



NREL/CCSE PEV Battery Second Use Project



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NREL/CCSE PEV Battery Second Use Project

- Competitively bid \$1.4M / 50% cost share project to
 - Perform detailed 2nd use analysis
 - Acquire aged plug-in electric vehicle (PEV) batteries
 - Perform long-term field testing
- Combines expertise of utilities, hardware developers, and PEV research centers
- Leverages UC Davis' \$1.1M 2nd use study
- Provides access to UCSD's extensive micro-grid for controlled field testing

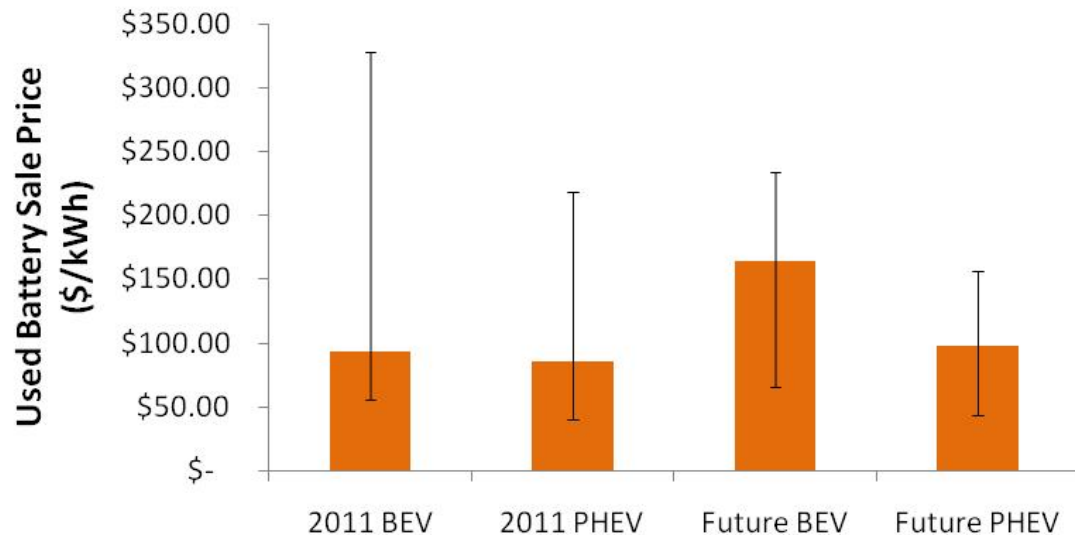
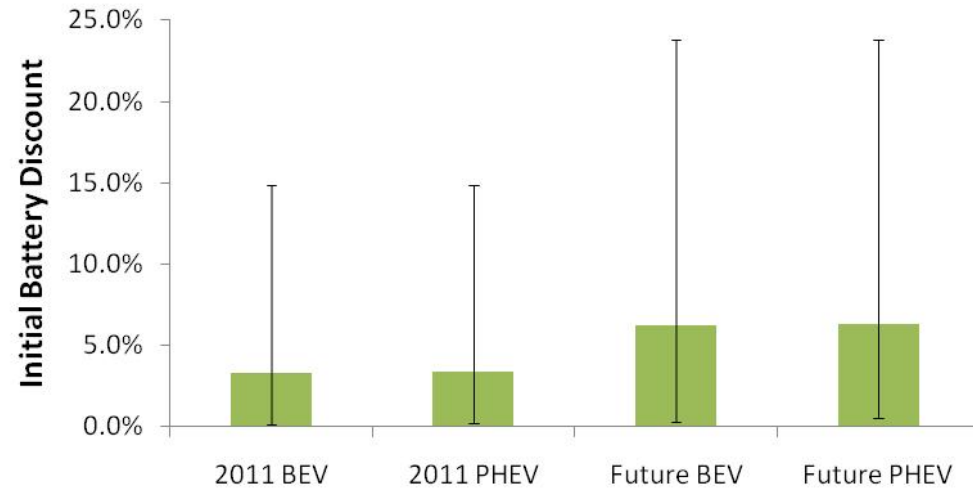


