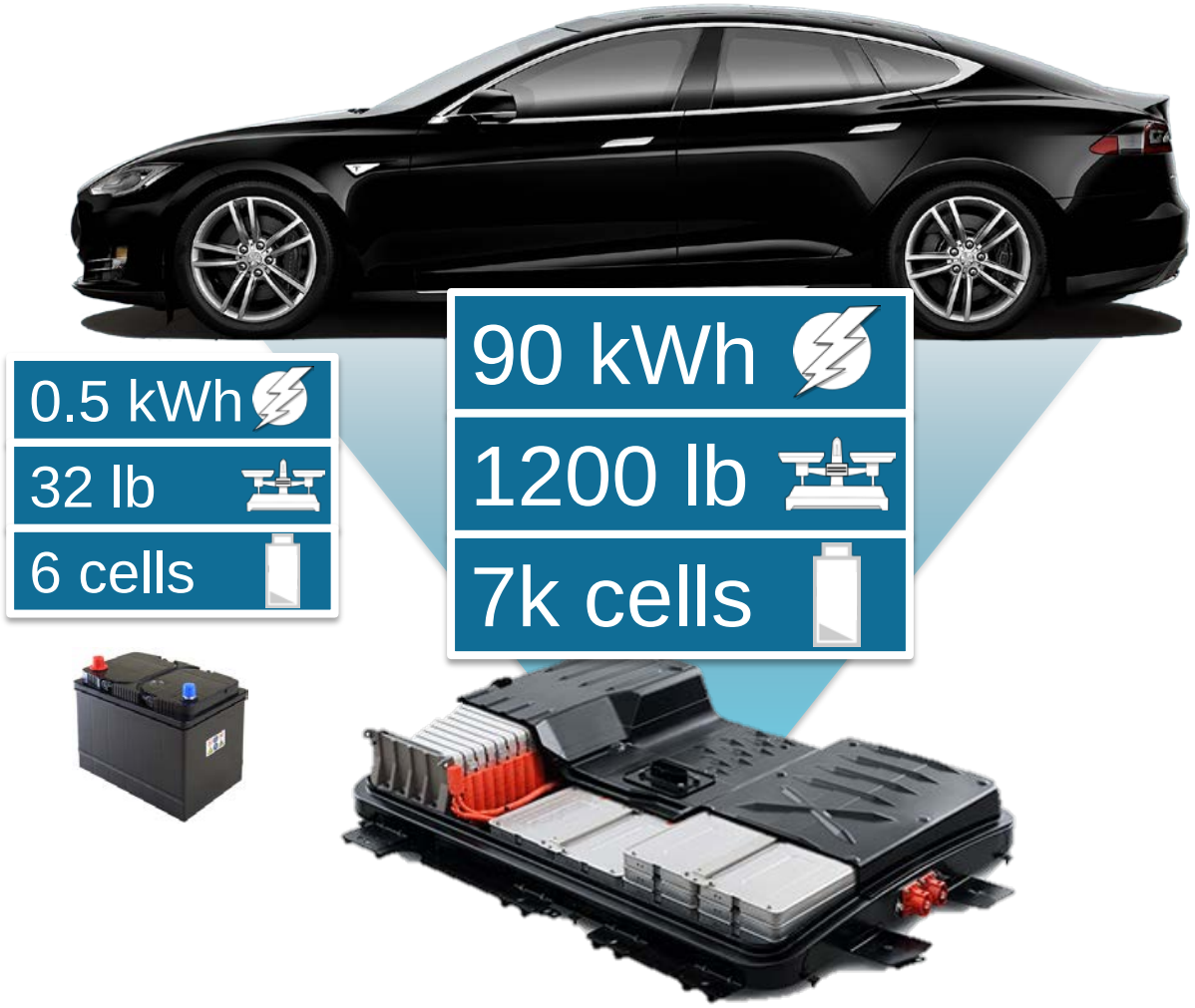
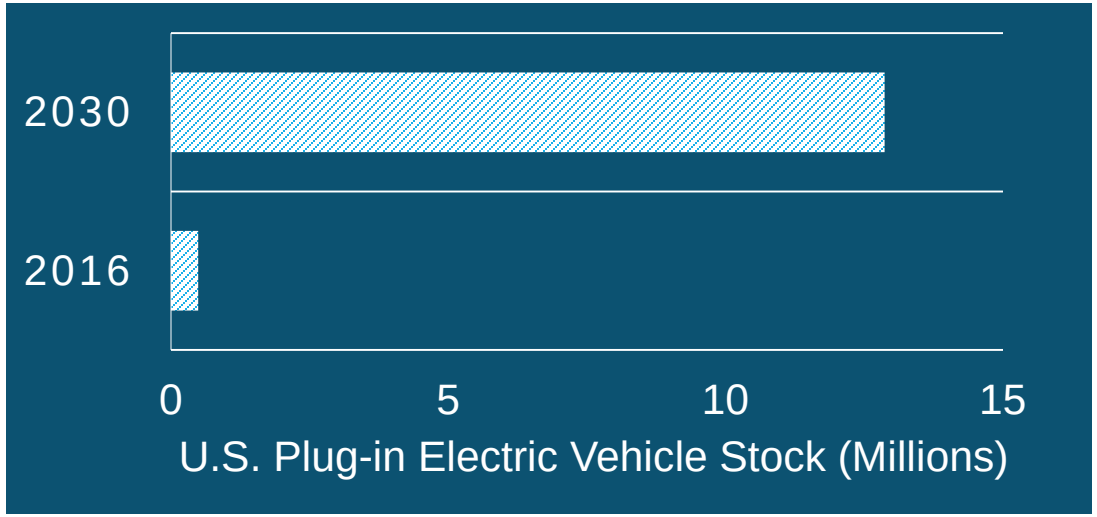
CHANGING WHAT'S POSSIBLE

