Storage Futures Study

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Speakers:

Will Frazier, ReEDS Diurnal Storage Lead Author

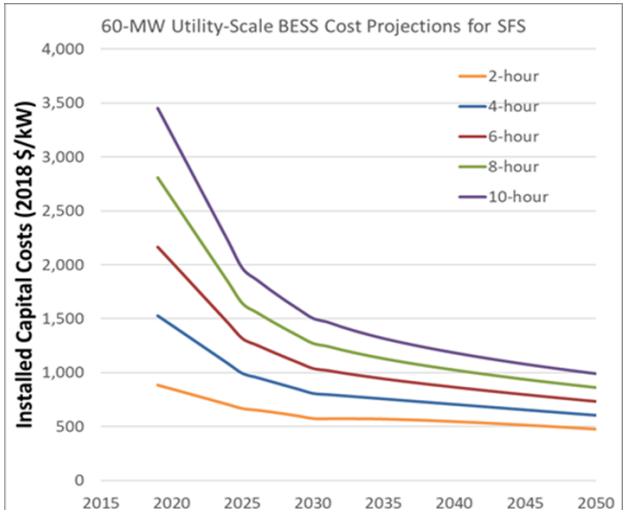
Storage Futures Study

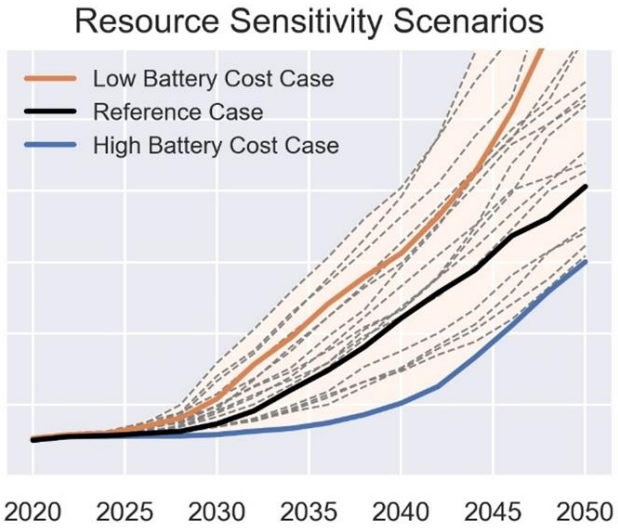
NREL is analyzing the rapidly increasing role of energy storage in the electrical grid through 2050.

- "Four Phases" - theoretical framework driving storage deployment
- Techno-Economic Analysis of Storage Technologies
- Deep dive on future costs of distributed and grid batteries
- Various cost-driven grid scenarios to 2050
- Distributed PV + storage adoption analysis
- Grid operational modeling of high-levels of storage
- The Challenge of Defining Long-Duration Energy Storage

One Key Conclusion: Under all scenarios, dramatic growth in grid energy storage is the least cost option.

