2-1. Cost Reduction in Renewable Power Generation

APERC Clean Hydrogen Workshop
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Outline

Electrolysis and electricity costs

Historical and future VRE costs

The importance of high capacity factors

Issues associated with grid connected power

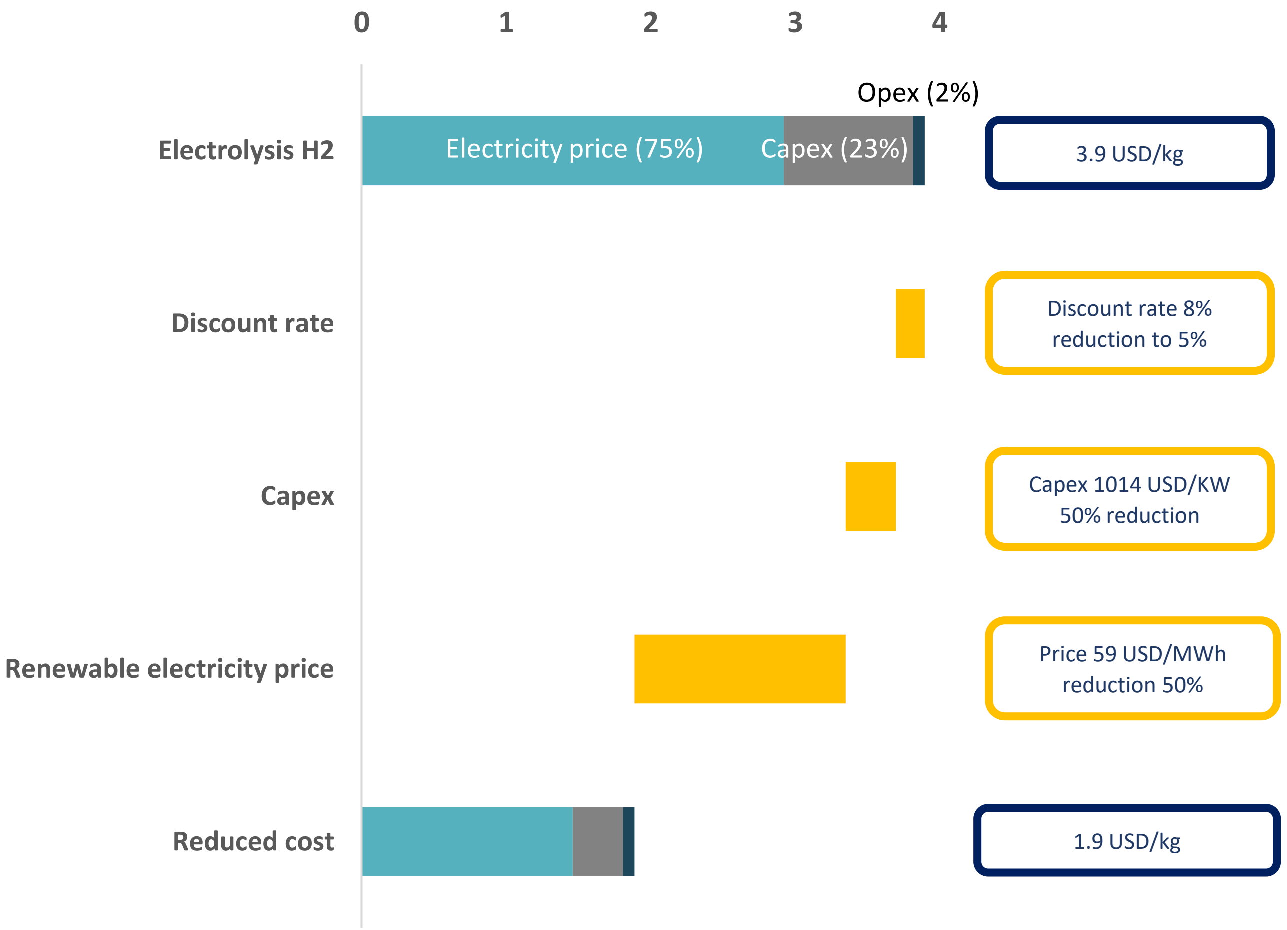
Summary

Low electricity costs increase the commercial viability of green hydrogen

- Electricity prices typically constitute 75% or more of the total cost of hydrogen production.