Automotive Batteries:
From Car to Grid and Back Again

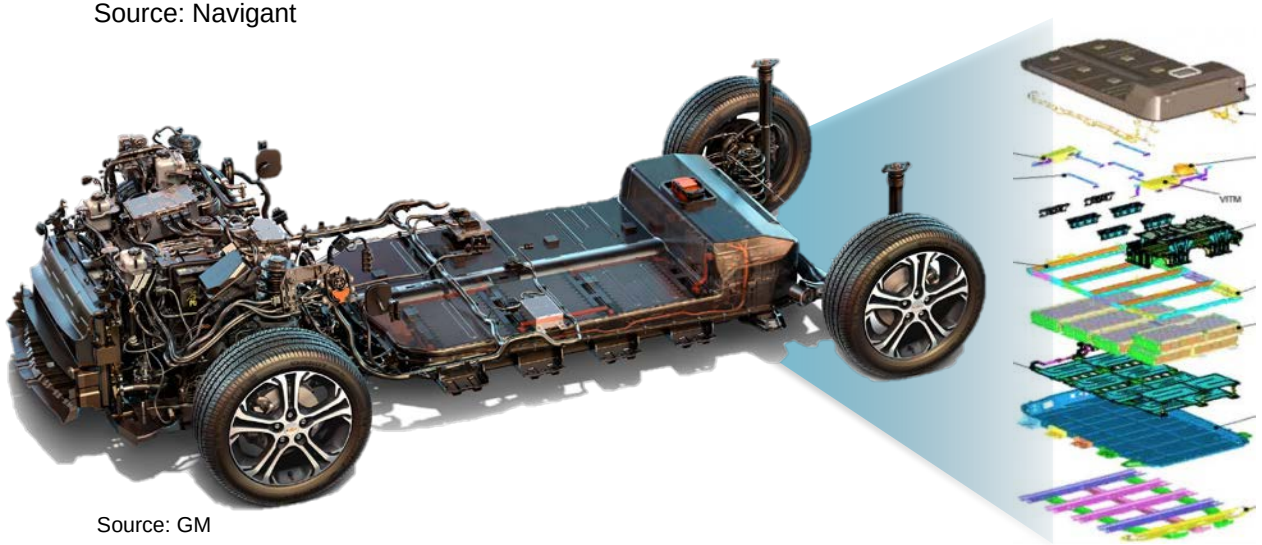
Joseph Manser, ARPA-E Fellow

EV (battery) market poised for substantial growth



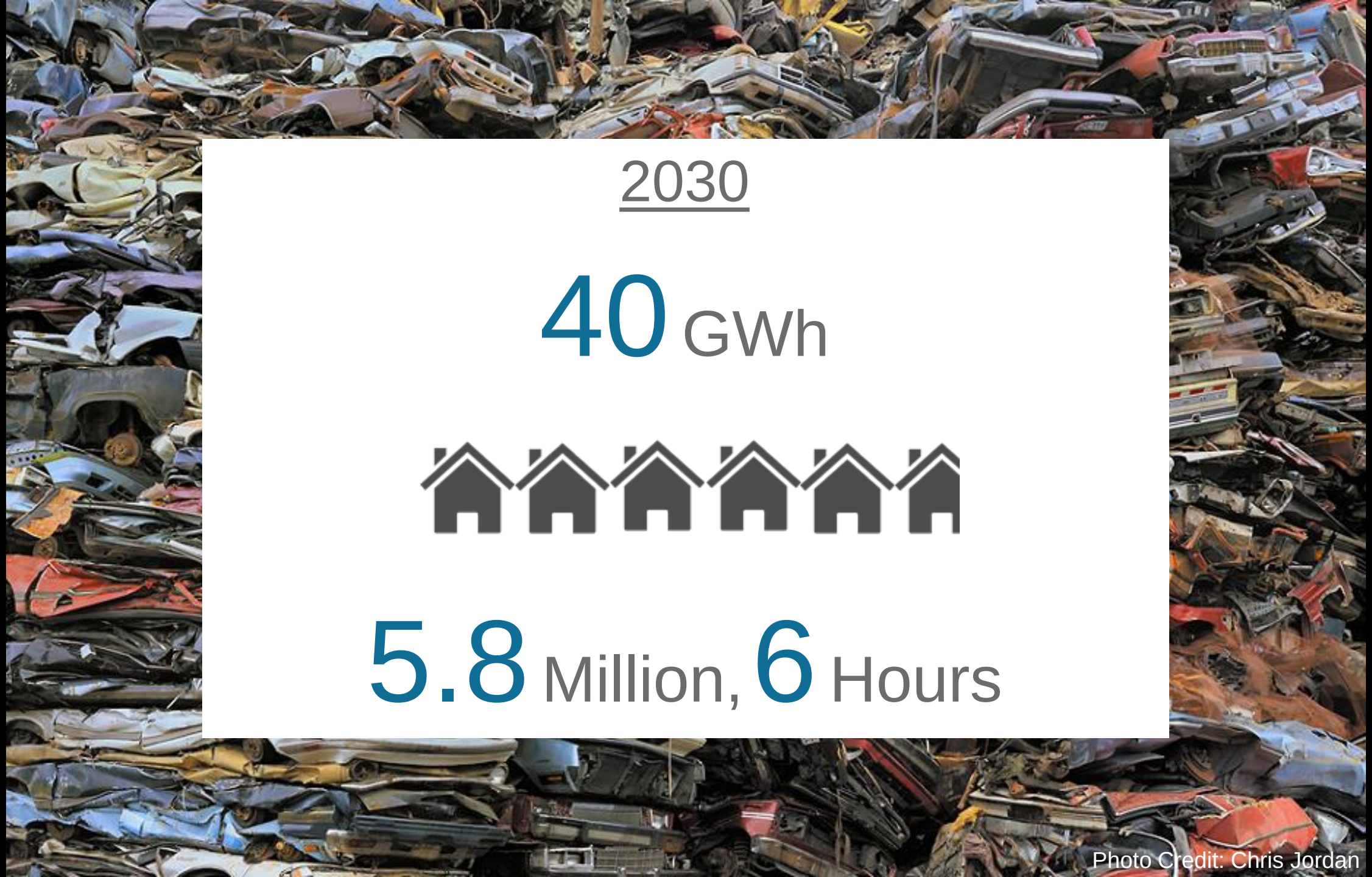


