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Electric Energy Storage an Essential Asset to the Electric Enterprise

Barriers and RD&D Needs

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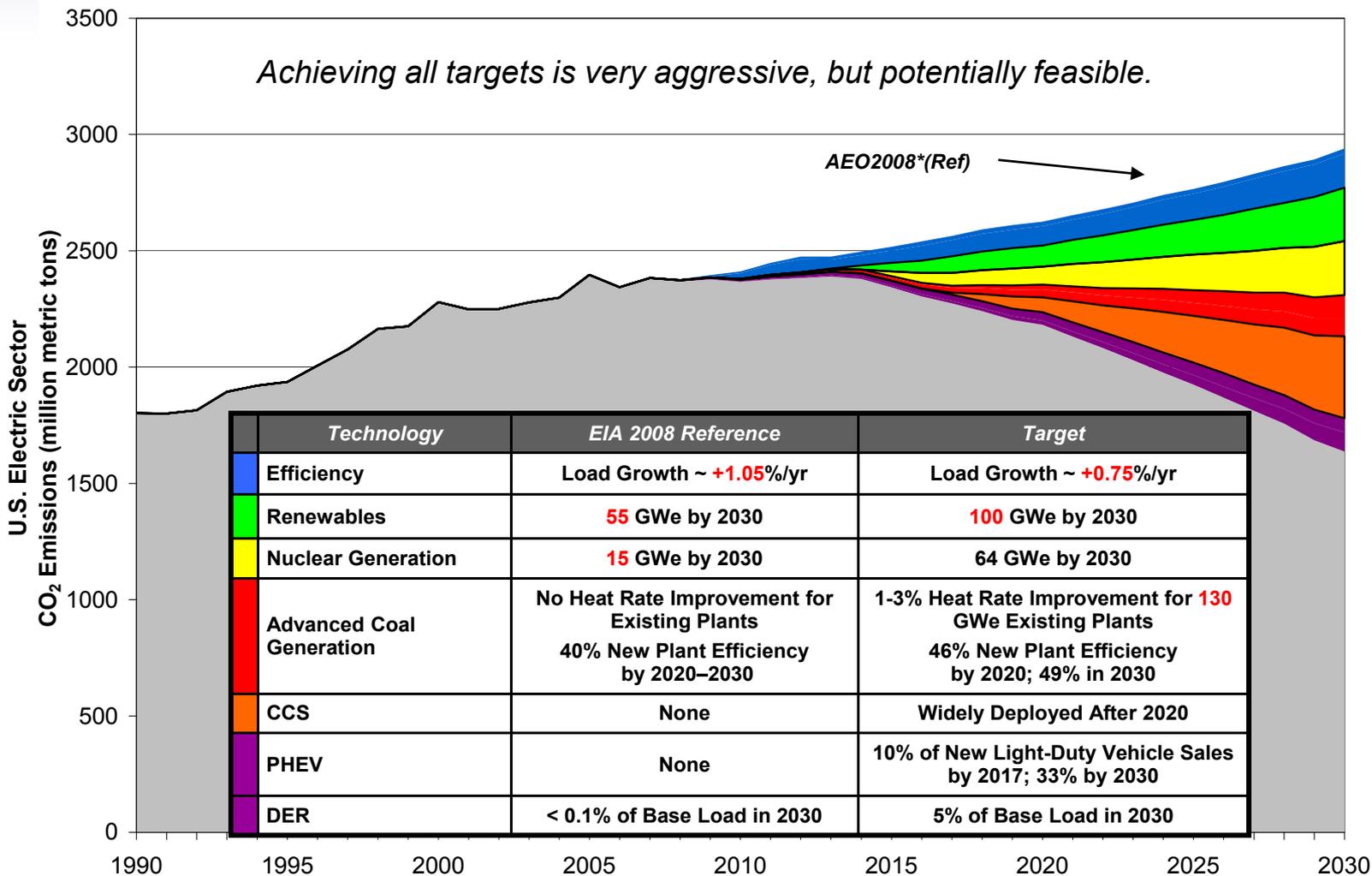
Barriers to Deployment of Energy Storage Systems