- Low costs for renewable power increases the commercial viability of green hydrogen.

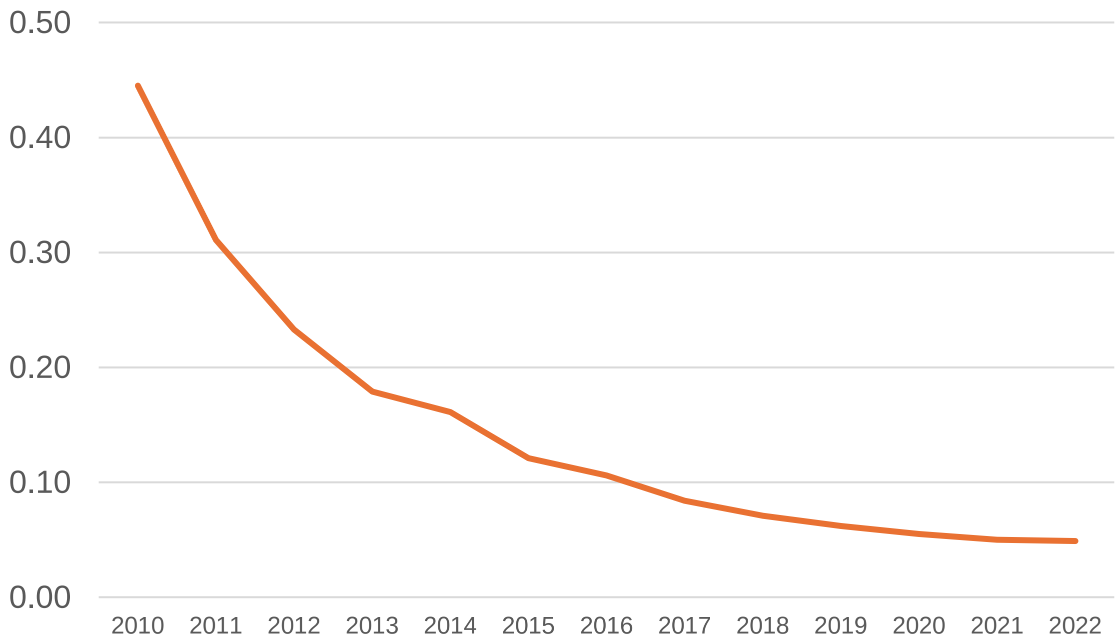
Impact of several factors on the cost of electrolysis-based hydrogen (USD/kg)



Source: APERC (2024)

