Vehicle Technologies Office

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BAT343: Silicon and Intermetallic Anode Portfolio Strategy Overview

Brian Cunningham (DOE)

Overview

- Vehicle Technologies Office Energy Storage Overview
- Cost Scenarios for Different Chemistries
- VTO Roadmap
- Silicon Anode Key Results
- Silicon Anode Focus Areas
- Questions?

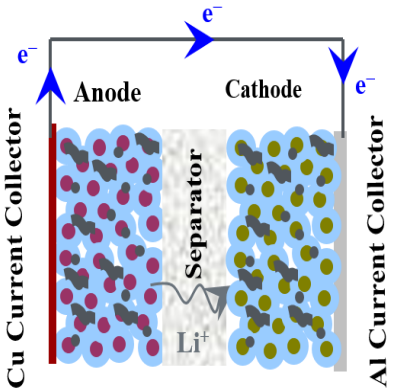
VTO Energy Storage R&D Overview and Strategy

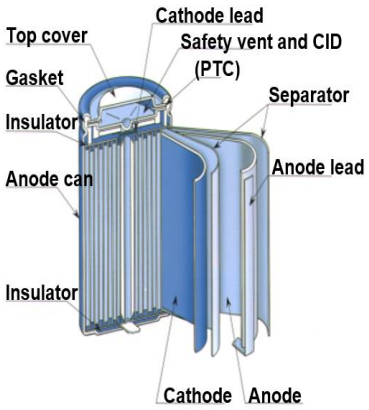
CHARTER: Develop battery technology that will enable large market penetration of electric drive vehicles

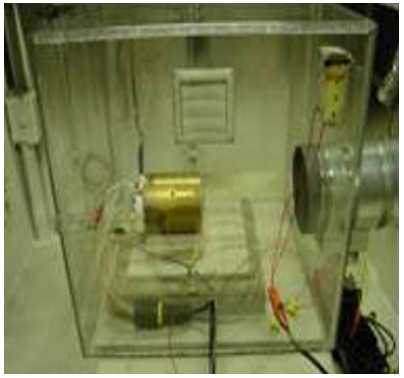
Cost Goal: $100/kWh$_{(useable)}$

Energy Storage R&D

- **Battery Materials Research (BMR)**
- **Applied Battery Research (ABR)**
- **Battery Development**
- **Battery Testing, Design, & Analysis**



