NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Three Angles on PEV Battery Second Use



The Battery Show

October 2011

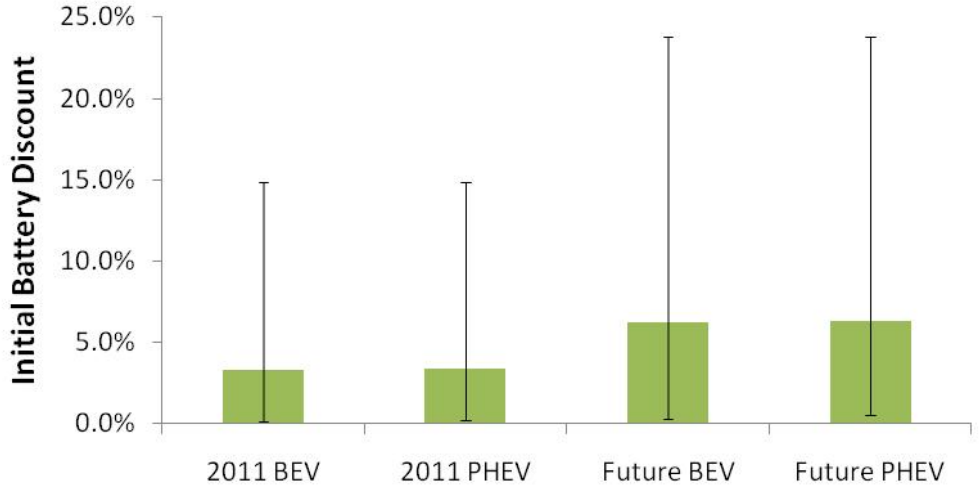
Jeremy Neubauer
Ahmad Pesaran

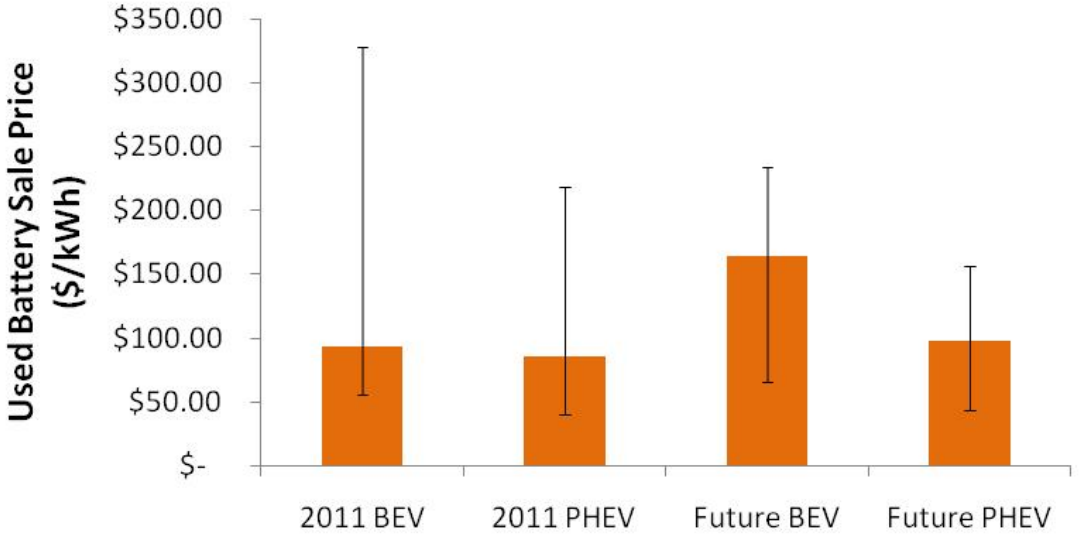
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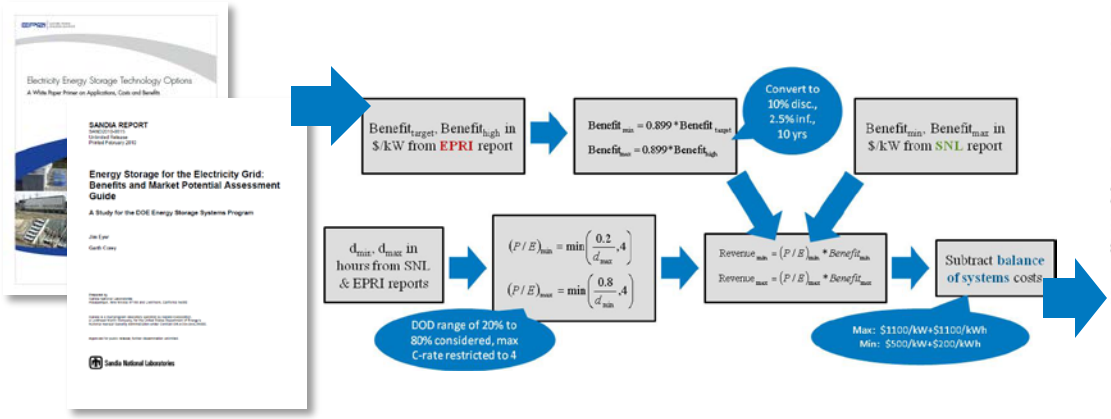
Competitive Technology

