WECC

LDES Advisory Group Modeling Approach

July 7, 2022

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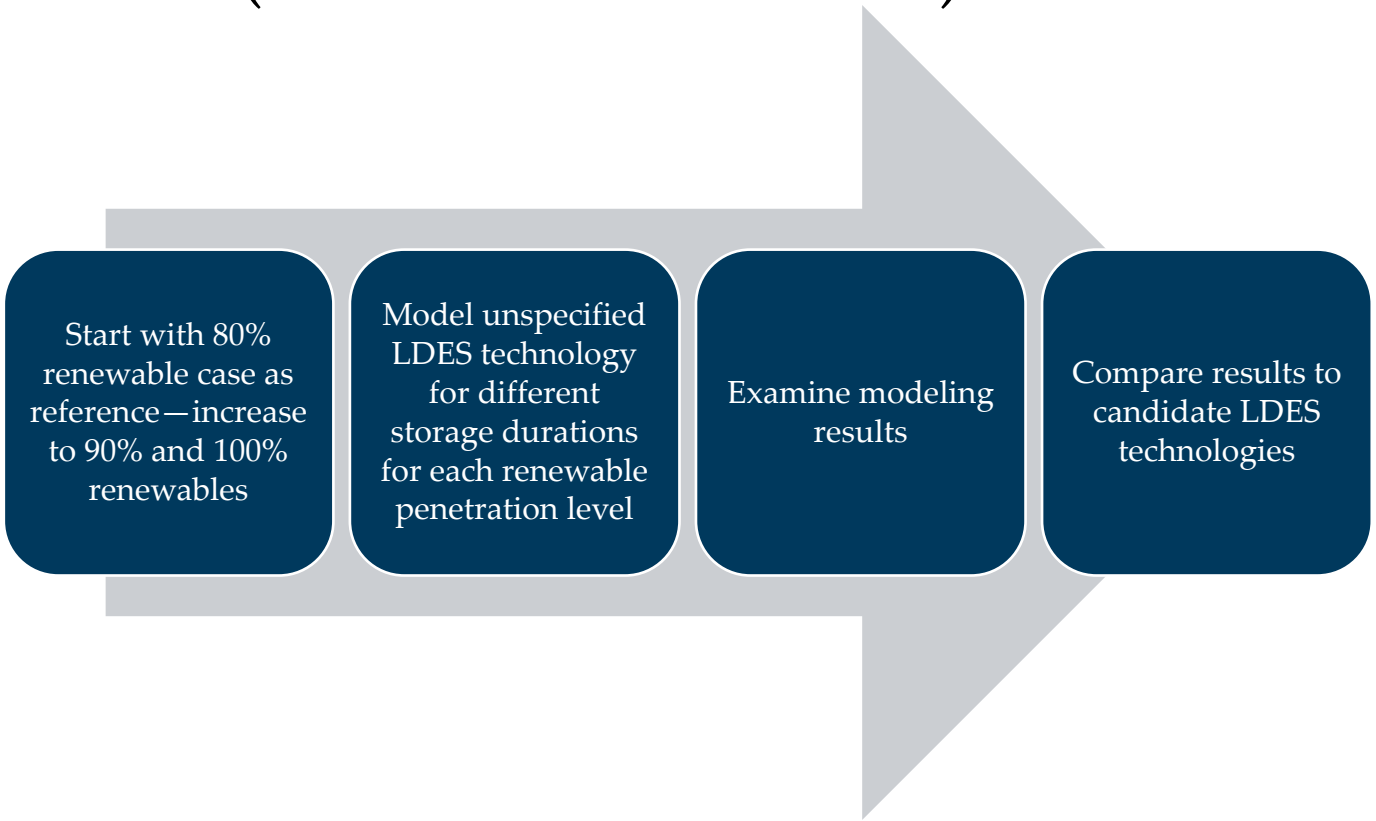
Overview

- Review of June 23rd meeting
- Proposed approach for Part 1 studies
- Review Delta, Utah projects
  - Advanced Clean Energy Storage (ACES) project
  - IPP Renewed project
- Next steps

June 23rd Meeting Review

Topics from June 23rd meeting

- LDES technology selection
- New study approach to test different durations of long duration storage resources (details in later slides)