- Macro Impact of Energy Storage to the State, RTO, Utility
 - Integrated Supply, T&D, Environmental (CO₂) Analysis
 - EPRI U-Plan Analysis of ERCOT in 2009 (October 2009)
 - EPRI Merge and Prism Analysis (July 2009)
- Application Solution Cost / Value / Gap Analysis
- Resolve Risks in Deployment of Energy Storage Systems
 - Full Integrated Systems > Cost Reduction > Standardization
 - Technology / Vendor Risks
 - Regulatory treatment
 - >> Increase Demonstrations of Storage; Use Cases Verified
- Energy Storage in Smart Grid – looking beyond bulk storage solutions
 - Demonstrations and Business Case Assessment
 - Advanced Inter-operability and Interconnection Standards
- Market Rules which encourage win-win and easy monetization of numerous value streams
- Increased R&D and in the basic sciences area to bring promising new technology to market

Full Portfolio of Energy Solutions needed for a Low Carbon Future

Technical Potential for CO₂ Reductions

Achieving all targets is very aggressive, but potentially feasible.



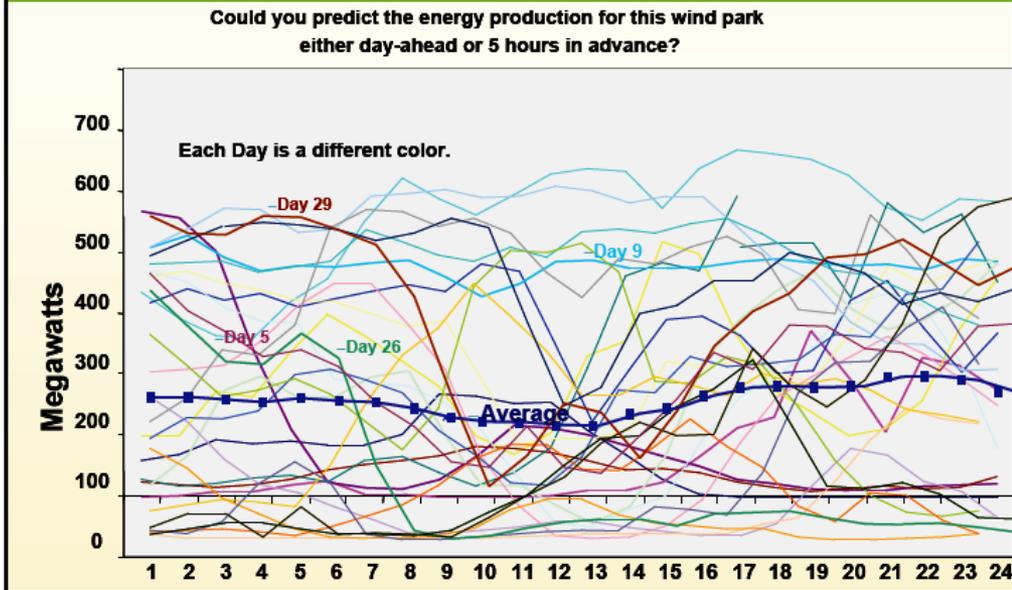
*Energy Information Administration (EIA) Annual Energy Outlook (AEO)