https://www.nrel.gov/analysis/storage-futures.html



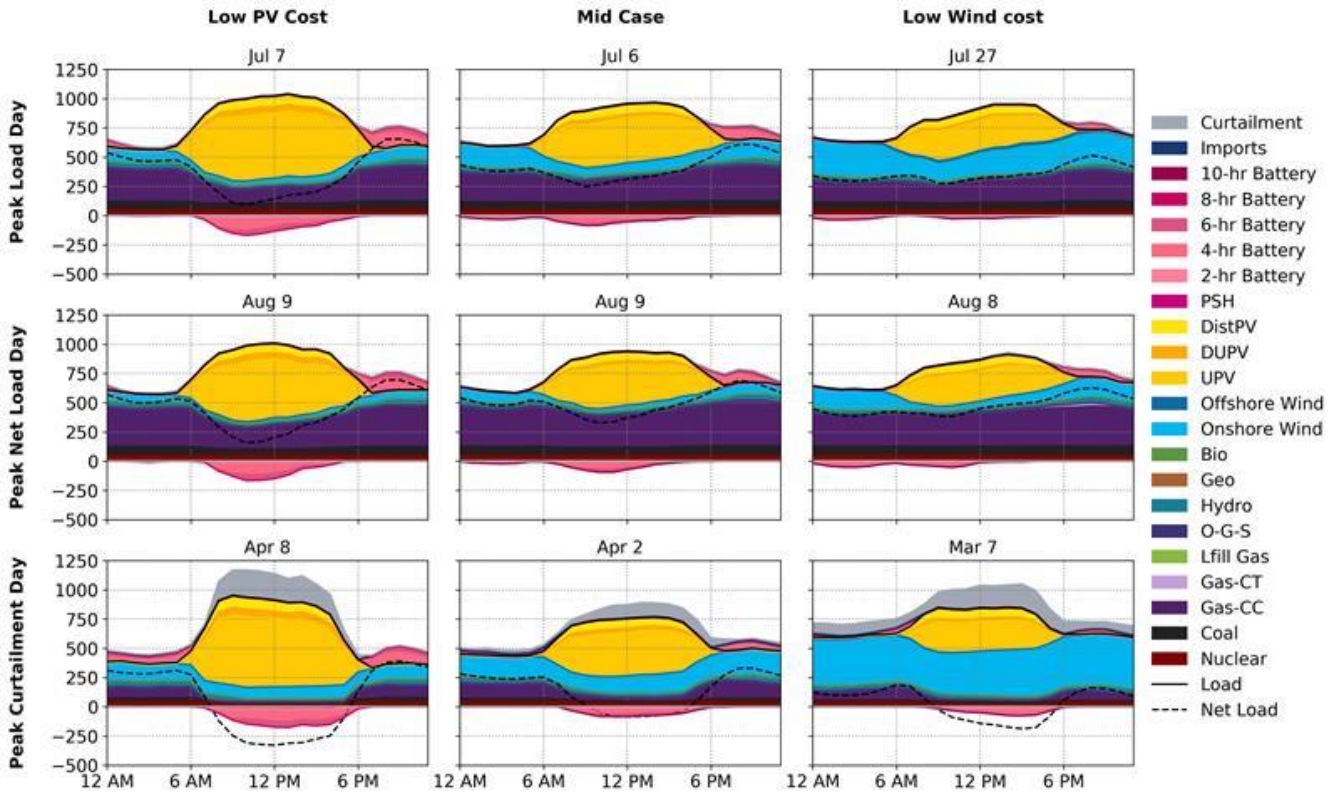


Grid-Scale Diurnal Storage Scenarios

Combinations of these sensitivities are used to create a total of 19 scenarios

Variable Renewable Energy Cost	Storage Cost	Natural Gas Price	Transmission cost
• *Reference Cost* • Low Wind Cost • High Wind Cost • Low PV Cost • High PV Cost	• *Reference Cost* • Low Battery Cost • High Battery Cost	• *Reference NG price* • High NG price • Low NG price	• *Reference transmission cost* • High transmission cost