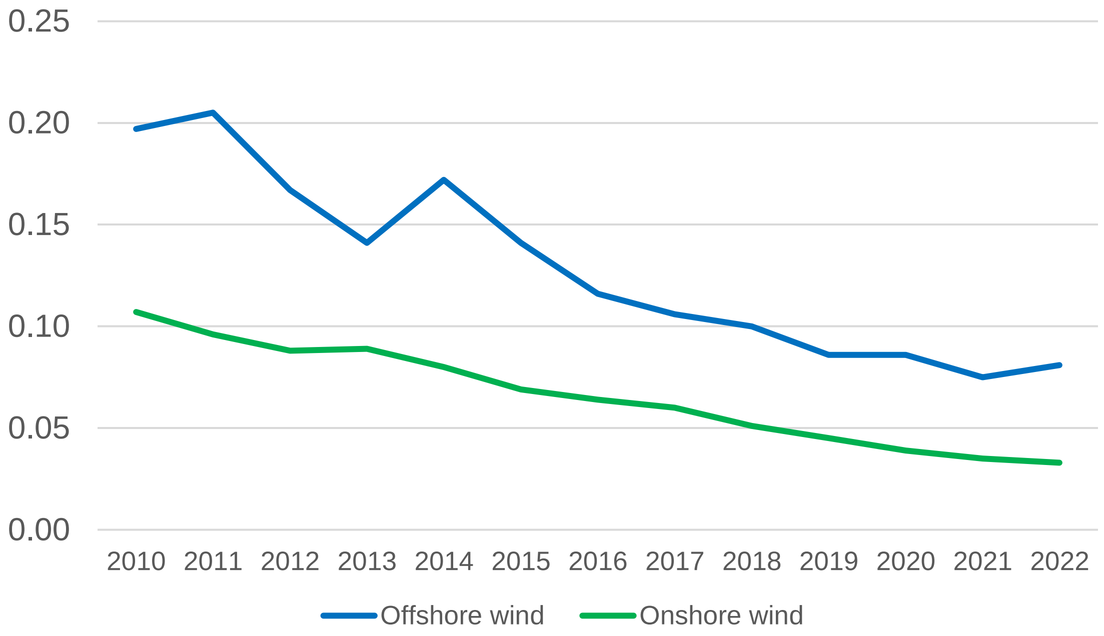
Cost of solar and wind power have dropped dramatically

Weighted average LCOE for solar PV energy (2022 USD/kWh)



Source: IRENA (2023)

Weighted average LCOE for wind energy (2022 USD/kWh)



Source: IRENA (2023)

- The levelized cost of energy (LCOE) for solar PV electricity dropped by 89% from 0.445 USD/kWh in 2010 to 0.049 USD/kWh in 2022.
- The LCOE for offshore and onshore wind turbines decreased by 6% and 9% per year from 2010 to 2022.