What are Emerging Clean and Flexible (ECF) Resources

- Placeholders for new technologies yet to be developed that are carbon free and flexible. These were used in the 2040 Clean Scenarios studies.
- For this assessment, LDES technologies represent ECF
- In the 2040 Clean Scenarios studies the ECF resources had the following characteristics:

Ramp rate: 6000 MW/min
Minimum Up/Dn: 1 hour
FO rate: 6.29%
Summer Derate: 0.94
Startup Cost: $0
Var. O&M: $2.083/MWh
Fixed cost: $712.36/MW/Month

Fuel: Unspecified-Clean
Fuel cost: $5/MMBtu
Heat Rate: ~5.5 MMBtu/MWh
Emission rate: 0 lb/MMBtu

Part 1 Studies

LDES Study Plan – Part 1 (Proposed)

Study #	Clean %	LD Duration
0	80	N/A
1	90	48
2	90	72
3	90	168
4	90	336
5	100	48
6	100	72
7	100	168
8	100	336

- Start with 80% renewable case as reference
- Keep all shorter-duration BESS (≤ 12 hours) in the case
- Part 1 LDES additions will be modeled as batteries, but using pumped storage hydro model in GridView
  - Minimum storage duration: 48 hours
  - PS dispatch option 5 which allows us to vary the charge/discharge prices by month
  - Optimal size of each unit?
  - Charge/discharge prices?
- Place LDES units near load centers or VER facilities with no storage
- Turn off Emerging Clean & Flexible (ECF) units in study cases
- Add additional VER if needed for LDES charging
- Full-year runs (could be preceded by test runs)

Energy Storage Model Details (PS Opt 5)

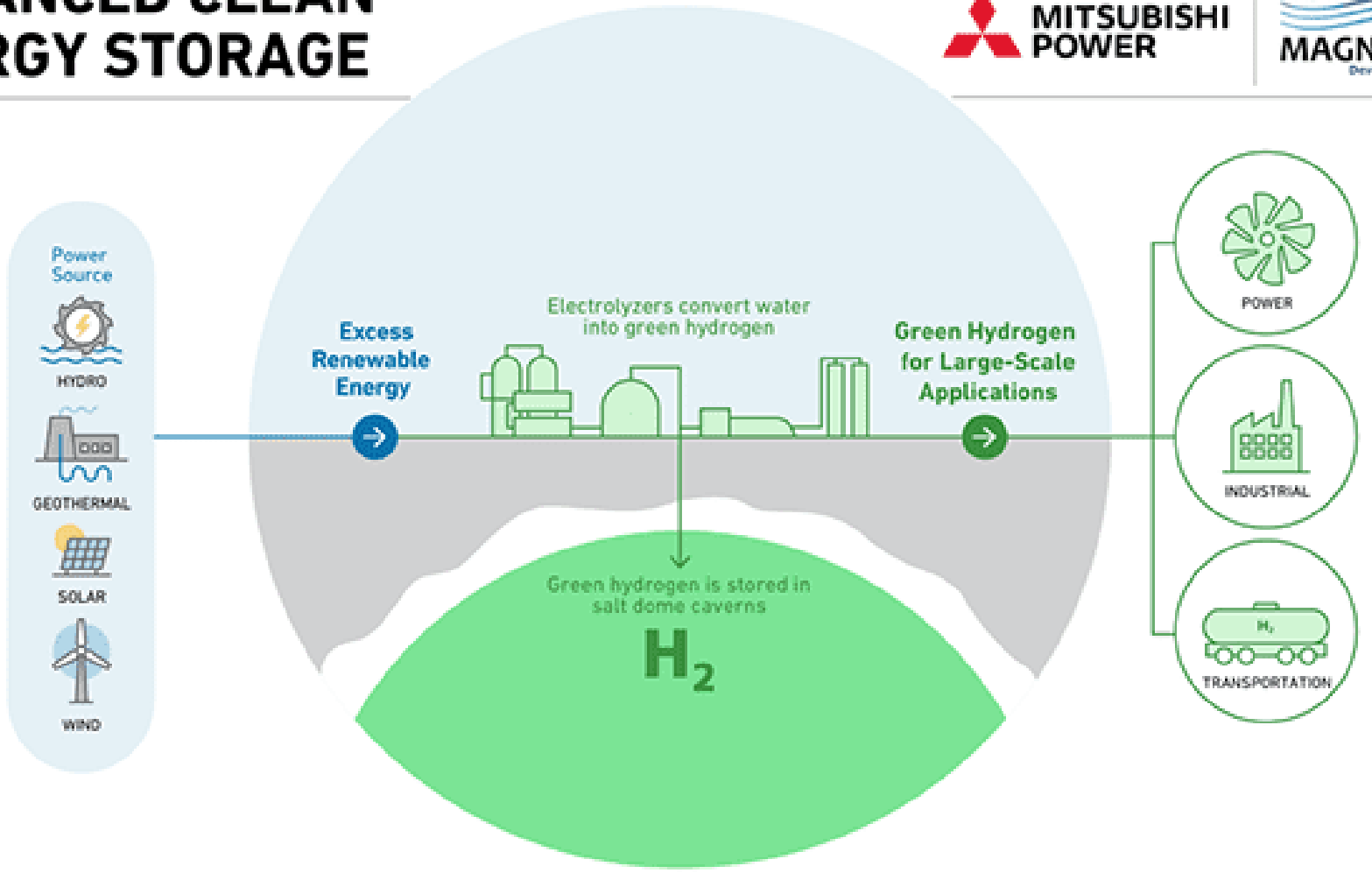
- Storage capacities (maximum/minimum/initial) in MWh
- Charge capacity and Discharge capacity in MW
- Efficiency in percent
- Price trigger to charge or discharge in dollars (LMP $/MW)
  - Example: Charge at $0/MW, Discharge at $100/MW
  - Prices can be set by month

