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Hydrogen-Based Energy Storage System

Energy Storage Enhancements (ESE)
Working Group, CAISO

July 26, 2021



Borrego Springs Electric System Upgrades



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The Borrego Spring's microgrid is connected to SDG&E's smart grid, but can disconnect and function independently during emergencies, supplying vital electricity to the local community through its onsite resources.

The Advanced Energy Storage deployments will be co-located adjacent to the microgrid.

- Hydrogen Energy Storage System (H2 ESS)
- Battery Energy Storage System (BESS)

The energy storage systems will participate in CAISO markets during most of the year, and prioritize local distribution and microgrid needs when necessary.

Hydrogen-Based Energy Storage

Inputs: Local distribution circuit, water, Oxygen

Outputs: Oxygen, water, local distribution generation

SDG&E is developing a Power-to-Gas-to-Power (P2G2P) project which will use hydrogen as the energy storage medium.

The energy storage system will:

- Use a grid-connected electrolyzer to generate hydrogen
- The hydrogen will be stored in high-pressure tanks
- A fuel cell will consume the stored hydrogen to produce grid power
- All created hydrogen is used exclusively by the fuel cell

The system will start as long-duration (8+ hours) energy storage.

The system duration may be expanded to greater hours through the addition of more hydrogen tanks, or to support even longer durations (e.g., multi-day weather events)



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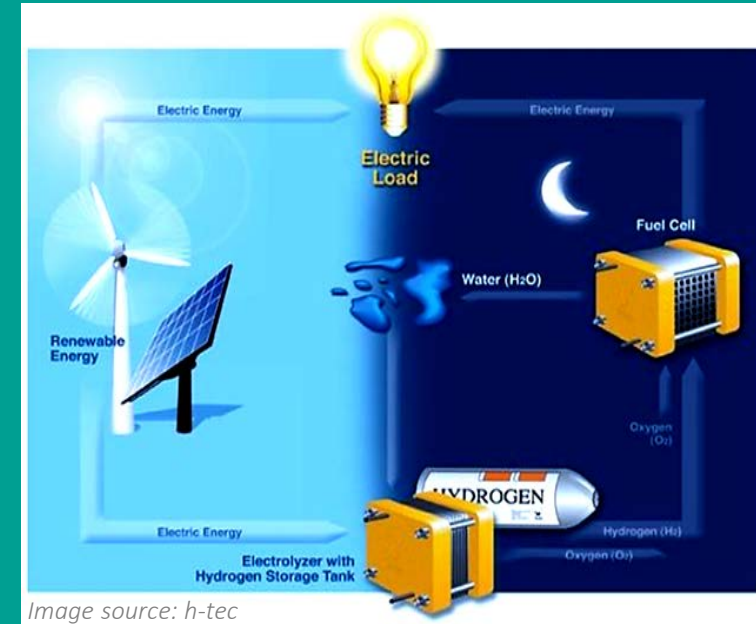
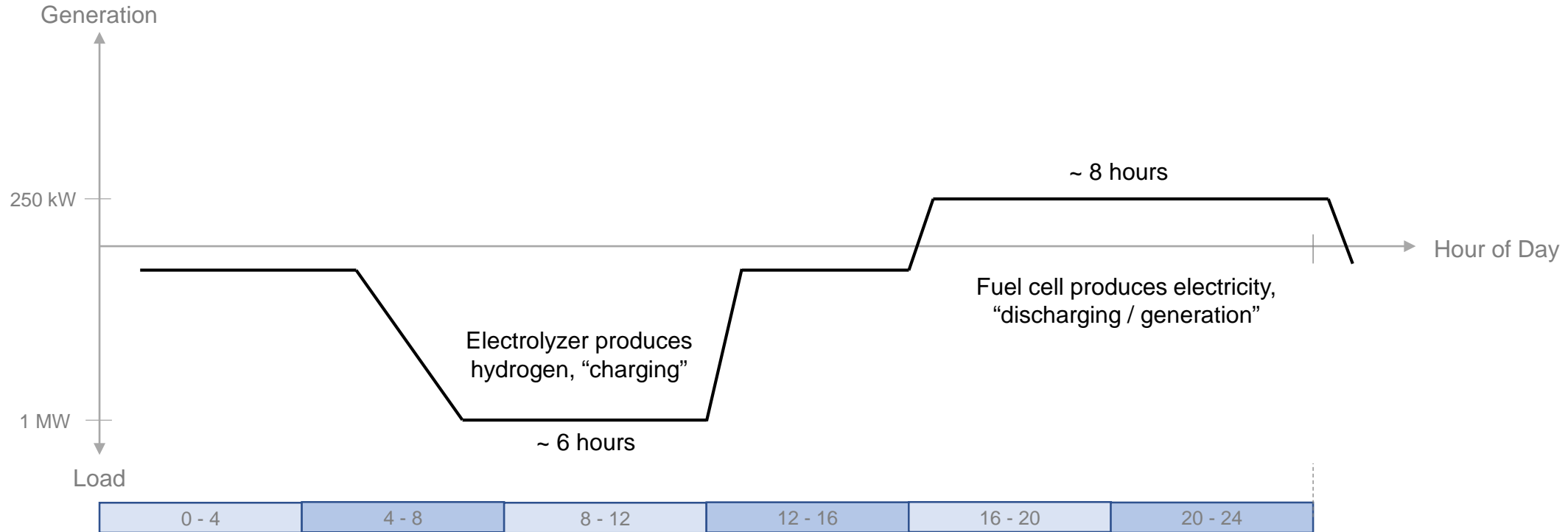