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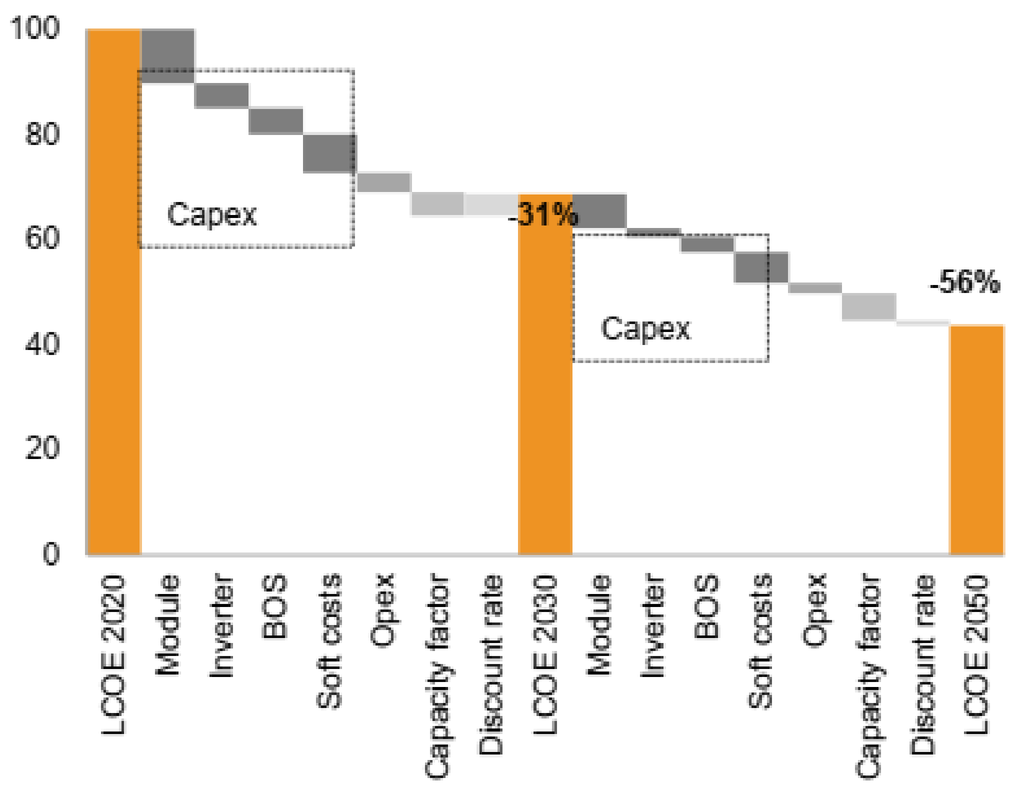
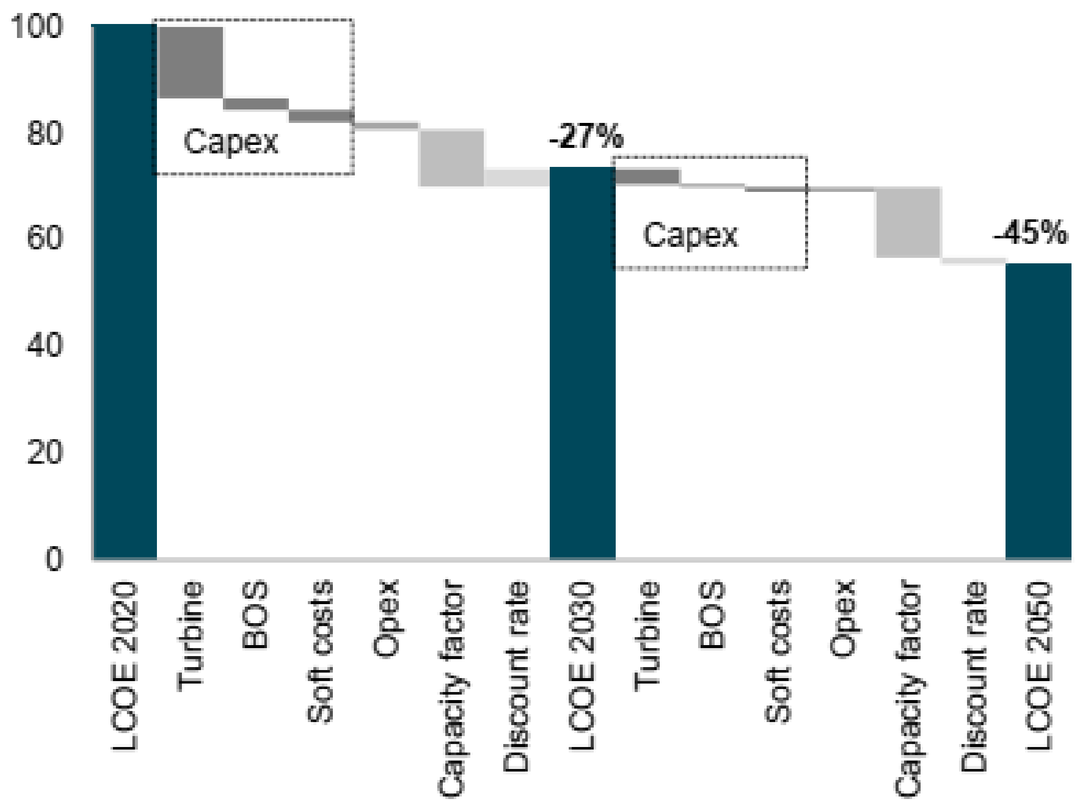
Long-term outlook for the cost of solar and wind power

