CCRO VIRTUAL CONFERENCE: ENERGY TRADING RISK SUMMIT USA

Electric Storage as a Trading and Risk Management Asset

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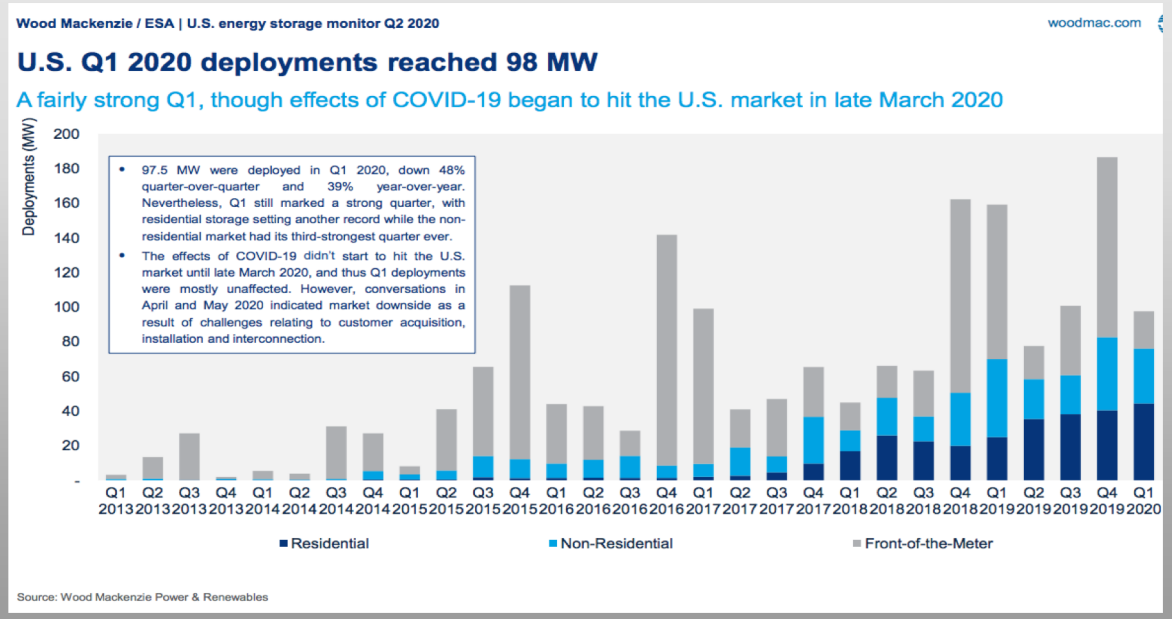
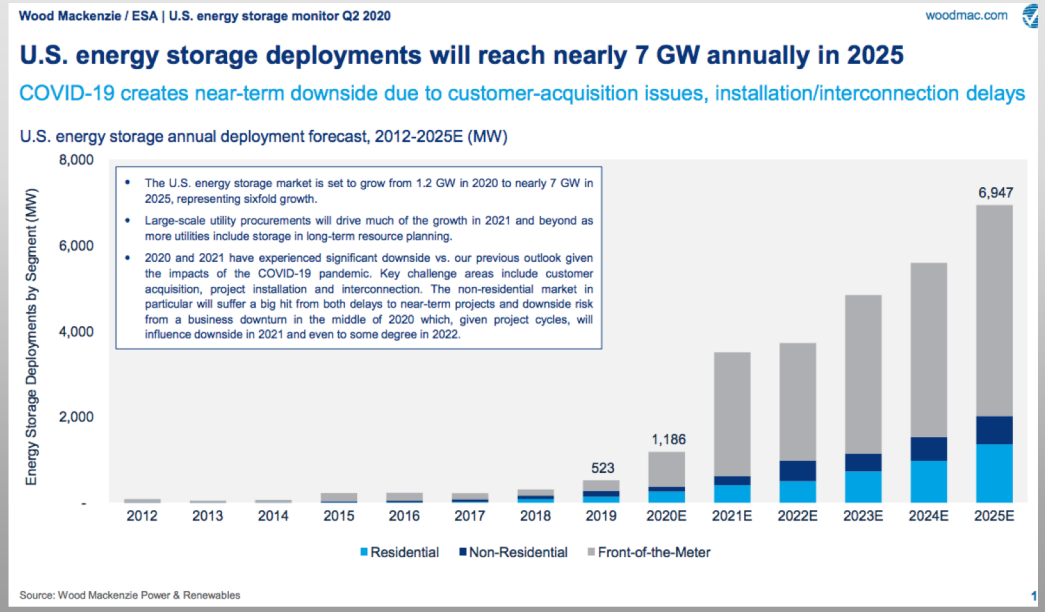
Bridging the Gap between the Theory and Practice