Source: Navigant



Source: GM

Photo Credit: Chris Jordan



2030

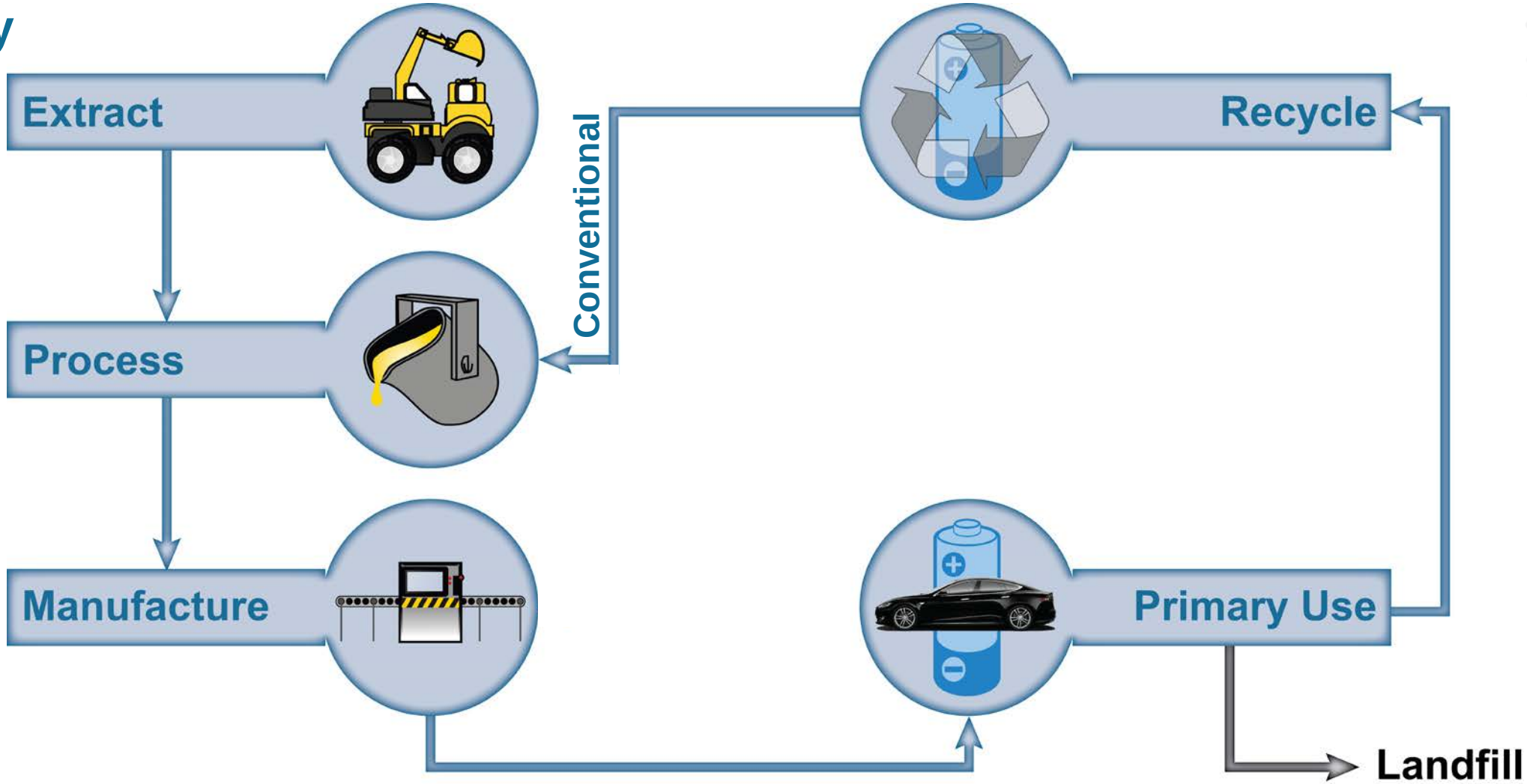
40 GWh

5.8 Million, 6 Hours

Photo Credit: Chris Jordan

Automotive battery ecosystem