Improvements to Storage Representation in ReEDS

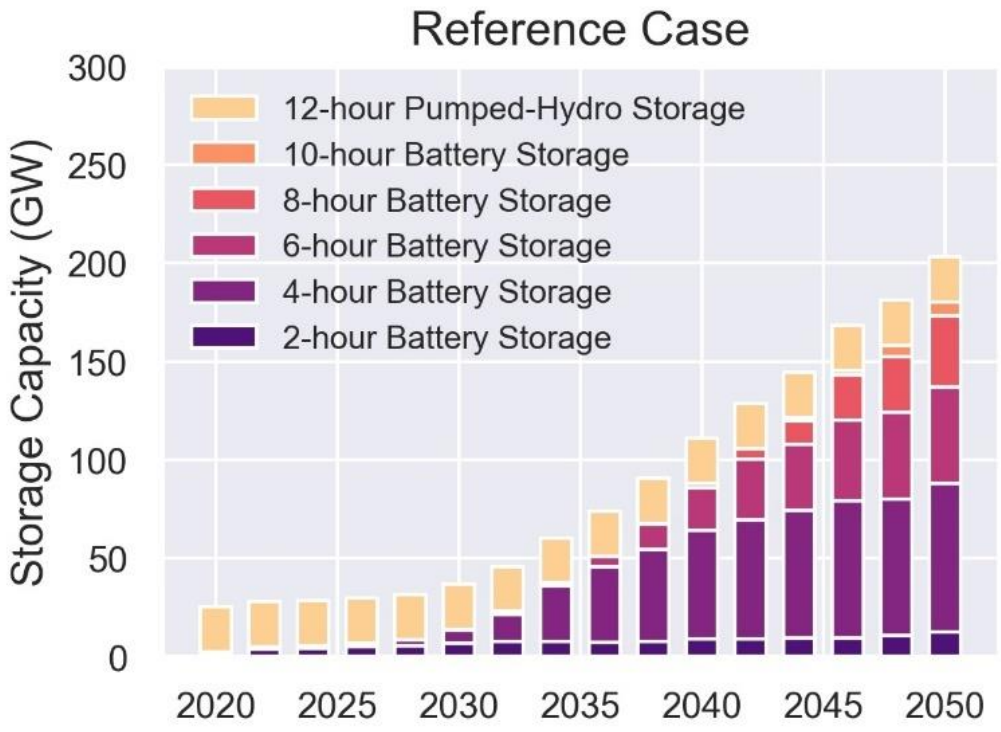


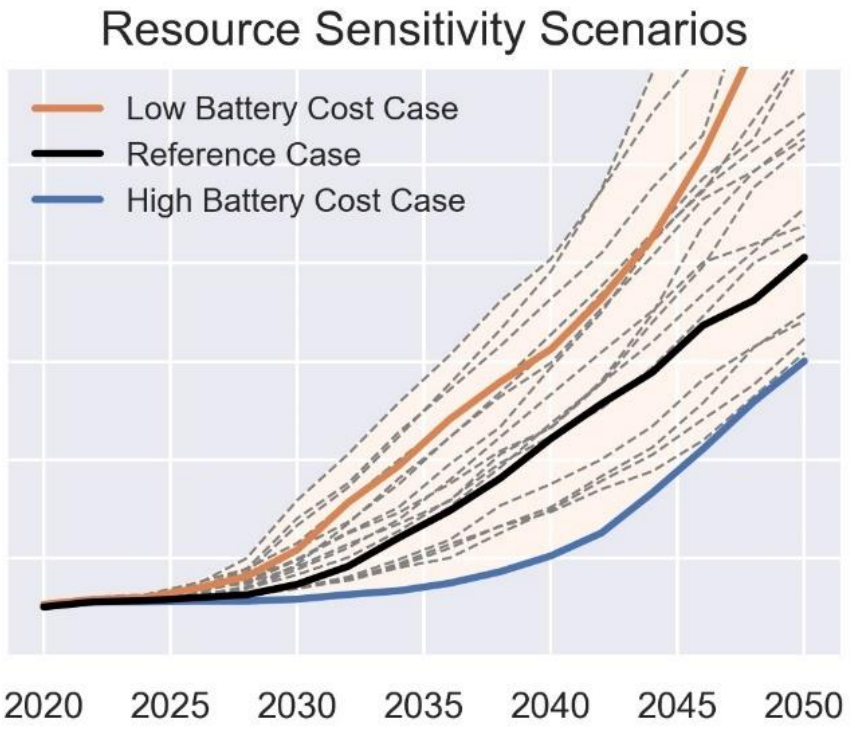
7 years of weather and load data for analyzing system reliability

Storage resources are split out by duration to capture the relationship between duration, capacity provision, energy arbitrage, and cost