Solar PV



Onshore Wind

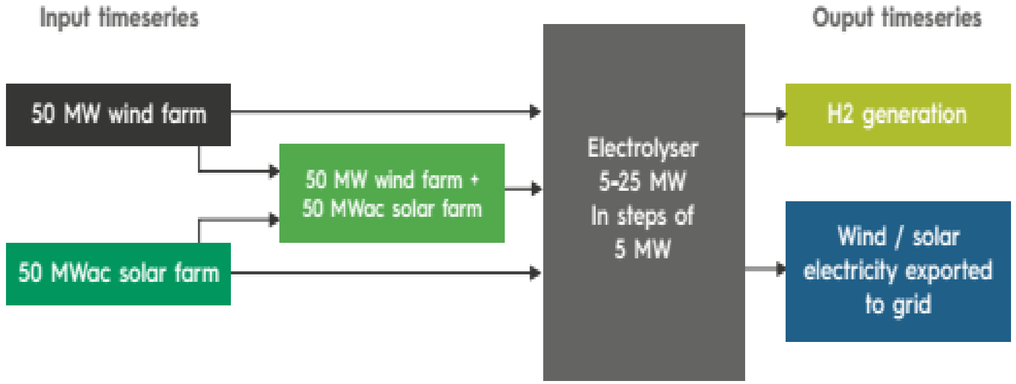


Source: S&P Global Commodity Insights (2022)

- Some analysts expect the LCOE of PV, onshore and offshore wind to decline an additional 45-60%.
- Higher interest rates could slow future price declines.

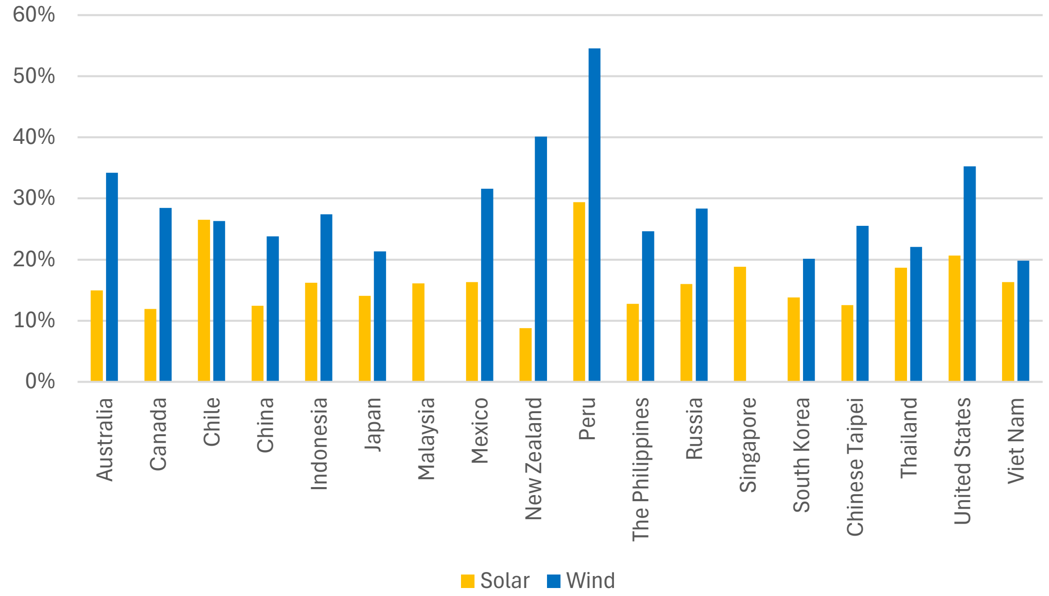
Electrolyzers need to run at high capacity factor to be viable

Electrolyzers co-located with VREs



Source: Natural Power (2023)