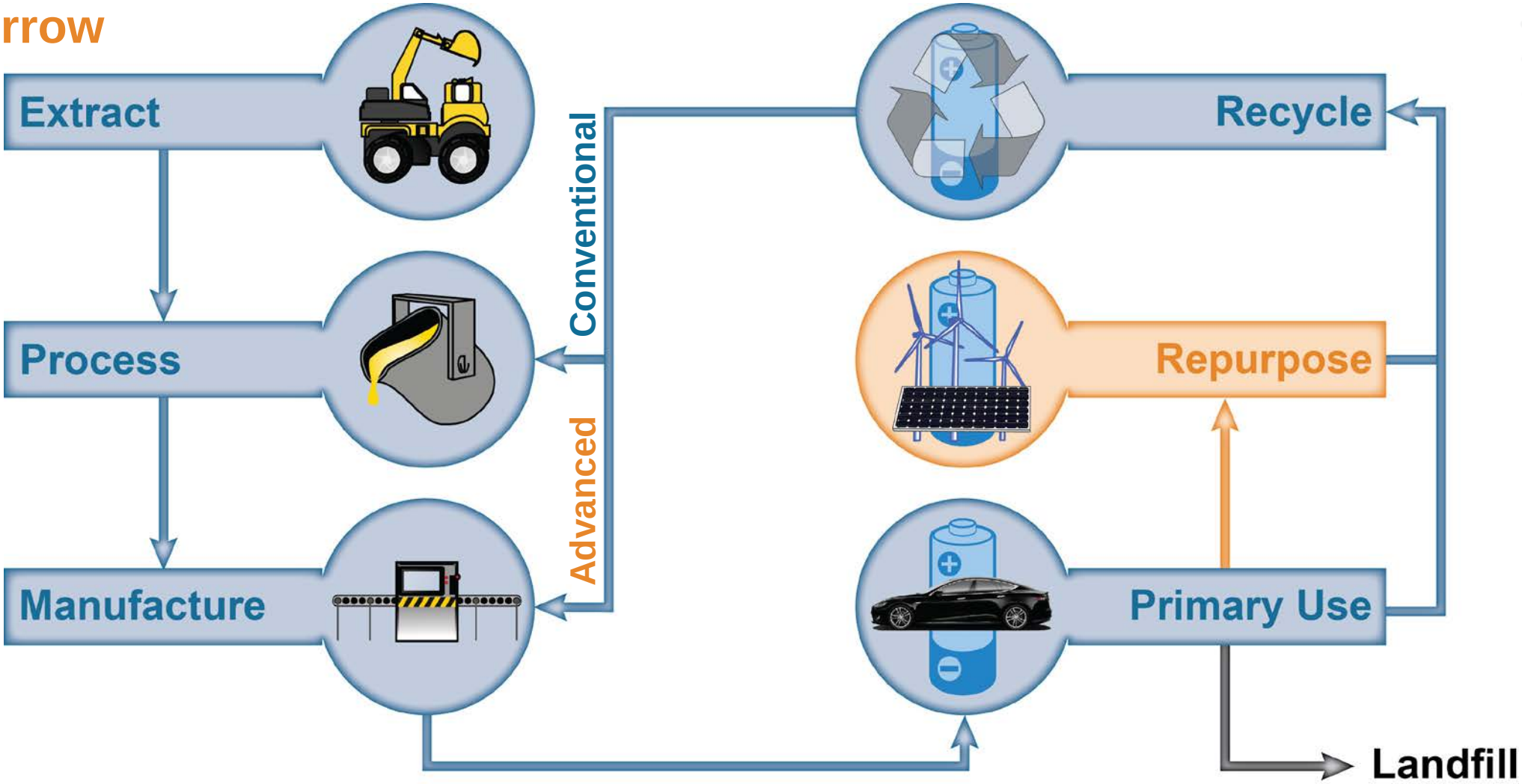
Today



Adapted from: Gaines, L. Comparison of Lithium Ion Battery Recycling Processes. *2011 Joint US-China Electric Vehicle and Battery Technology Workshop* (2011)