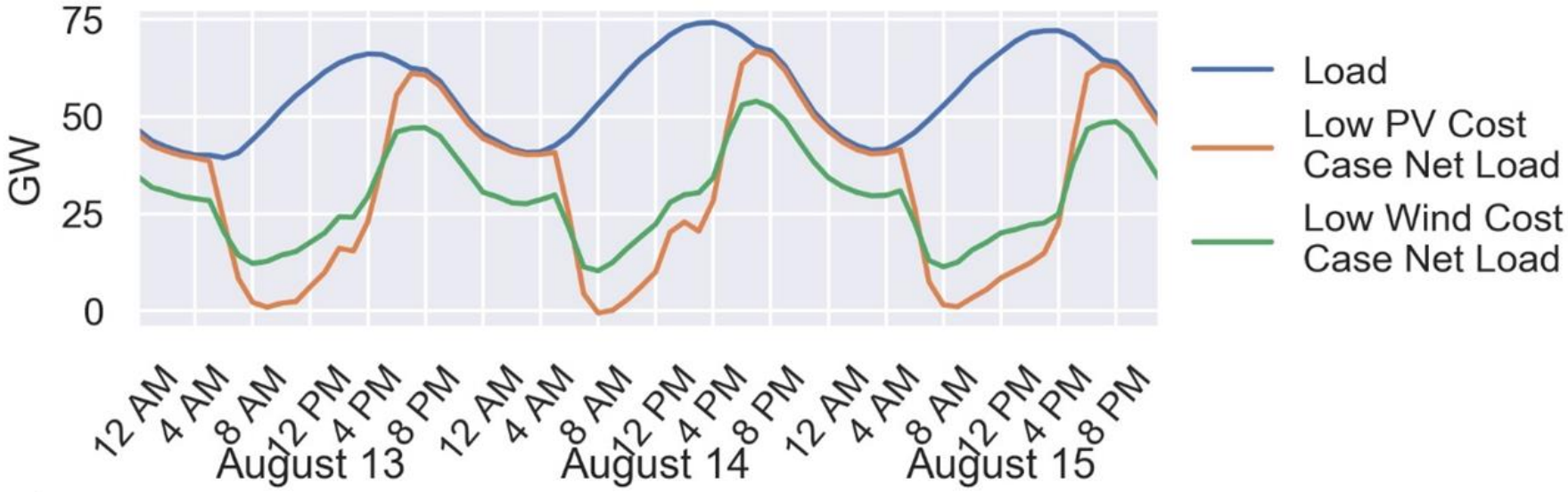
Dispatch of generation, storage, and transmission **simulated for each hour of year** to inform investment decisions

Modelled storage deployment in ReEDS





Interaction of Storage and Net Load (2050 in California)

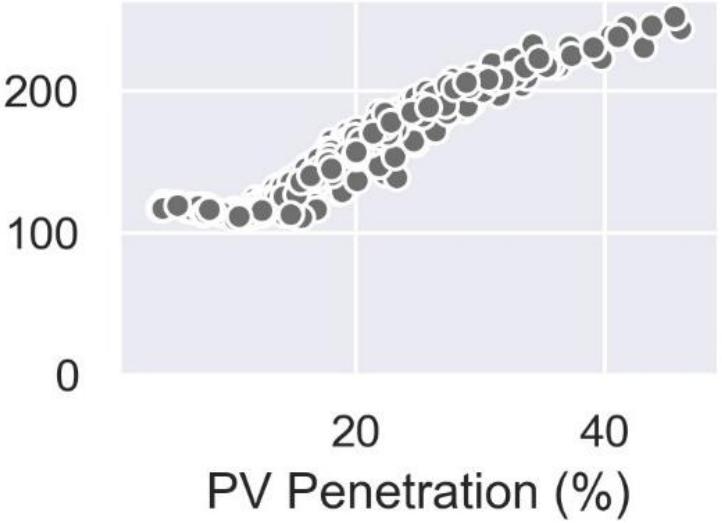


Net load profiles → inform capacity value of storage

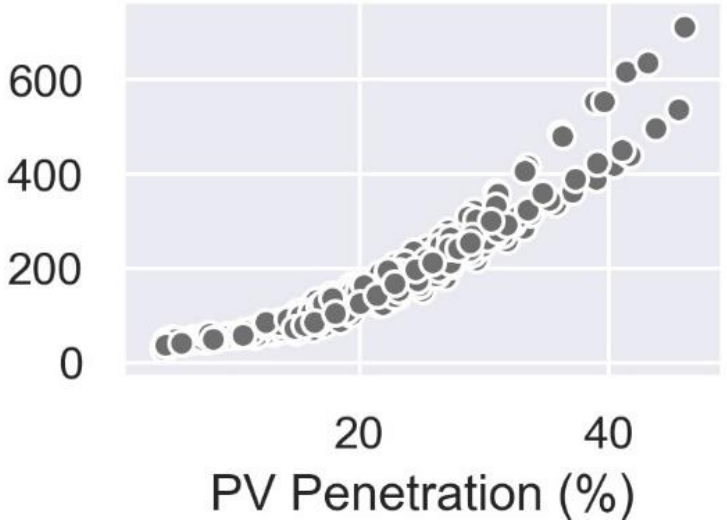
Energy price profiles → inform energy time-shifting value of storage