Wind Power

Large Power Fluctuations



Tehachapi Wind Generation in April – 2005



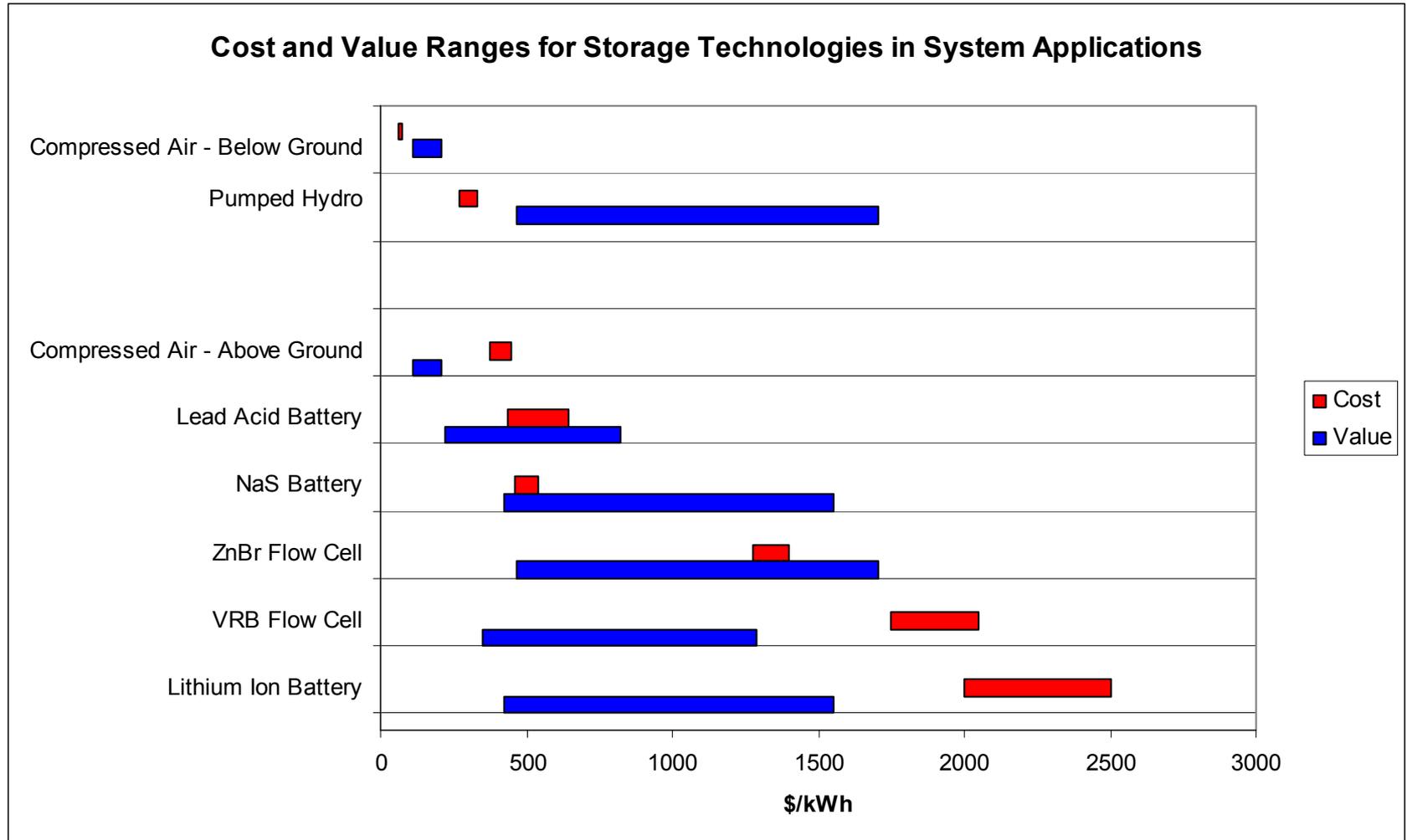
Energy Storage and Wind Integration

Key Research Questions

- Can Energy Storage increase the penetration of wind generation ?
- What options and operating parameters are optimal for increased wind penetration?
- What is the underlying economic value proposition of bulk energy storage?