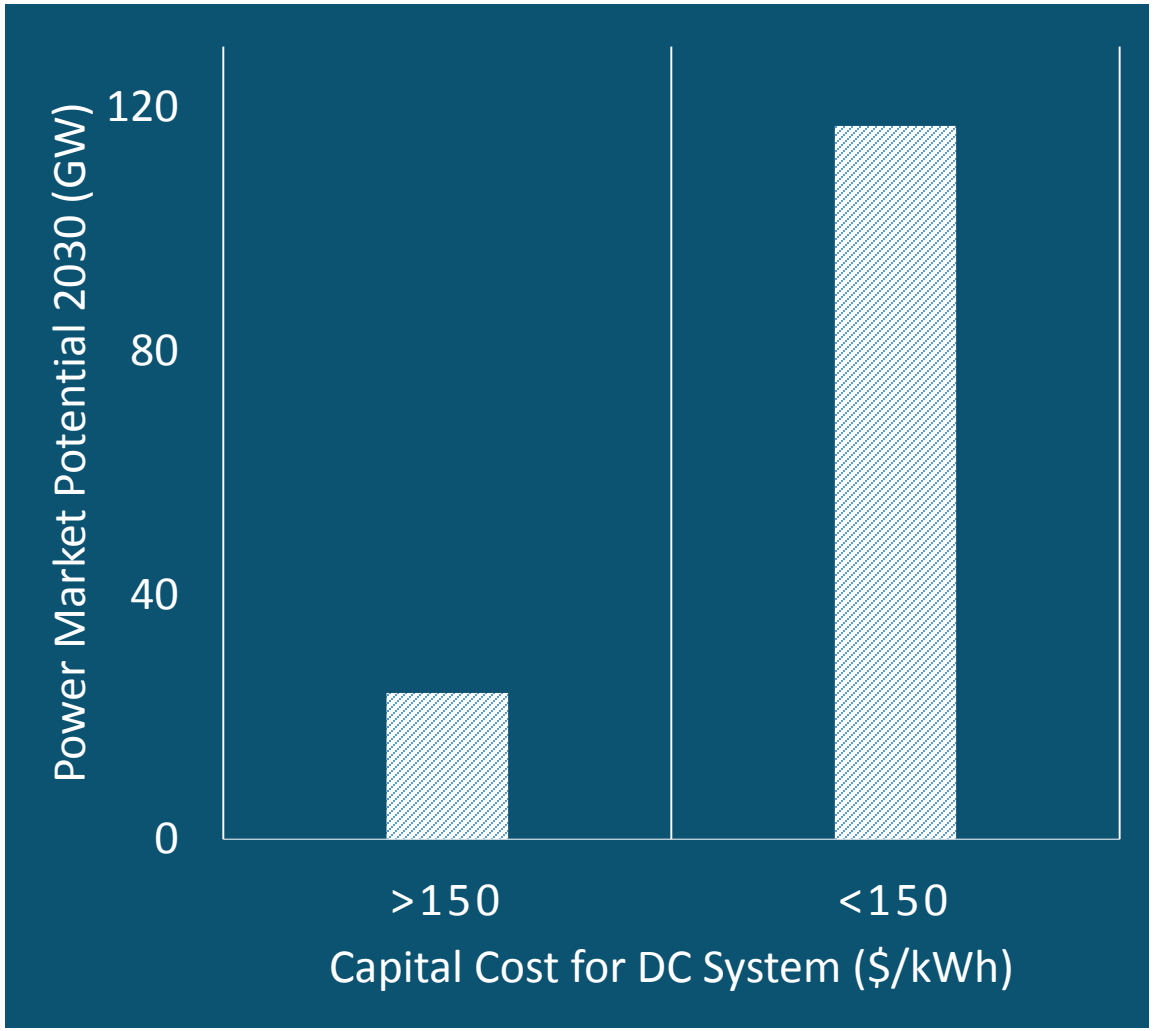
Automotive battery ecosystem

Tomorrow



Adapted from: Gaines, L. Comparison of Lithium Ion Battery Recycling Processes. *2011 Joint US-China Electric Vehicle and Battery Technology Workshop* (2011)

