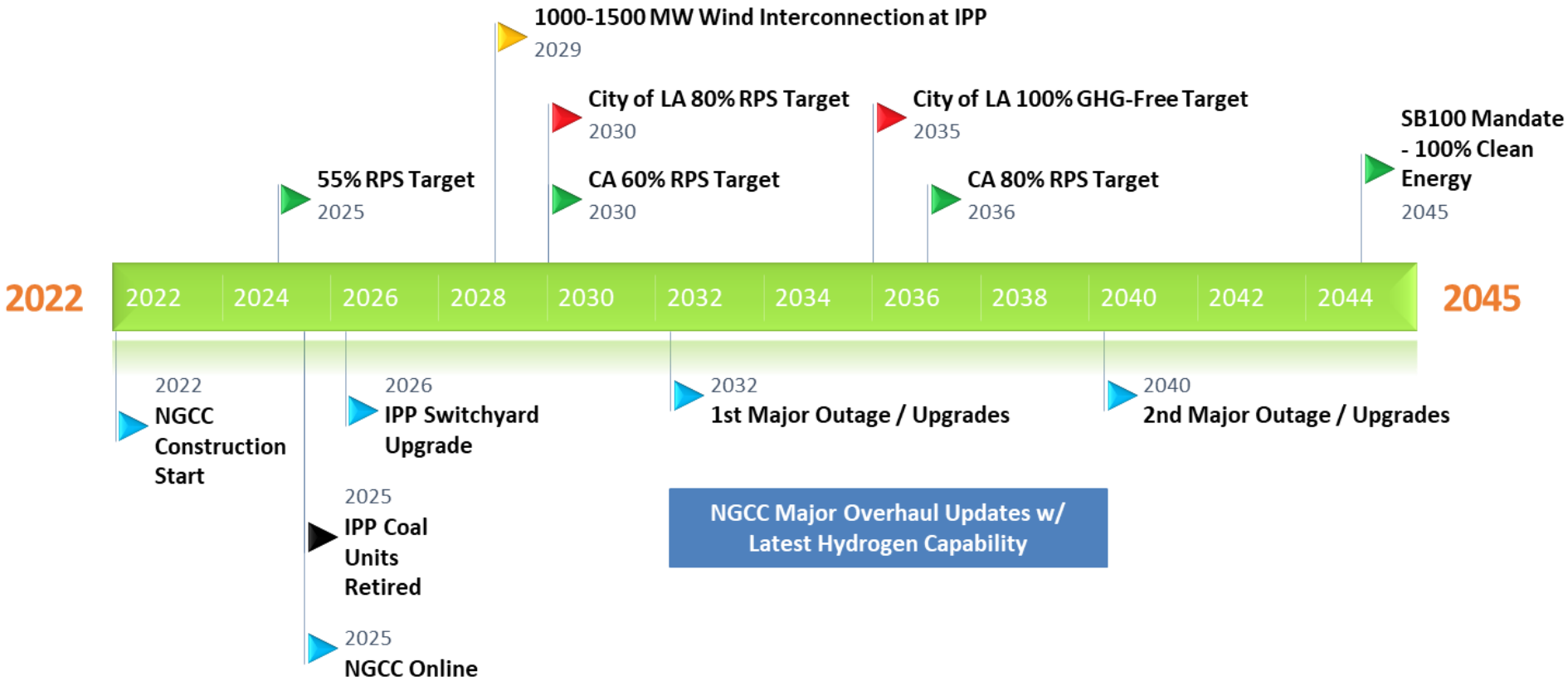
- Electrolyzers are a major cost driver in value chain
- Forecasts show that the prices are expected to significantly decrease with time
- Lines up with Generator upgrades for additional volumes of H2.

Current State of Technology

- Current combustor technology can support stable operation up to 30% at this scale
- High concentrations of H2 presents challenges with:
  - Flame Stability
  - Flashback
- Major R&D investments are being made to improve performance and prevent component damage

Multi Cluster Combustor (ETN Global)

Hydrogen Timeline



Next Steps

- IPA looking for sign deal with ACES by end of 2021
- Multi-stage RFP Green Hydrogen Fuel Supply
  - Phase 2 scheduled to be advertised in July 2022
  - Anticipated award of Hydrogen Supply Project agreement by December 2023
- Current Federal Outreach
  - Seeking DOE funding opportunities to fund new project and lower costs of ACES project


LA
DWP
Los Angeles
Department of
Water & Power
CUSTOMERS FIRST