Capacity factor of solar PV and wind plants in APEC, 2022

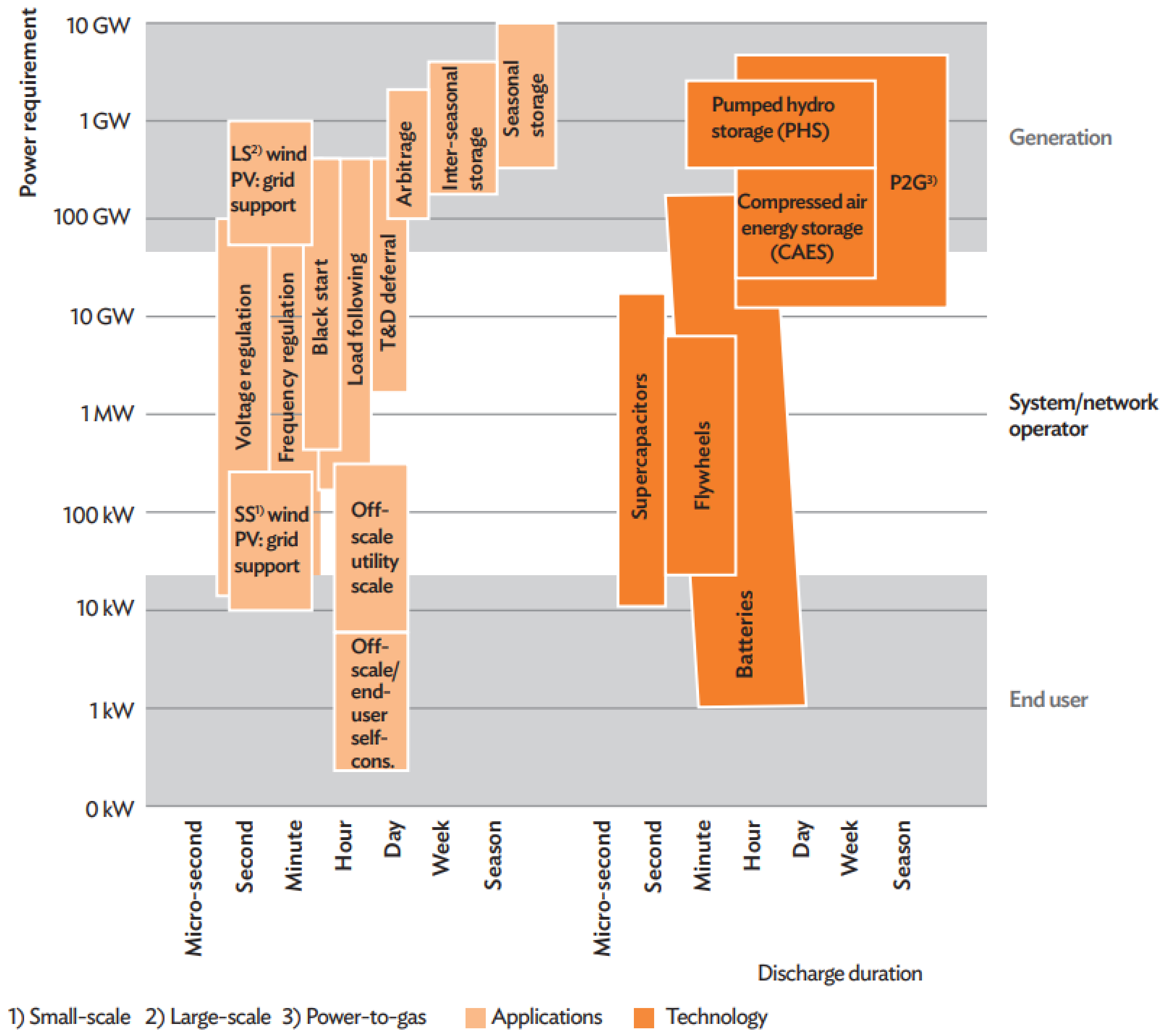


Source: Ember (2024)

- An electrolyzer needs to run at a capacity factor of at least 60% to be commercial.
- Without storage solar and wind power plants run at much lower capacity factors.