Market opportunity for repurposed packs




Source: BMW

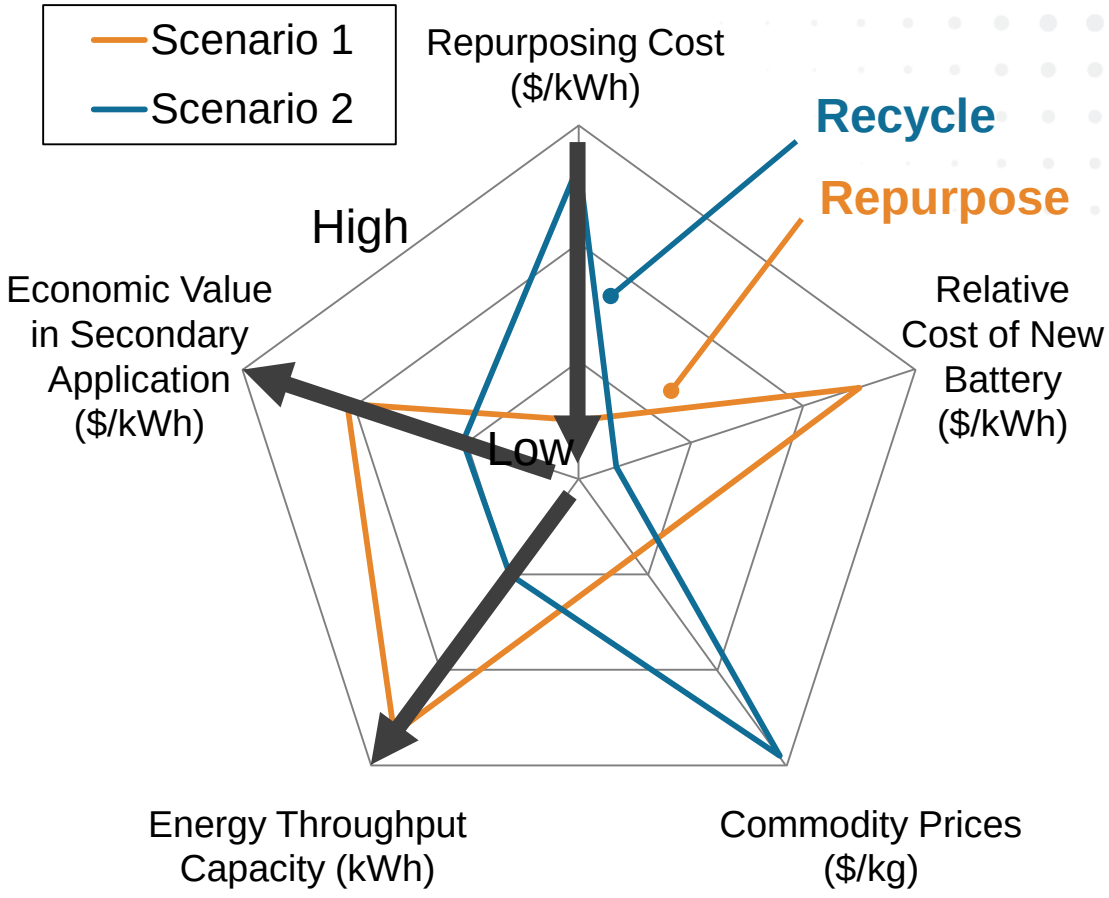
Adapted From: "Following the Grid Storage Current: Technology, cost, and economics," IHS Energy, 2016.