Image source: h-tec

Asymmetric System Operation

Conceptual diagram – for discussion purposes only

Compressors and other equipment may classify as auxiliary load.

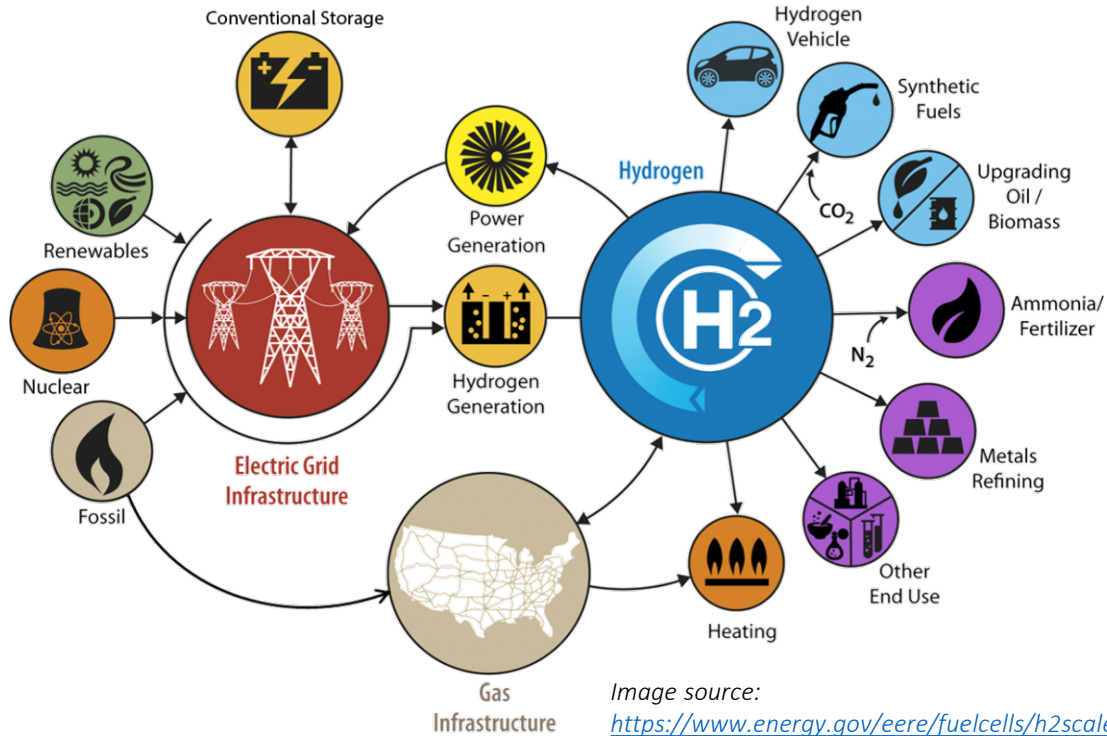


Preliminary conversations with CAISO have led to the direction to classify this as “hybrid energy storage”, since:

- 1) the asymmetric nature does not fit the normal energy storage operating assumptions for CAISO models as the electrolyzer and the fuel cell operate independently, and
- 2) a stand alone fuel cell of less than 500kW does not meet the minimum for a standalone generator.

Future Considerations

Hydrogen is a Versatile Technology for the Clean Energy Future



- An electrolyzer may produce additional hydrogen for additional purposes at a future time (e.g. fuel cell vehicle fueling, natural gas system blending).
- The multi-use nature of hydrogen may require additional regulatory, accounting, and settlement processes to account for input energy used for “energy storage” to be separated from other usages in the future.

What is Green Hydrogen?

Hydrogen is already used in multiple industries for diverse purposes. “Green Hydrogen” is produced from renewable energy like solar and wind.

SDG&E, other utilities, and energy infrastructure providers around the globe are investing in green hydrogen infrastructure to support net-zero emissions and climate goals.


Thank you

Questions

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