Storage can help address VRE intermittency but is expensive

- Each technology can serve a specific application.
- Is it cost-effective to add energy storage to the wind and solar mix to further maximize electrolyzer capacity?
- What will be the size of storage?
- Is there an optimum mix of solar, wind, storage, and electrolyzer capacity to minimize the levelized cost of hydrogen?



Source: Handbook on Battery Energy Storage System (2018)

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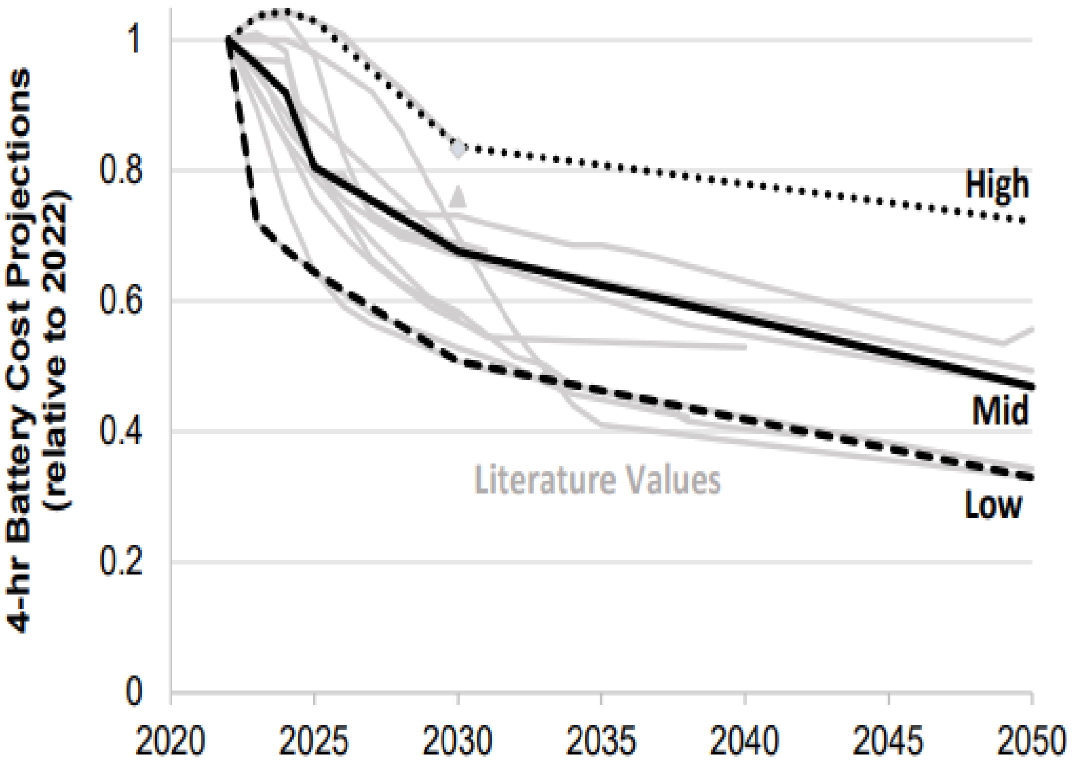
Many analysts expect the cost of storage to decline further

- Many publications expect large cost reductions in the near-term that then slow in the mid-term.
- By 2030, costs are expected to decline by 47%, 32%, and 16% in the low, mid, and high cases, respectively.
- By 2050, these could be further reduced by 67%, 51%, and 21%, respectively.