Factors impacting the feasibility of repurposing

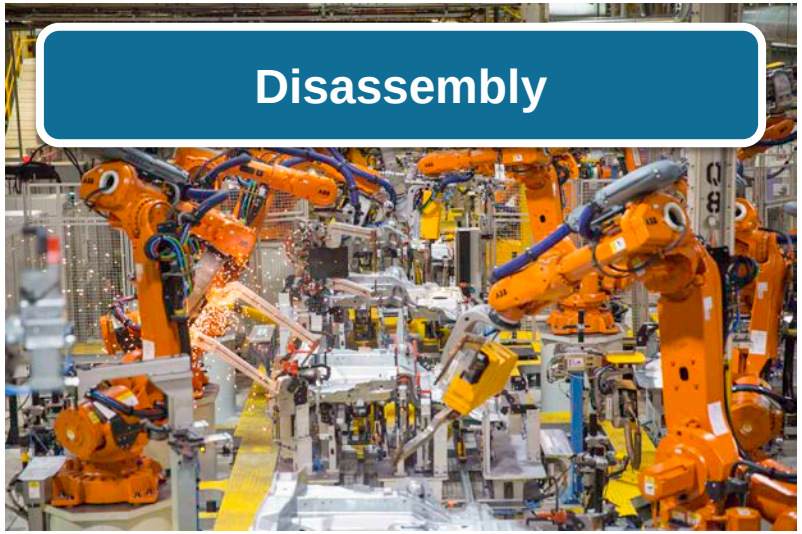
Energy throughput capacity

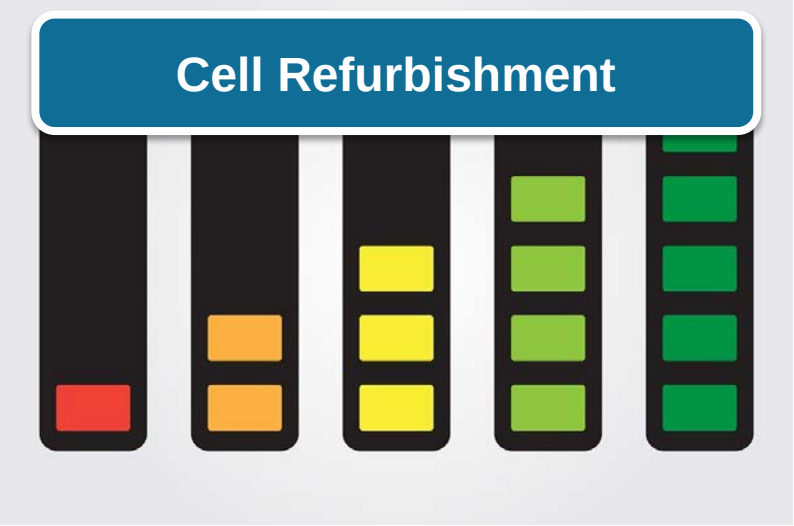
Disassembly, testing, repackaging, validation, warranty

