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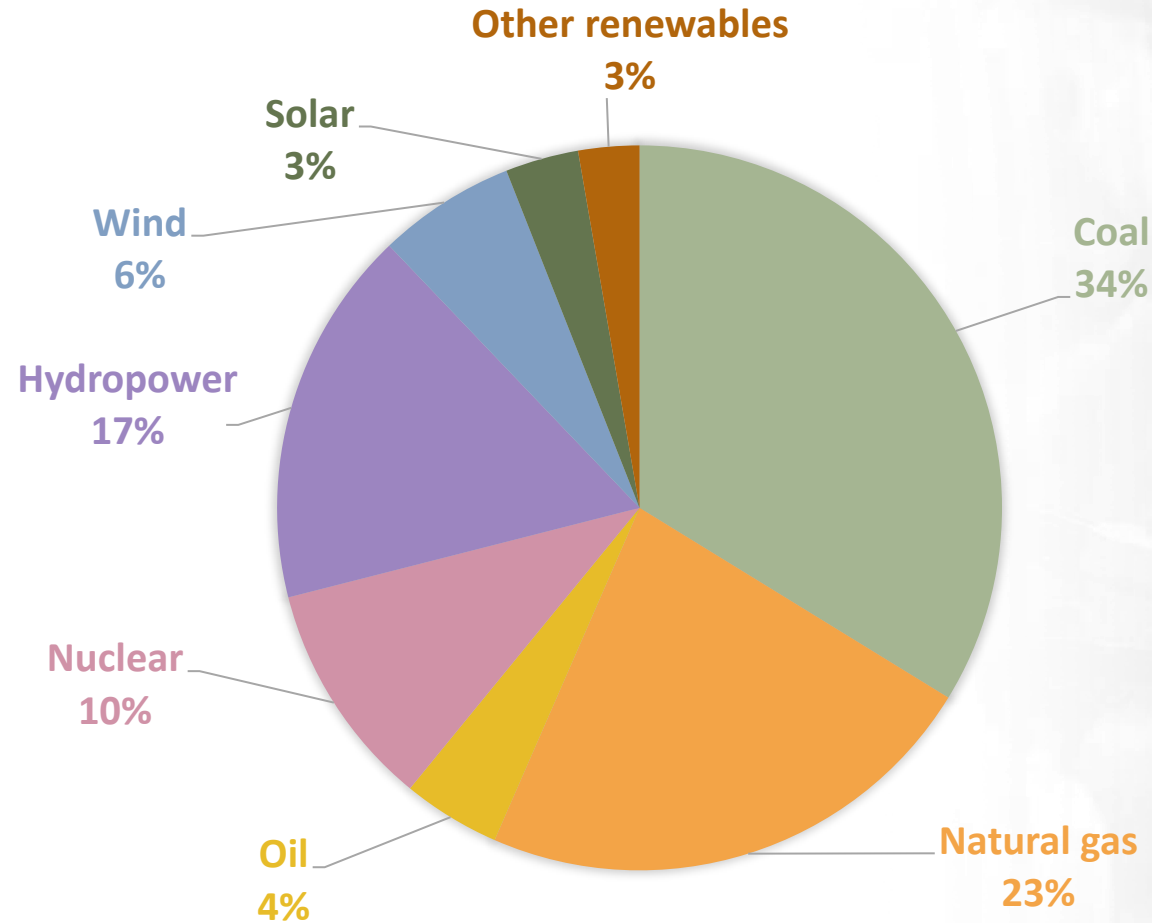
Meeting electricity demand with distributed wind and solar generation: system flexibility drives optimal siting