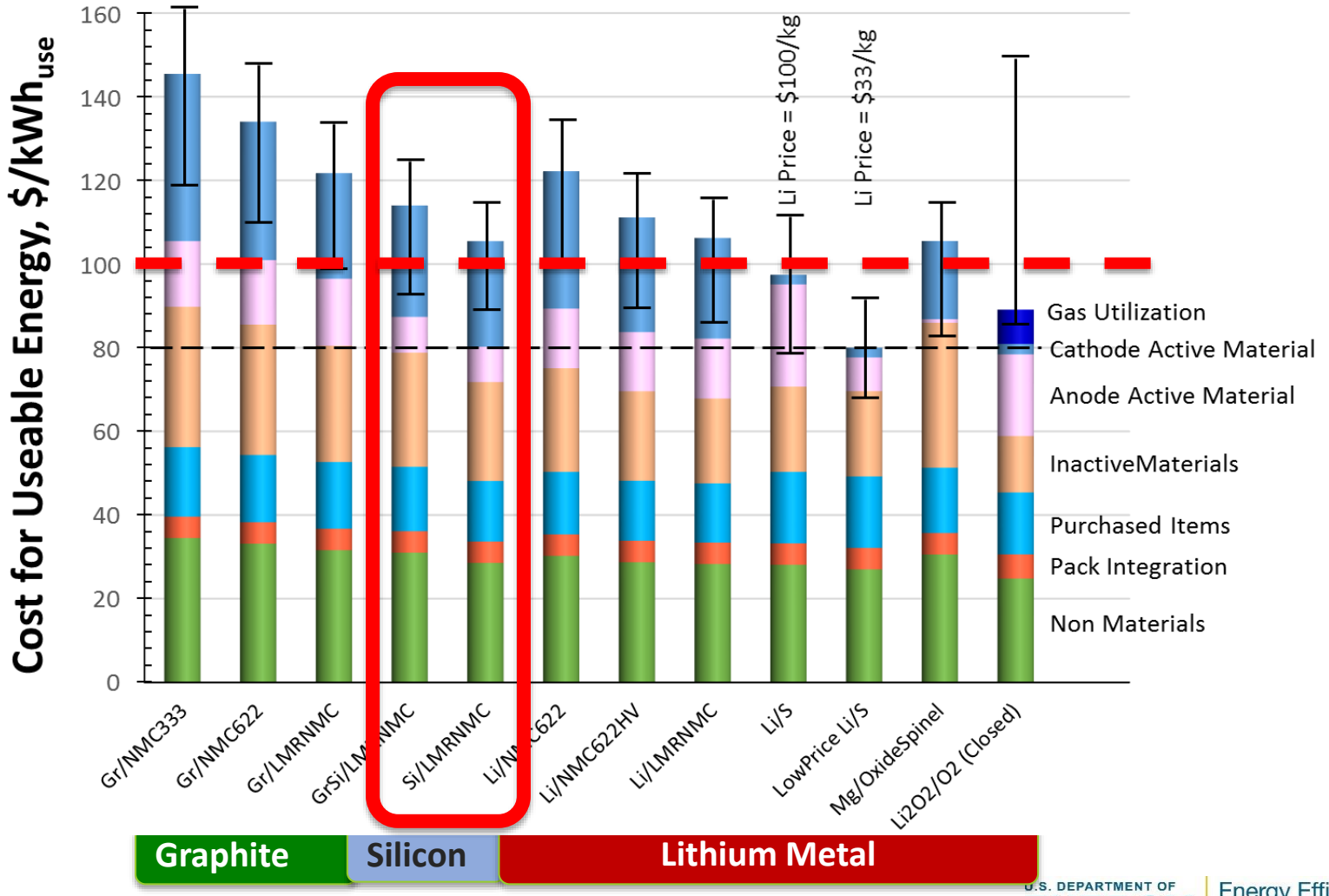




What Chemistries Can Help Meet DOE's Cost Goal?

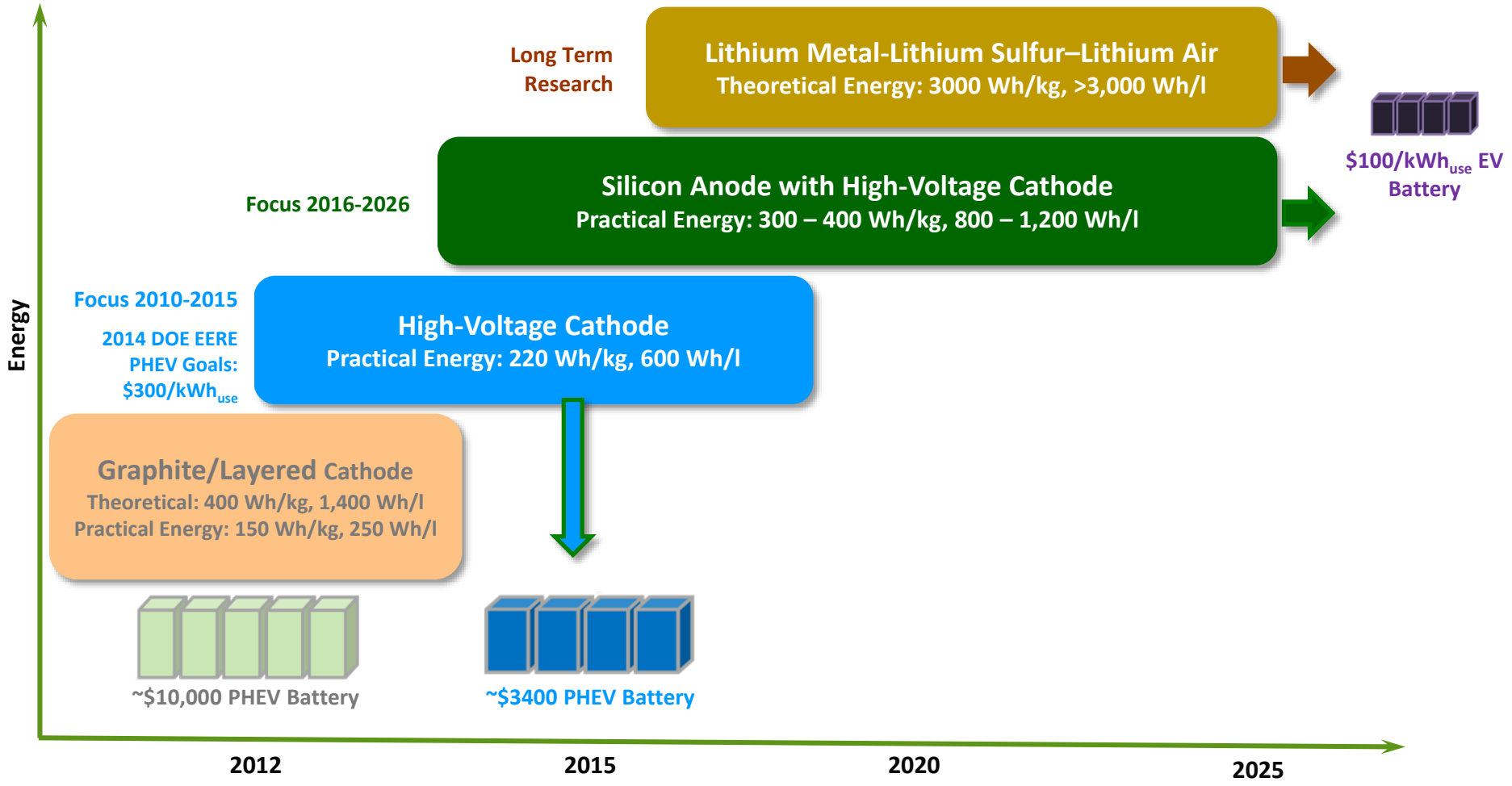
Projected Cost for a 100kWh$_{Total}$, 80kW Battery Pack

These are best case projections: all chemistry problems solved, performance is not limiting, high volume manufacturing, does not include extreme fast charge capability.