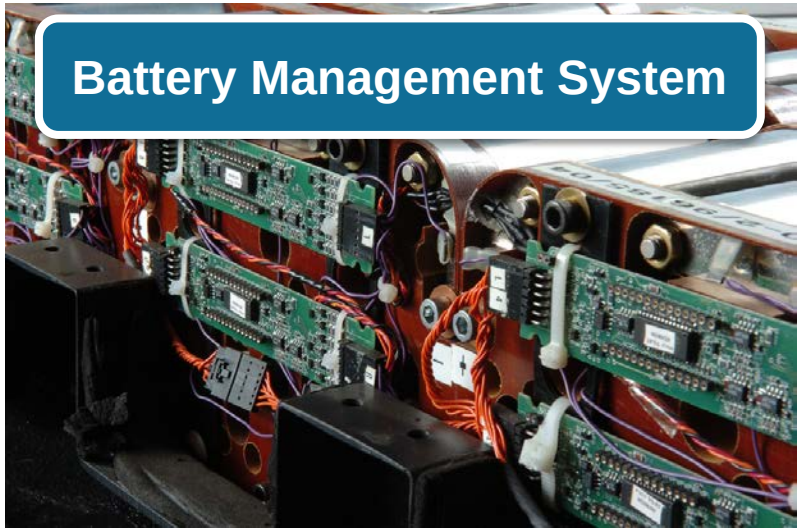
Cost of new batteries & recycling

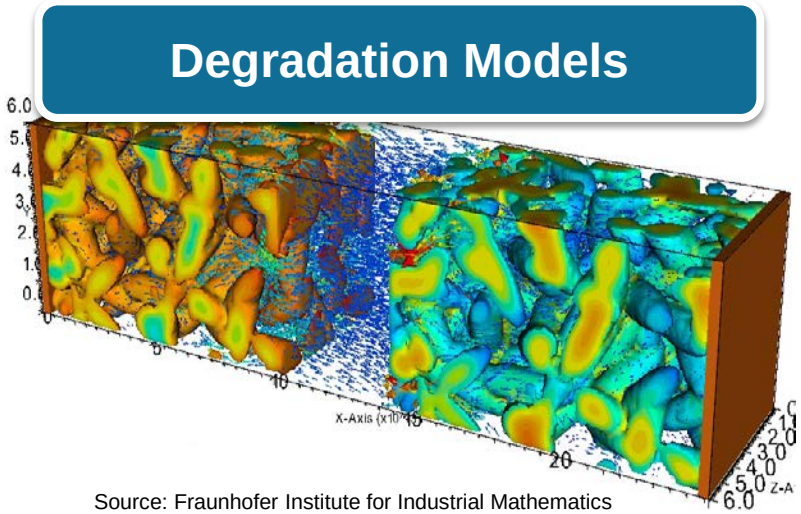


Technological opportunities

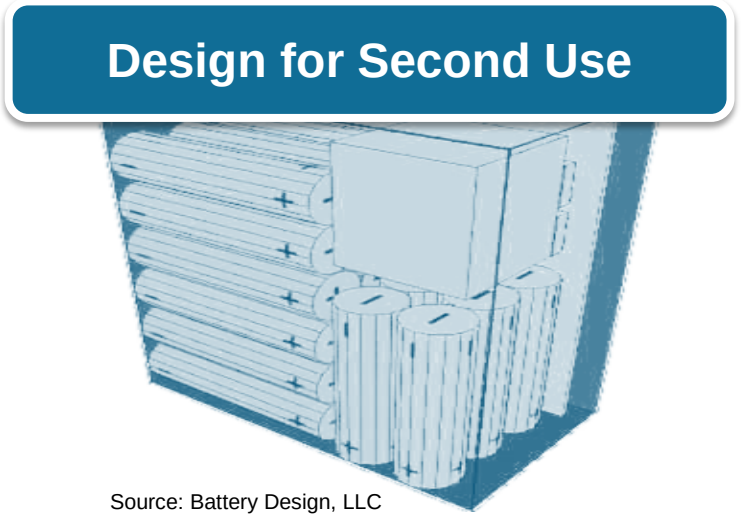








Source: Fraunhofer Institute for Industrial Mathematics



Source: Battery Design, LLC

Thank you

- What technical areas can ARPA-E pursue to:
  - Facilitate development of a low cost and reliable second use and end of life automotive battery ecosystem

- Panel session tomorrow at 11:20 a.m. in Potomac 5

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