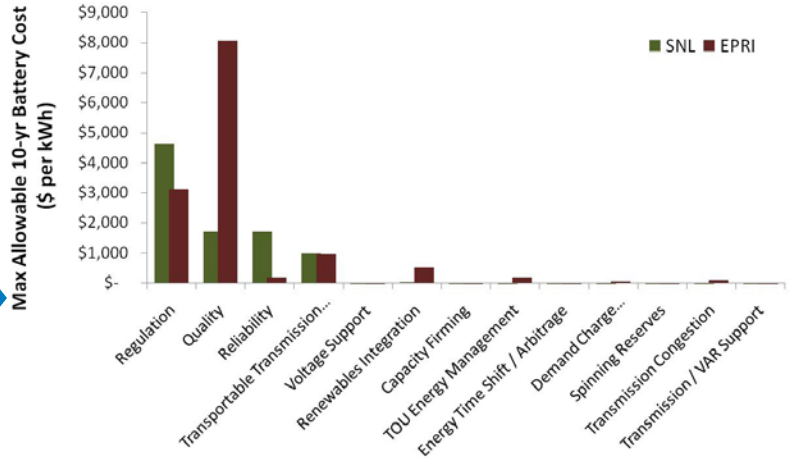
- Maximum salvage value of a used battery will be limited by future battery prices
- Under favorable conditions, second use can only discount today's battery prices by **12%** or less
- However, second use will offer batteries to secondary applications at reduced cost (typically **<$170/kWh**)





Revenue Streams





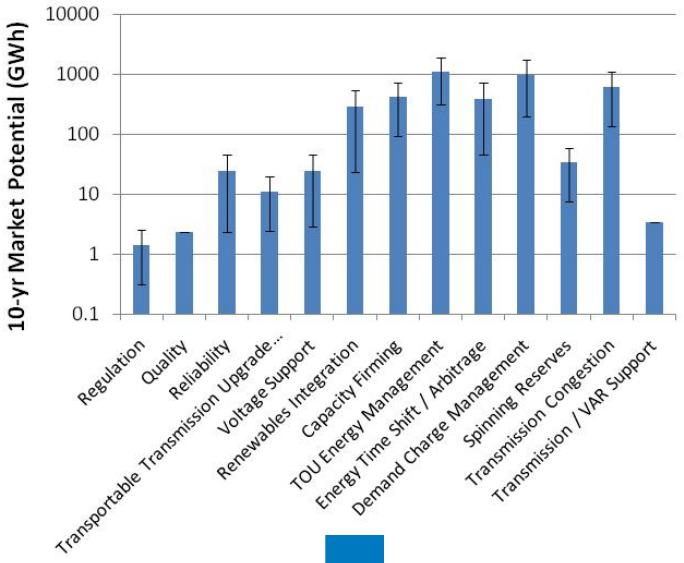
- Revenue is highly variable
- Allowable battery costs are highly sensitive to balance-of-system (BOS) costs
- Batteries need to be very cheap for these applications to be viable