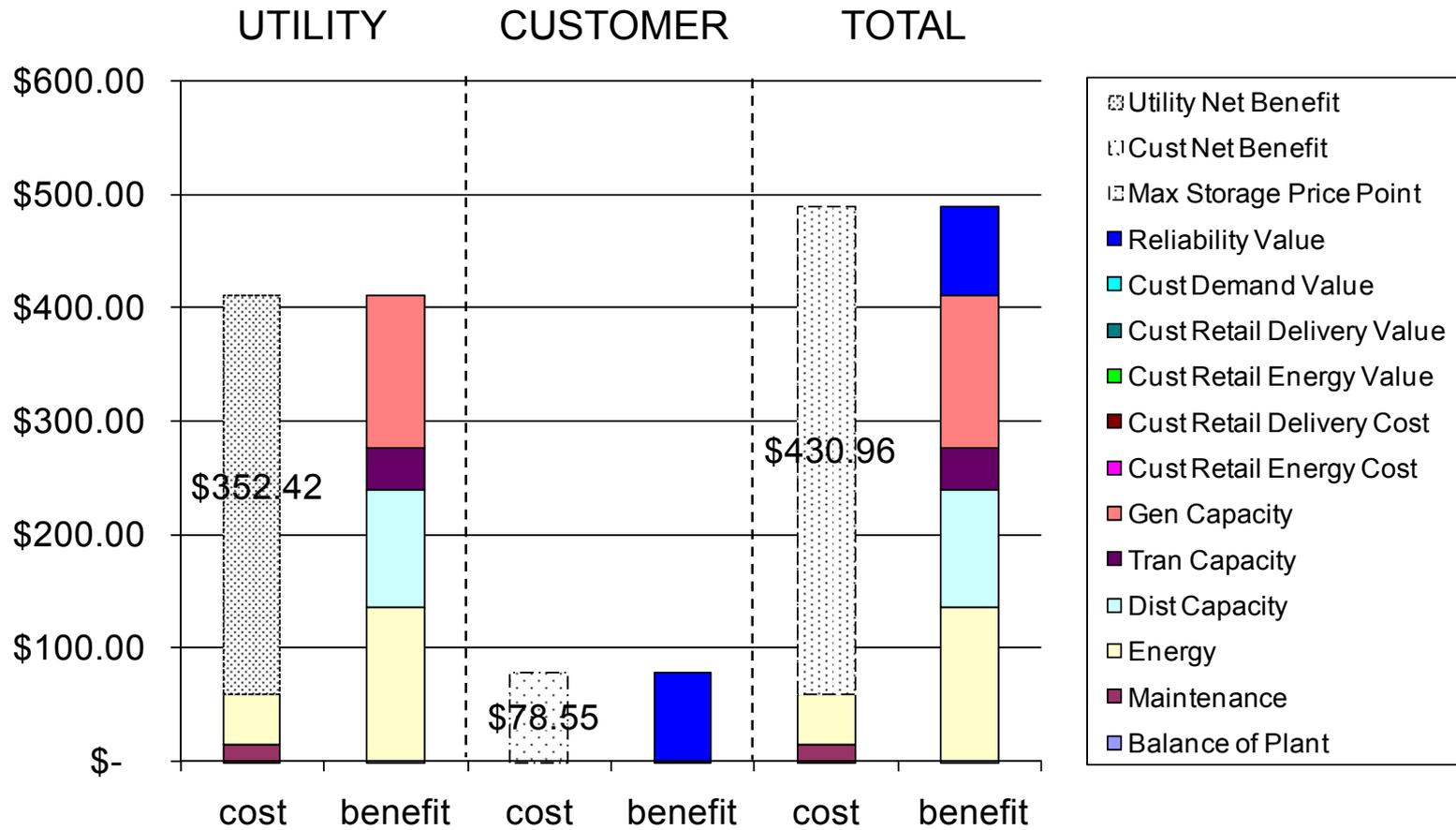


R&D Needed to Understand Cost and Value in Various Applications – (EPRI work underway in 2009)