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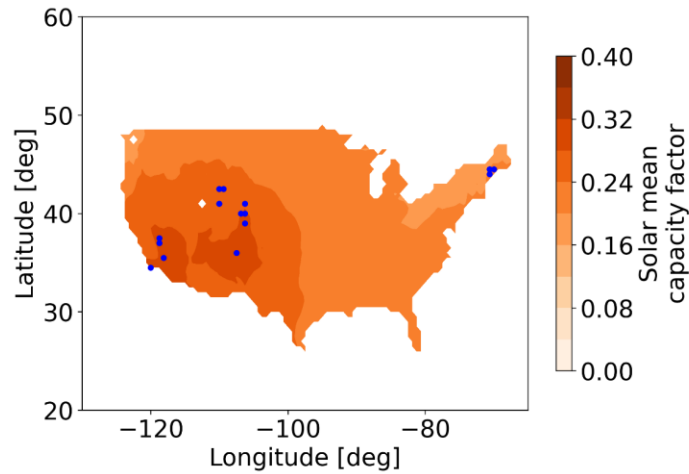
Carnegie Institution for Science
Department of Global Ecology
Stanford, CA, USA



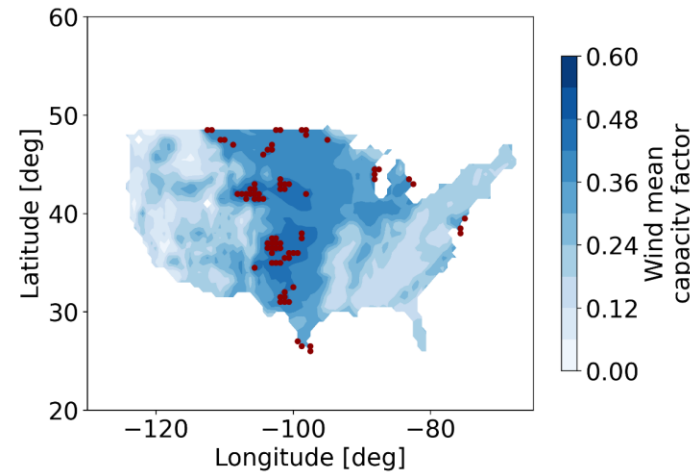
ELECTRICITY PRODUCTION BY SOURCE IN 2020



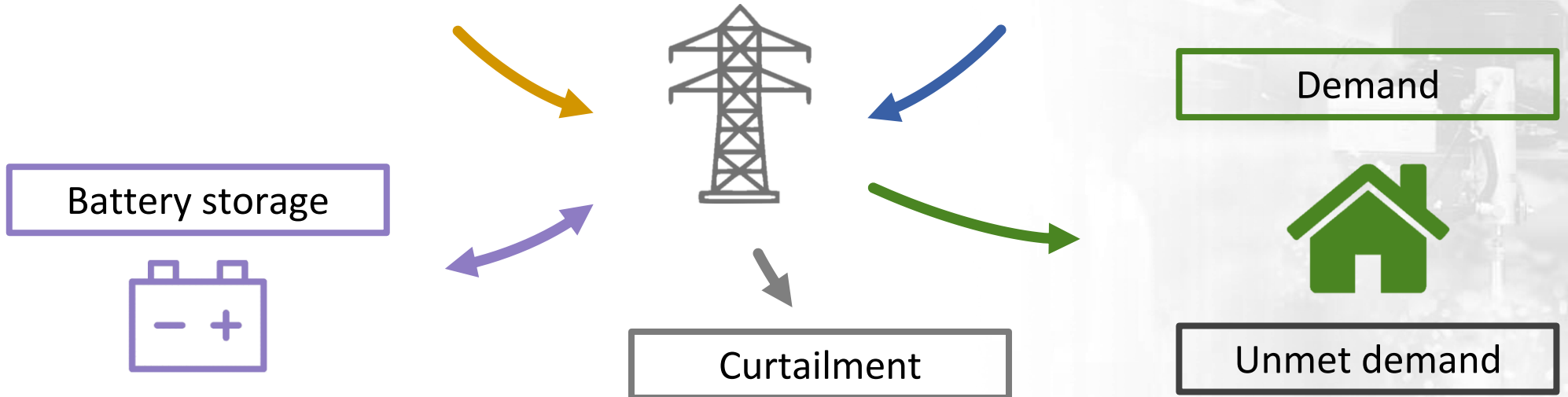
How to optimally site distributed wind and solar generation while decarbonizing electricity systems?