Storage Correlates with PV More than Wind

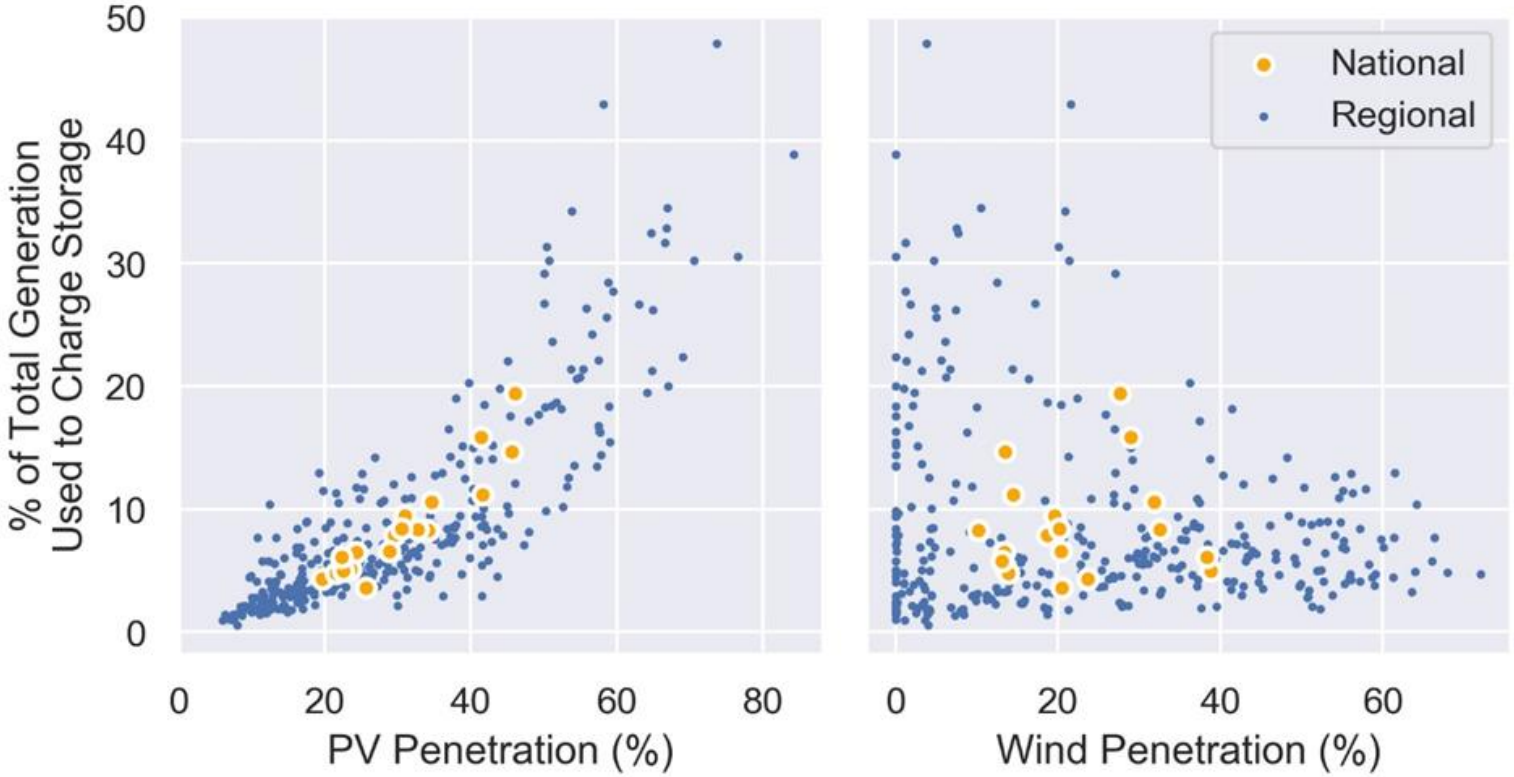
Peaking capacity potential (GW)
(determined by net load shape)