Preliminary Analysis Results

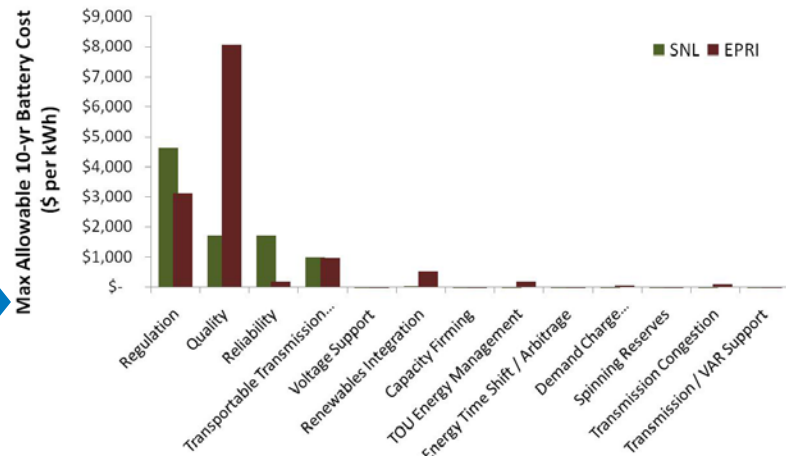
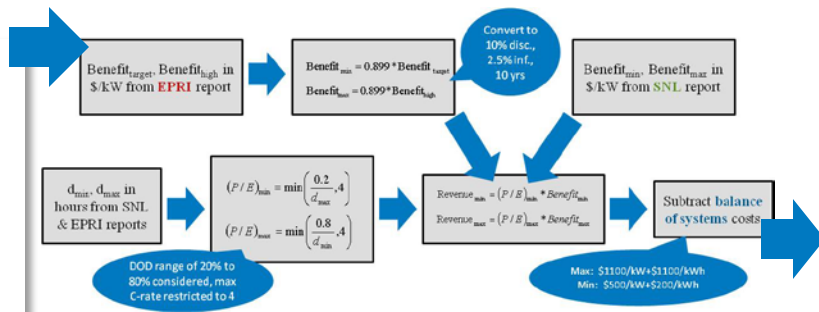
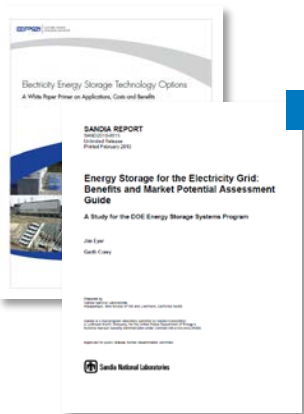
- Impact of competing technologies
- Potential revenue generation
- Supply and demand

Competitive Technology

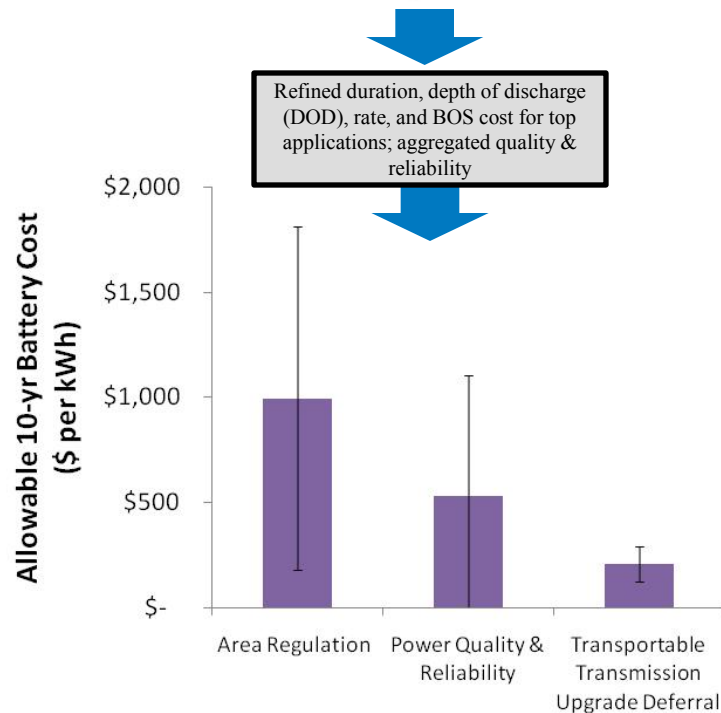
- Maximum salvage value of a used battery will be limited by future battery prices
- Under favorable conditions, second use can only discount today's battery prices by **12% or less**
- However, second use will offer batteries to secondary applications at reduced cost (typically **<\$170/kWh**)