Study Result Analysis

- Unserved load
- Wind and Solar curtailments
- Dispatch of Energy Storage
  - Hourly average by month
  - Total charge and discharge energy by month
- Dispatch Summary comparison to 2040 80% Clean Scenario (reference case)
- Path congestion report

Clean Energy Projects near Delta, Utah

ADVANCED CLEAN ENERGY STORAGE



1. The Advanced Clean Energy Storage project will produce, store, and transport green hydrogen at utility scale for power generation, transportation, and industrial applications in the western U.S. Courtesy: Mitsubishi Power

Advanced Clean Energy Storage Project (ACES)

- Production and Storage of green hydrogen in two salt caverns near Delta, Utah
- Each cavern will be able to store 5500 metric tonnes (150,000 MWh) of hydrogen
- Green hydrogen will be produced using surplus renewable energy to power electrolyzers (220 MW) that split H_2O into hydrogen and oxygen.
- The hydrogen is then injected into the salt caverns and pressurized to 2900 psi
- Currently under construction; in-service by June 2025
- Link: https://www.powermag.com/massive-utah-hydrogen-storage-project-garners-finalized-504m-doe-loan-guarantee/

Hydrogen Electrolyzers

- Used to split water (H_2O) into hydrogen and oxygen
- H_2 is "Green" if the electrolyzers are powered by renewables

Largest Hydrogen Electrolyzers

Company	Capacity (MW)	H2 Production	Commissioning	Type
Shell China	20	?	January 2021	PEM
Air Liquide	20	8.2 tons/day	January 2021	?
Baofeng China	30		April 2021	Alkaline
Baofeng China	150	23,700 tons/yr	December 2021	Alkaline
Sinopec China	260		June 2023	Alkali

“IPP Renewed” Project

- Two 420 MW Combined Cycle (2x1) plants adjacent to the IPP Coal Plant; In-service by June 2025 as IPP retires
- Fuel is blend of natural gas and hydrogen
- Hydrogen component = 30% in 2025 increasing to 100% by 2045
- Hydrogen supplied by ACES
- Current status: Under construction
- https://youtu.be/JKi_IbRGhqQ

Delta Projects

- The WECC study cases from the 2020-2021 study program and the WECC ADS cases did not model the ACES and modeled the IPP CC project as 100% natural gas fired.
- Based on the 2025 in-service dates for ACES and IPP Renewed, it seems prudent to model these accurately in the LDES Studies.
- How to model?
  - Separate or coupled
  - Seasonal hydrogen
  - Multi-sector hydrogen

Next Steps

Next Steps

- Work with GridView vendor to obtain final storage modeling methodology
- Decide on adding Delta clean energy projects
- Review 2040 80% Clean Scenario and use that as the reference for making comparisons
- Prepare and run the Part 1 studies
- Bring results back to LDESAG for review

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Electric Reliability and Security for the West

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