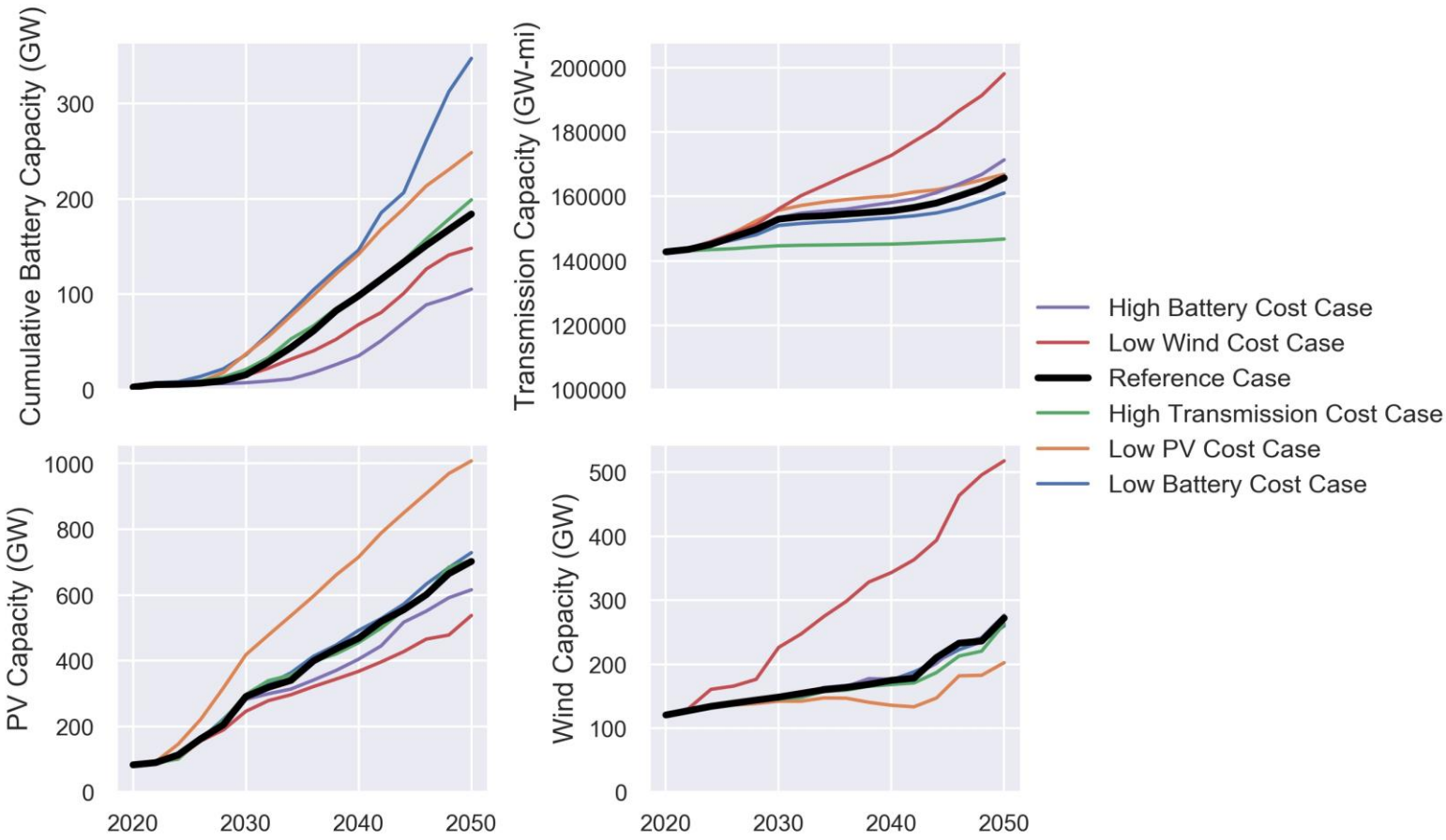
Energy time-shifting potential (TWh)
(determined by energy price profiles)