R&D to Understand Cost / Benefits

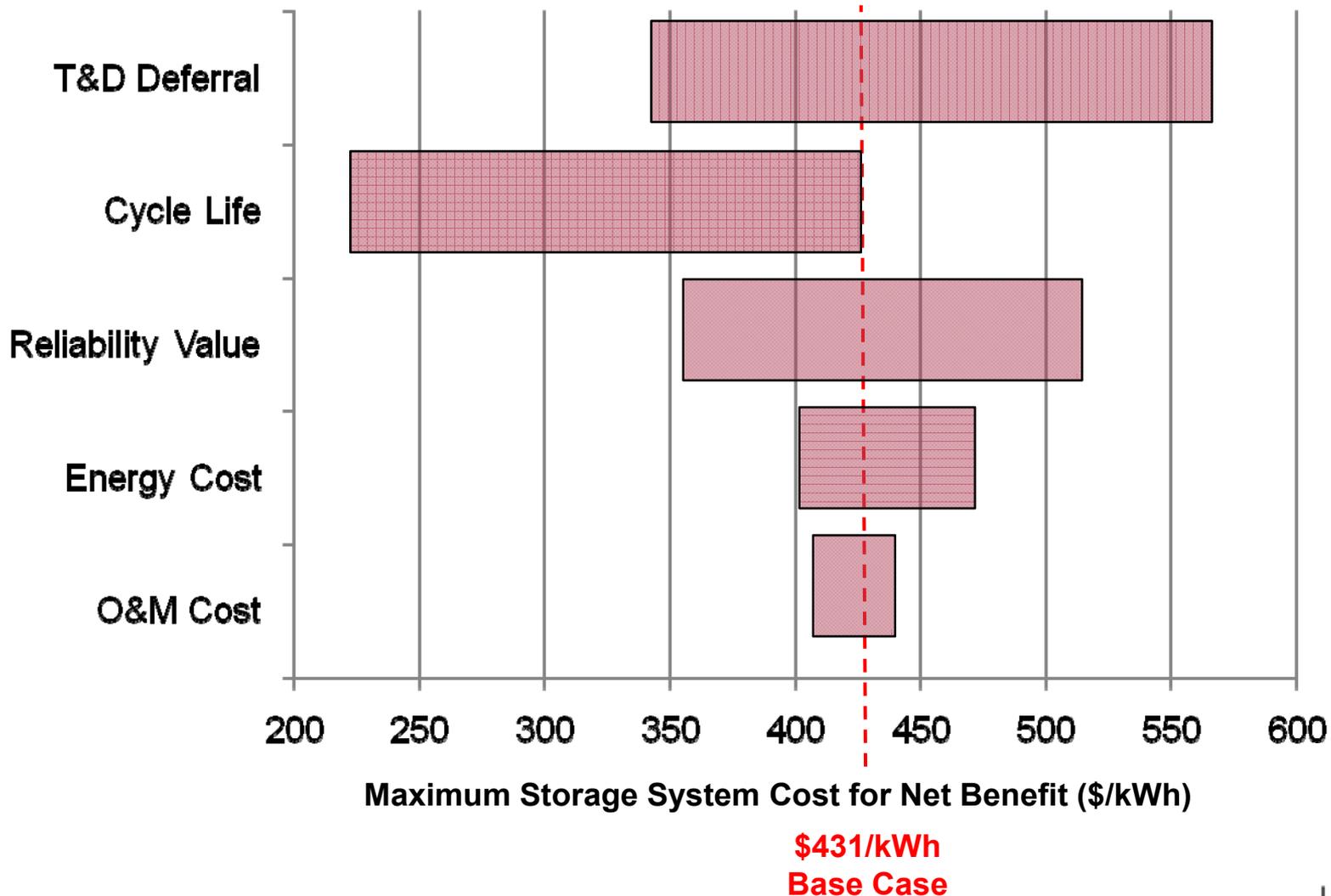
San Francisco Energy Storage Valuation Tool Results (Hourly Pricing, Utility Dispatch)