Refined duration, depth of discharge (DOD), rate, and BOS cost for top applications; aggregated quality & reliability

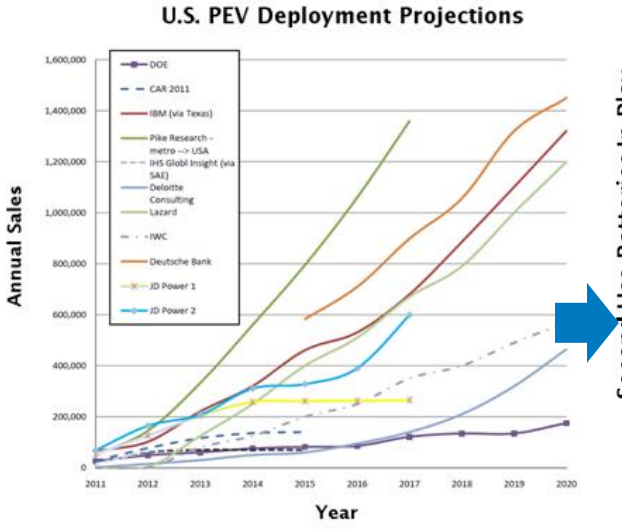


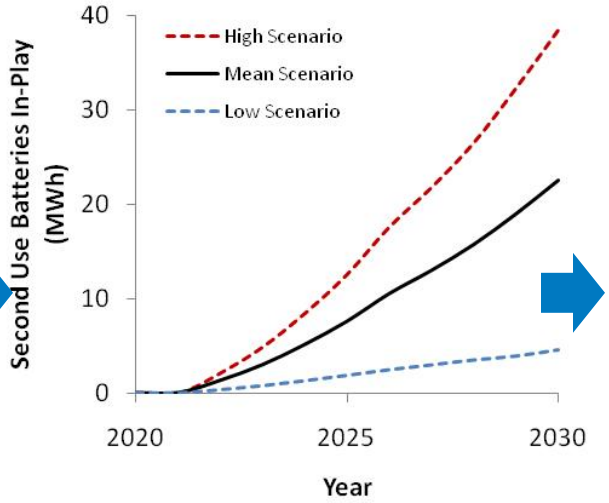
Supply and Demand

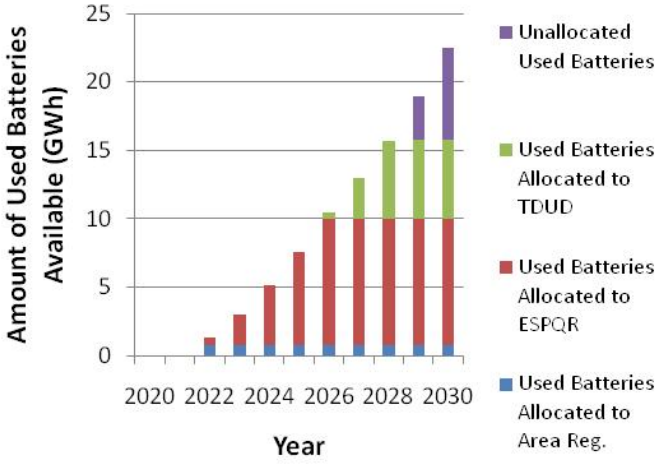
- High-value applications have both competition and small markets
- Supply from PEVs has the potential to overwhelm many second-use markets



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







Acknowledgments

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- Technical questions regarding battery second use should be directed to Jeremy Neubauer at 303-275-3084 or jeremy.neubauer@nrel.gov