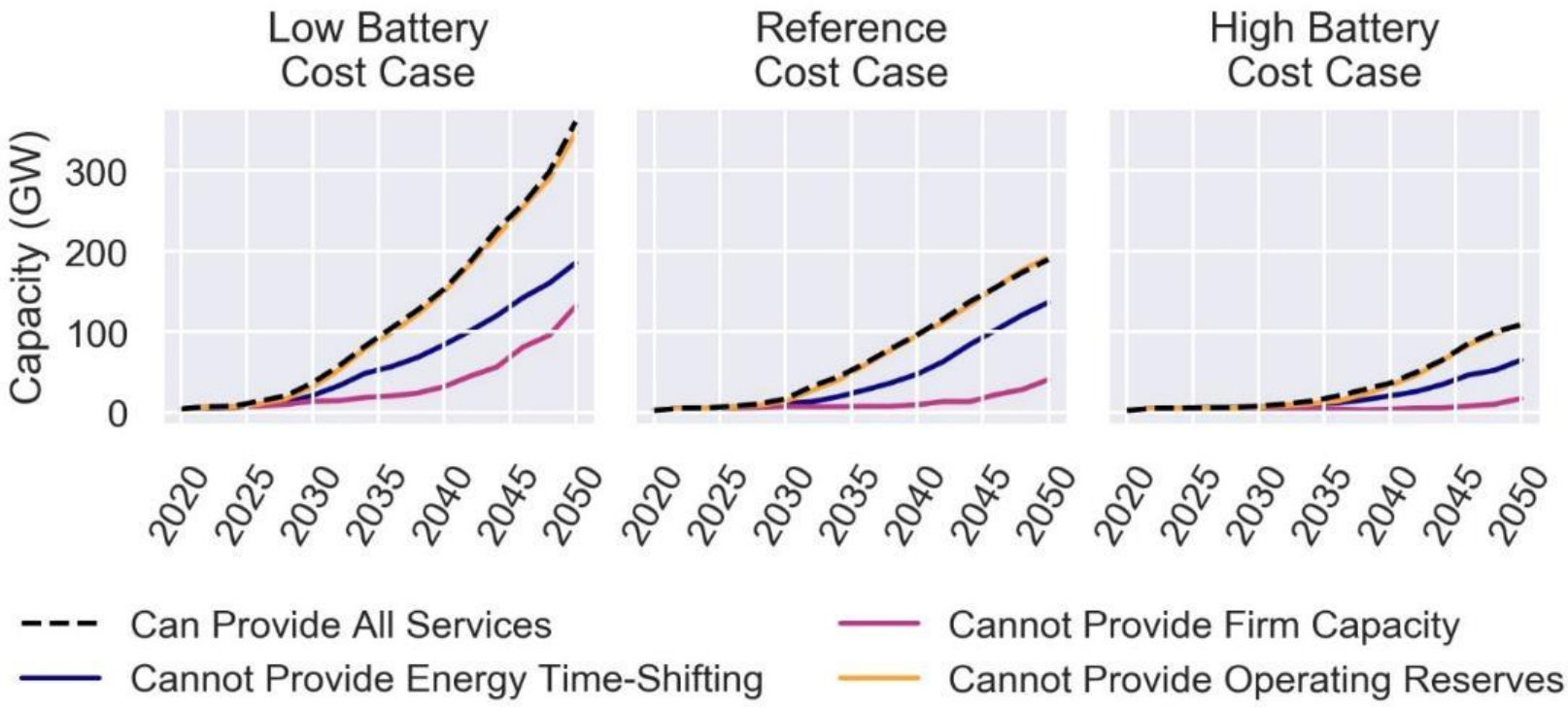
Amount of Generation that Goes through Storage