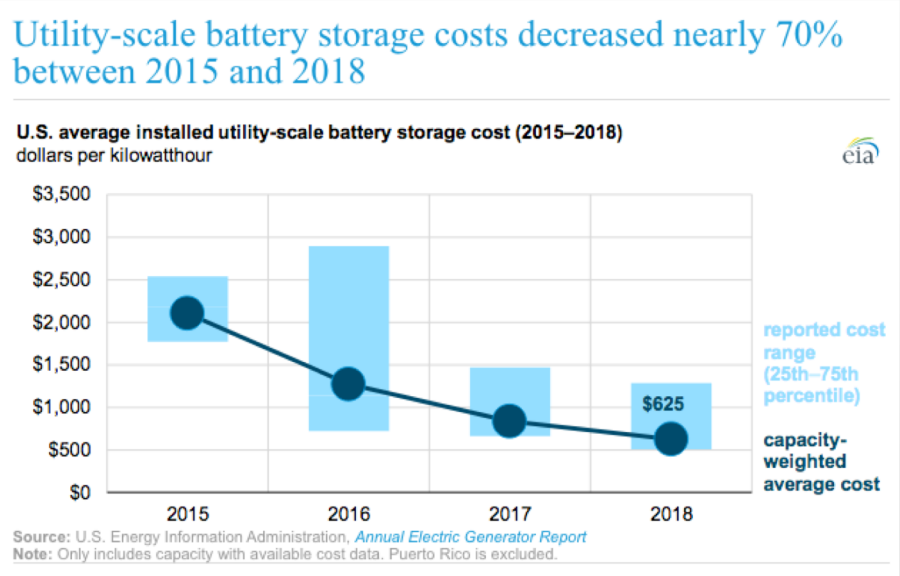
Deployment of battery storage



Expected future deployment



Market trends driving deployment



Regulatory support

- FERC Order 841 and court backing
  - FERC has jurisdiction over how energy storage interacts with the interstate transmission markets it regulates, even if those systems are interconnected to the grid under regulations set by the states
- FERC Order 2222
  - Enables DERs to participate alongside traditional resources in the regional organized wholesale markets through aggregations
- State policies by the numbers
  - Seven states have energy storage mandates, targets and goals
  - Five states have revised their distribution interconnection rules to better reflect characteristics of energy storage systems
  - Three states have incentives

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Development costs continue to plummet

- Since 2018 cost has dropped further, to $300/kWh or less
  - Current economics allow 10%+ returns on typical investments, after assumptions on revenue and operating costs
  - Risk assessment is key

Valuing / optimizing: capacity, ancillary

- ISOs provide significant incentive to commit to discharging during peak load periods
- Response times vary by region and program
- These sources can be more than 50% of total expected revenue

Valuing / optimizing assets: energy price

- Peaker economics
  - Compare to most expensive generators
  - Call option-like return profile, discharging only at peak demand / price

- Tank / reservoir model – borrow from oil, gas, NGLs market experience
  - Volatility drives frequency of activity, charging and discharging
  - Challenge is to translate into higher-frequency power market

Risk assessment

- As with ownership of any storage asset, risk assessment is long volatility
  - Downside for enterprise is shift lower in volatility
  - Additional battery storage (as well as other) capacity can lower spot market volatility in the long run
  - Would also affect capacity and ancillary services income
- Execution risk: ability to transact at expected levels
  - Legacy manual and spreadsheet-based approaches used for conventional assets will not meet the challenges
  - Co-optimization across value stack requires better software, intelligence and strategies

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Risk Mitigation

- For each component of risk, there is opportunity to mitigate via long-term agreements
  - PPA
  - VPPA
  - Long-term lease

Owner / Investor financing implications

- Utility owners can absorb risk into rate base
- Private equity investors typically looking to manage risk; will sell upside in order to guarantee portion of returns
  - Much of their previous experience in generation, where income is defined by PPAs and other long-term, fixed-price agreements

Risk absorbers

- Trading companies

  - Have long been active in leasing storage of other energy products.

  - Likely interested in owning optionality at right price

- Banks and other financial intermediaries

  - Similar to trading companies, subject to Dodd-Frank

Alternative technologies

- Pumped hydro
- Compressed air, or any other mechanical process that utilizes intraday pricing to charge and discharge
- Other battery technologies