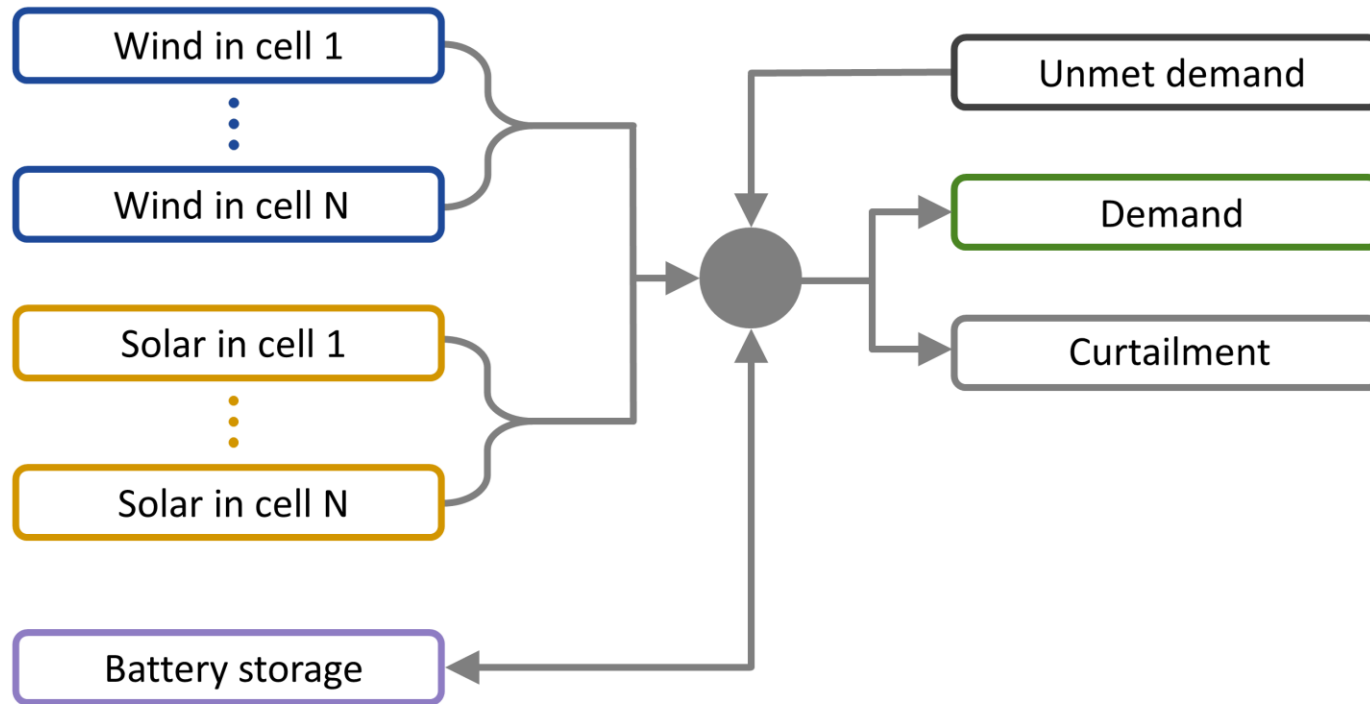


Distributed solar



Distributed wind





Input data

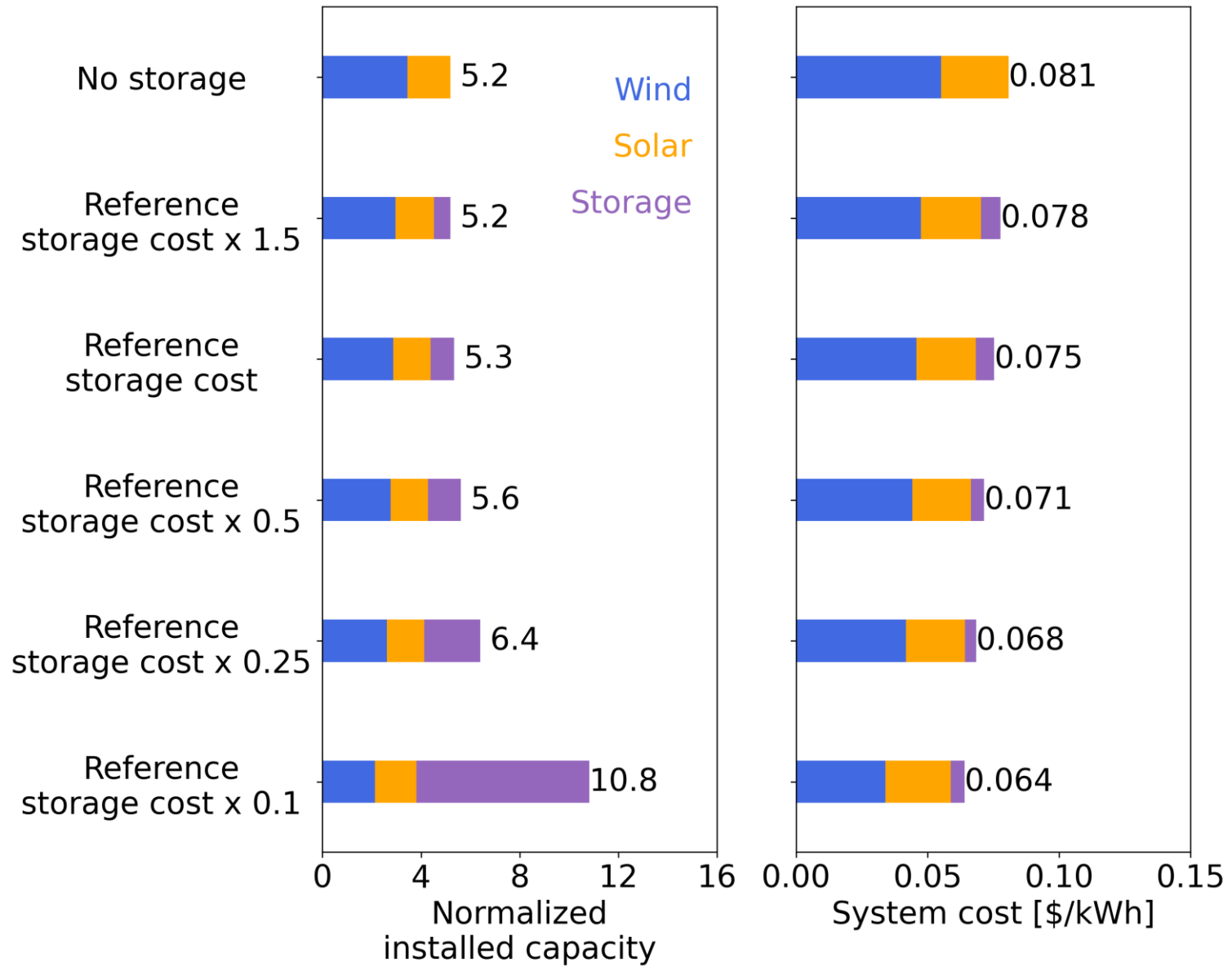
- Fixed costs of each technology
- Time series of demand
- Time series of wind and solar capacity factors
- Charging time, efficiency and decay rate of batteries
- Penalty cost for unmet demand