Revenue Streams

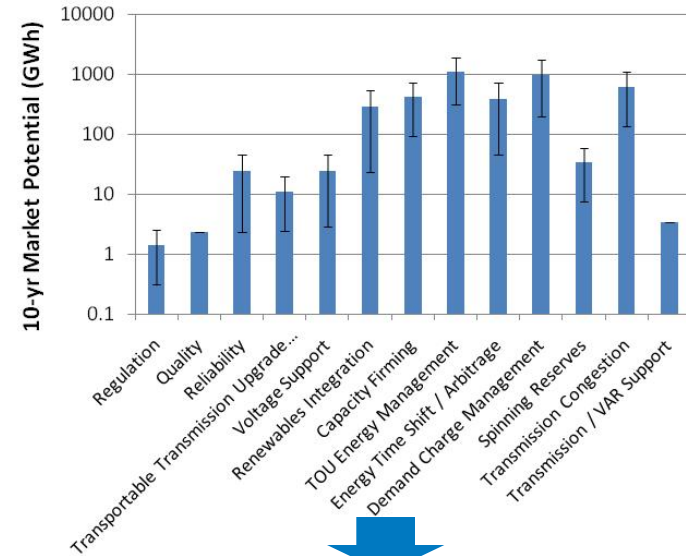


- Revenue is highly variable
- Allowable battery costs are highly sensitive to balance-of-system (BOS) costs
- Batteries need to be very cheap for these applications to be viable

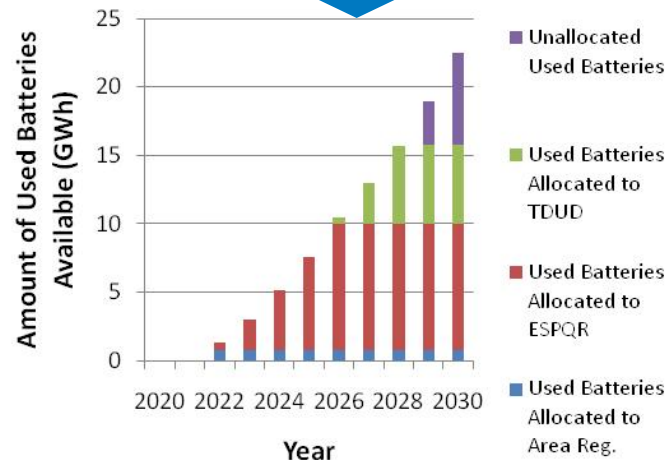
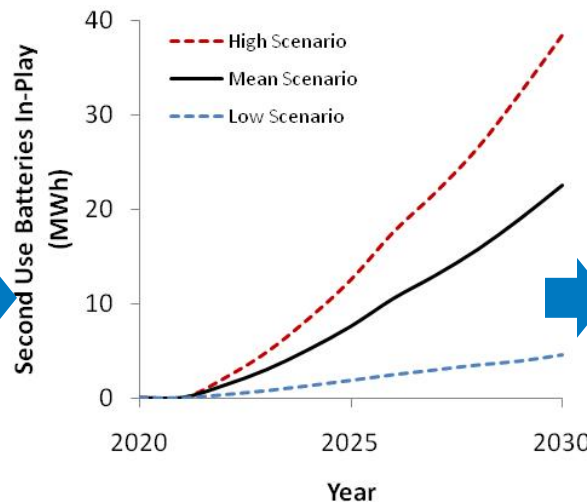
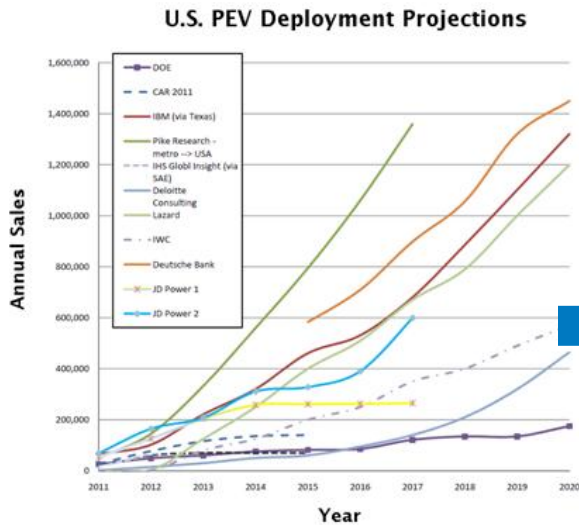


Supply and Demand

- High-value applications have both competition and small markets
- Supply from PEVs has the potential to overwhelm many second use markets



Refined duration, DOD, and rate; aggregated quality & reliability



NREL/CCSE Ongoing Work

- **Batteries**
 - Multiple aged Li-ion batteries of various chemistries (iron phosphate, manganese spinel, NMC, etc.) have been acquired
 - Acceptance testing is underway to identify capabilities on the grid
- **Analysis**
 - Build upon our preliminary analysis and our aged battery acceptance testing to make a detailed study of specific second use applications
- **Field Testing**
 - Controlled long-term field testing of up to four aged batteries will be conducted at a test site under development on UCSD's microgrid

Acknowledgments

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- We appreciate the support provided by DOE program managers
 - David Howell
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 - Steve Goguen
- Thanks to Mike Ferry and the entire CCSE second use team
- Technical questions regarding battery second use should be directed to Jeremy Neubauer at 303-275-3084 or jeremy.neubauer@nrel.gov