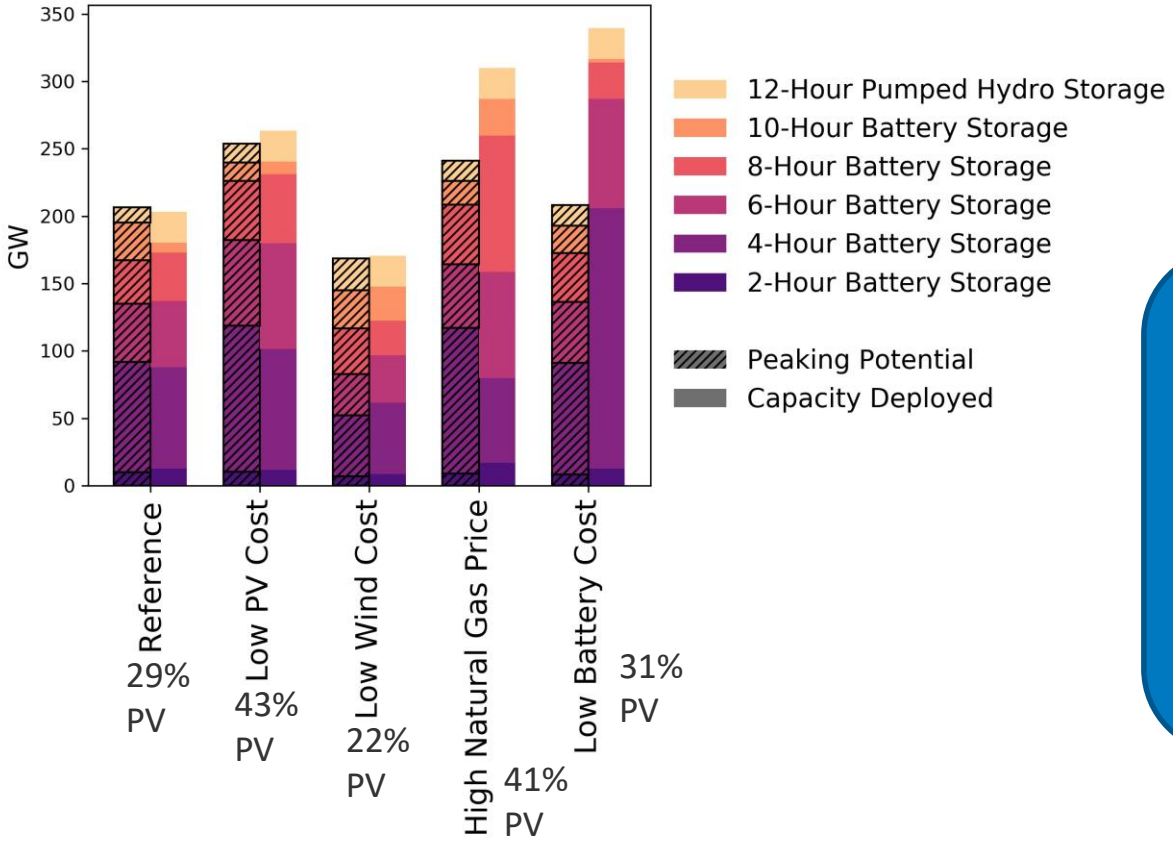
Transmission Correlates More with Wind



Relative Value of Storage Services



Economic Deployment versus Peaking Capacity Potential



Storage is optimized based on the relationship between:

- capacity value
- energy value
- storage duration
- storage cost & performance

Grid-Scale Diurnal Storage Scenarios Key Takeaways

Capacity value drives deployment, but energy arbitrage value is needed to realize optimal deployment

Diurnal storage is more synergistic with PV penetration than with wind penetration

Significant storage growth (>125 GW) in all scenarios

Any storage technology that can meet the cost and performance values used in this paper will be competitive

Questions and Discussion

https://www.nrel.gov/analysis/storage-futures.html

Encouraging everyone to share/forward NREL outreach on social media

- https://www.nrel.gov/news/program/2021/nrel-launches-storage-futures-study-with-visionary-framework-for-dramatic-increase-in-deployment.html
- NREL also posted items on Linkedin, Twitter, etc.

www.nrel.gov

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