Need to Easily Monetize Benefits

R&D to understand Sensitivity in Cost / Value

SF Hourly Pricing Sensitivity Analysis: Tornado Diagram



Projected Regional Technical Potential for Electricity Storage Applications

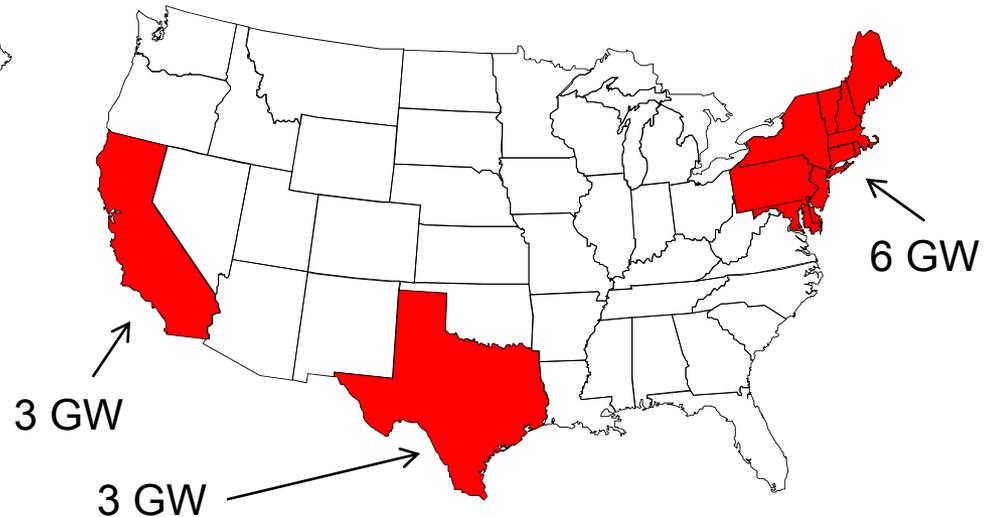
Near-Term Technical Potential



New York: 2 GW
California: 3 GW

5 GW Total
(1,125 GWh @ 225 hrs/yr)

Mid-Term Technical Potential

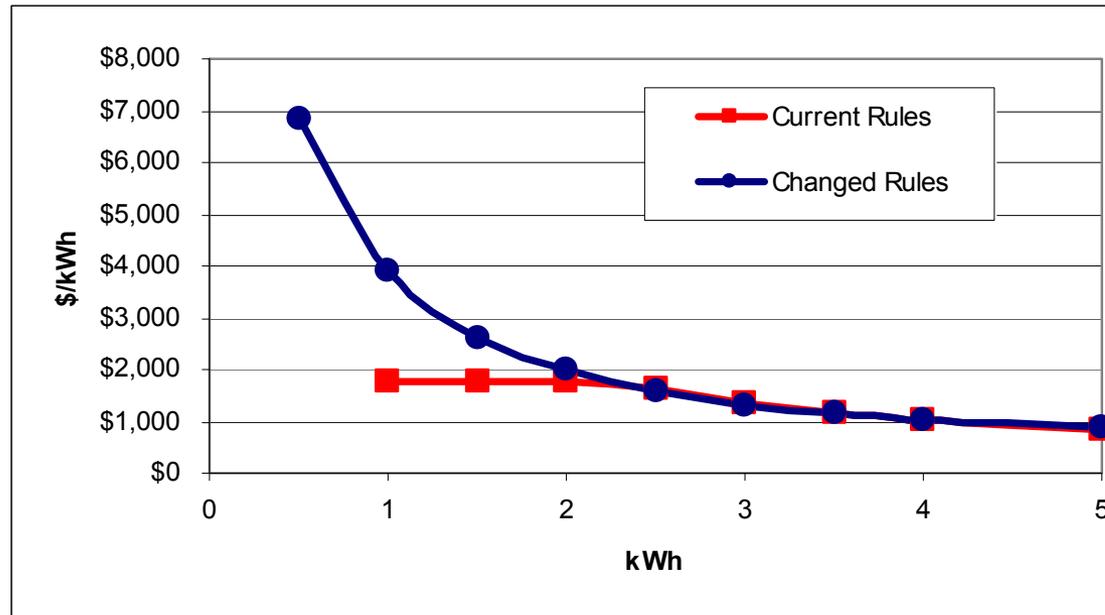


States with average commercial electricity prices greater than 11 cents/kWh:

12 GW Total
(2,700 GWh @ 225 hrs/yr)

Changing Market Rules could be a Game Changer for Storage Technologies

Increase in Energy Storage Value with Changed Rules for Regulation Markets



- Minimum bid duration of 1hr
- Minimum bid size of 1 MW
- Prohibition of asymmetrical bidding (except in CAISO)
- ISO-NE and CAISO in pilots