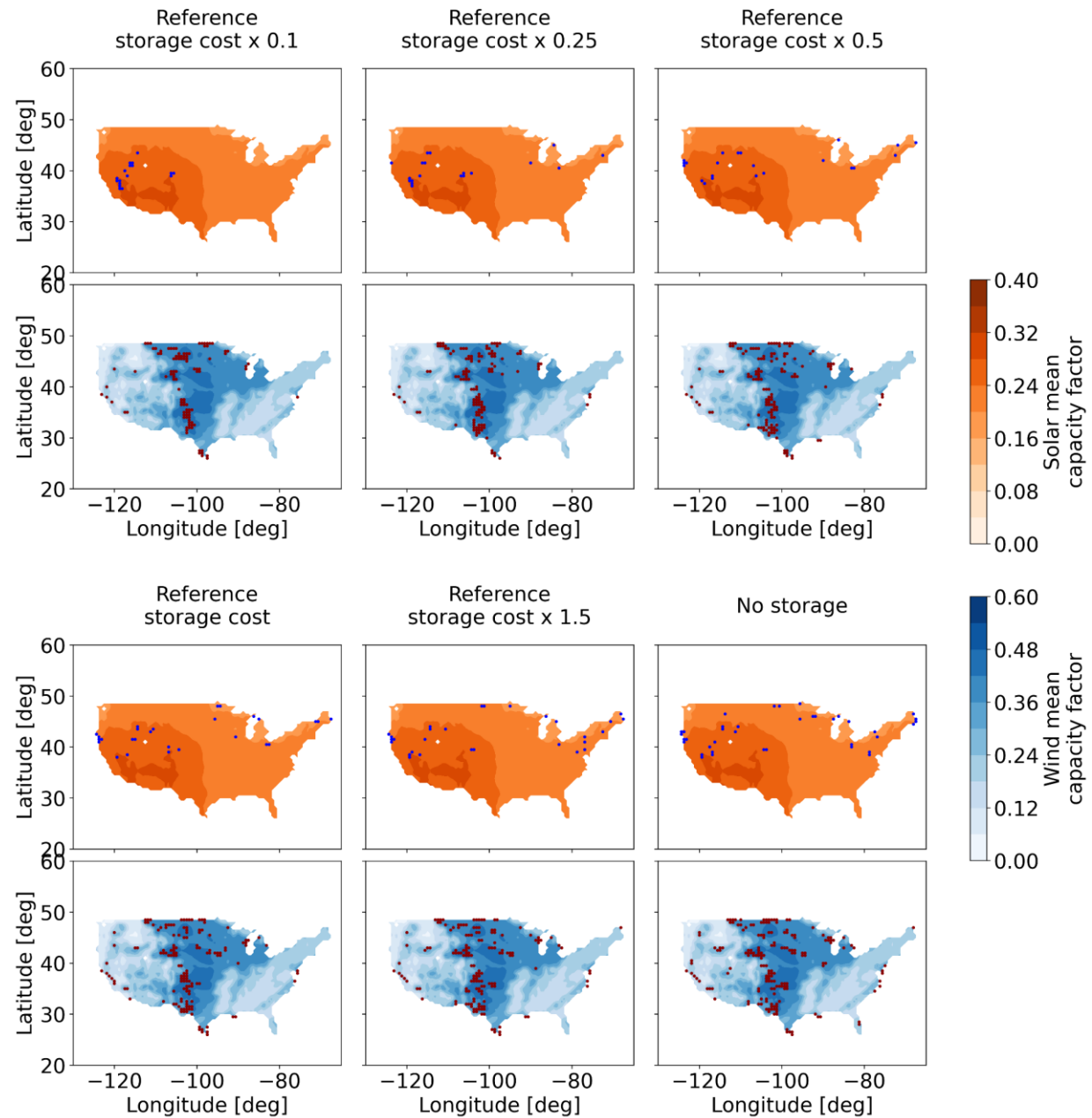
Decision variables

Installed capacity and dispatch time series of each technology

Objective function to minimize

System cost





Key takeaways

- We analyzed the drivers of optimal siting of wind and solar installations to meet electricity demand
- If energy storage were free and widely available, chosen locations for wind and solar installations would be in regions with the highest levels of resource availability
- As the energy storage cost increases, and thus storage capacity decreases, chosen locations have lower capacity factors and the electricity system is more reliant on wind generation.





Thanks for you attention!

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