Battery cost projections for 4-hour lithium-ion systems, with values relative to 2022



Source: Cost Projections for Utility-Scale Battery Storage, NREL (2023)

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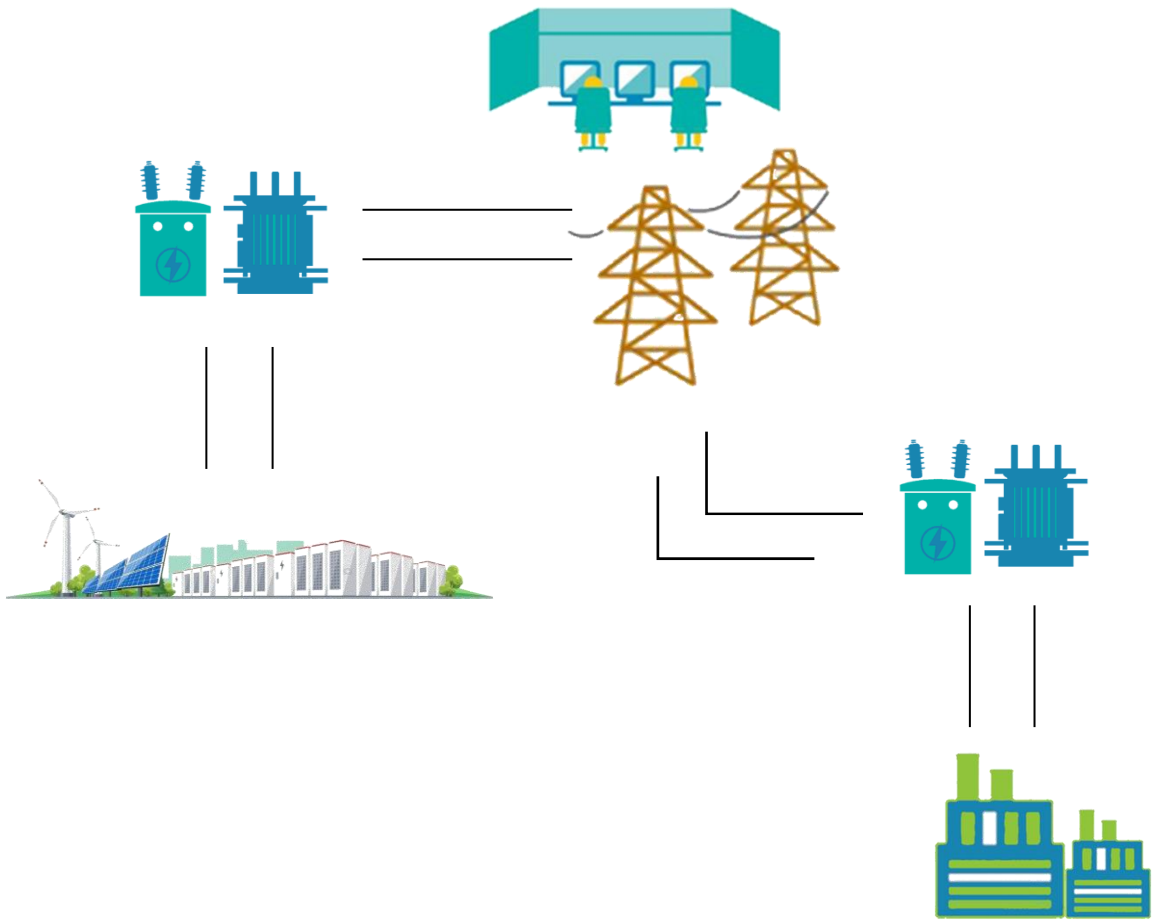
Grid energy as feasible back-up



- Electrolyzers that are co-located with renewables would benefit from support from the electric grid.
- However, connecting the electrolyzers to the grid may introduce challenges related to emission compliance and zero-emission certification.
- If grid energy is utilized to produce green hydrogen, tax incentives may be reduced.

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Summary

- Low electricity costs increase the commercial viability of green hydrogen.
- The cost of solar and wind power have dropped dramatically and could fall further.
- Electrolyzers need a higher capacity factor than solar and wind power provide.
- Electricity storage can help, but currently is expensive.
- Grid power could address the capacity factor issue but raises other issues.
- Allowing some grid power support could accelerate the production of low carbon hydrogen.

Thank you.

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