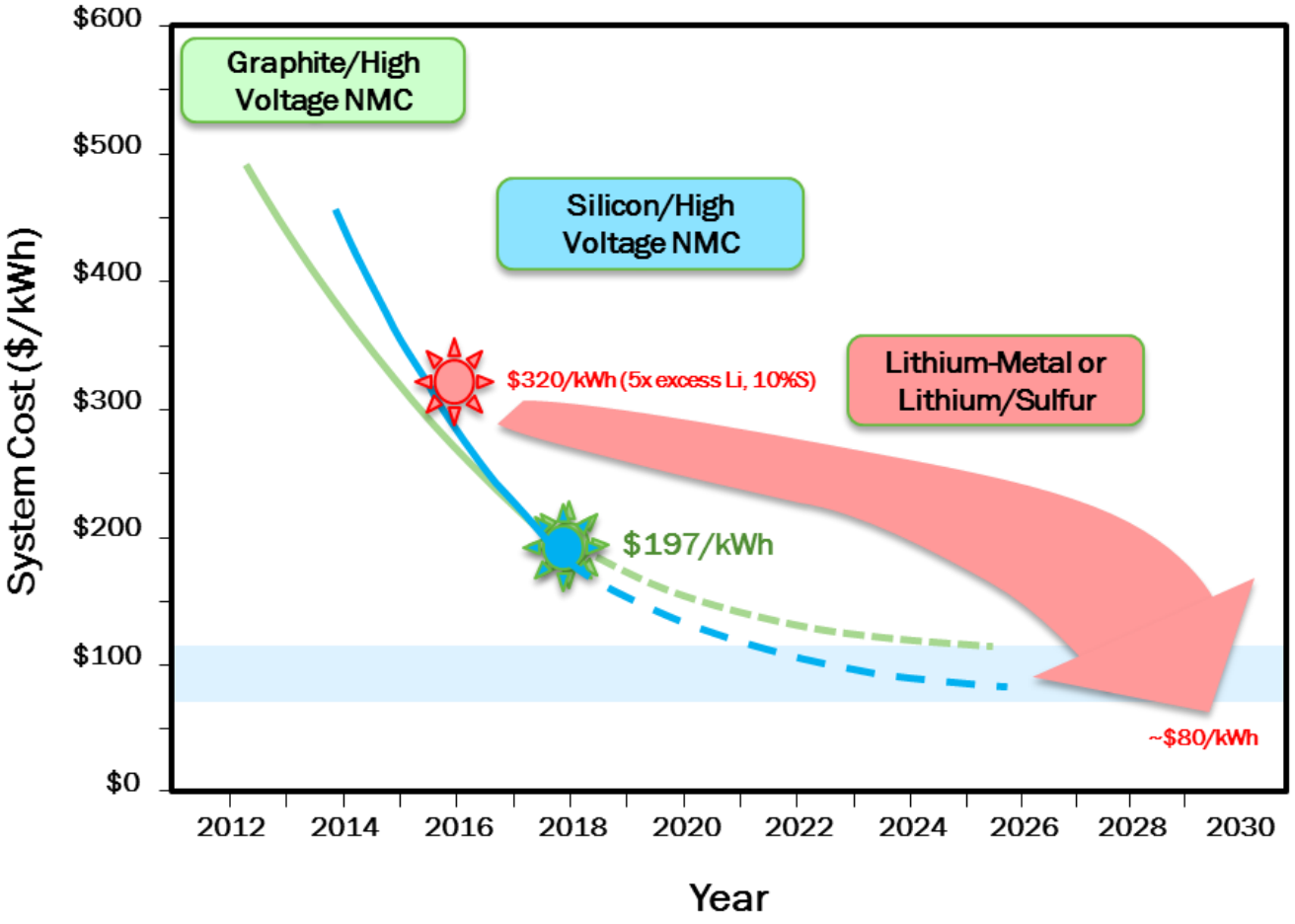
VTO R&D Materials Roadmap

Current emphasis: The development of high voltage cathodes and electrolytes coupled with high capacity metal alloy anodes. Research to enable lithium metal-Li sulfur systems.



DOE Vehicle Technologies Battery R&D Roadmap

GOAL: Research new battery chemistry and cell technologies in order to reduce the cost of electric vehicle battery packs to less than $100/kWh by 2028 (cost parity with ICE).



Graphite/High Capacity Cathode

- Higher cathode capacity
- Low/no Cobalt
- Recycling & fast charge

Silicon/High Capacity Cathode

- Higher anode capacity
- Cycle/calendar life
- Fast charge

Lithium-Metal & Li/Sulfur

- Solve cycle life/ catastrophic failure
- reduce excess lithium and electrolyte

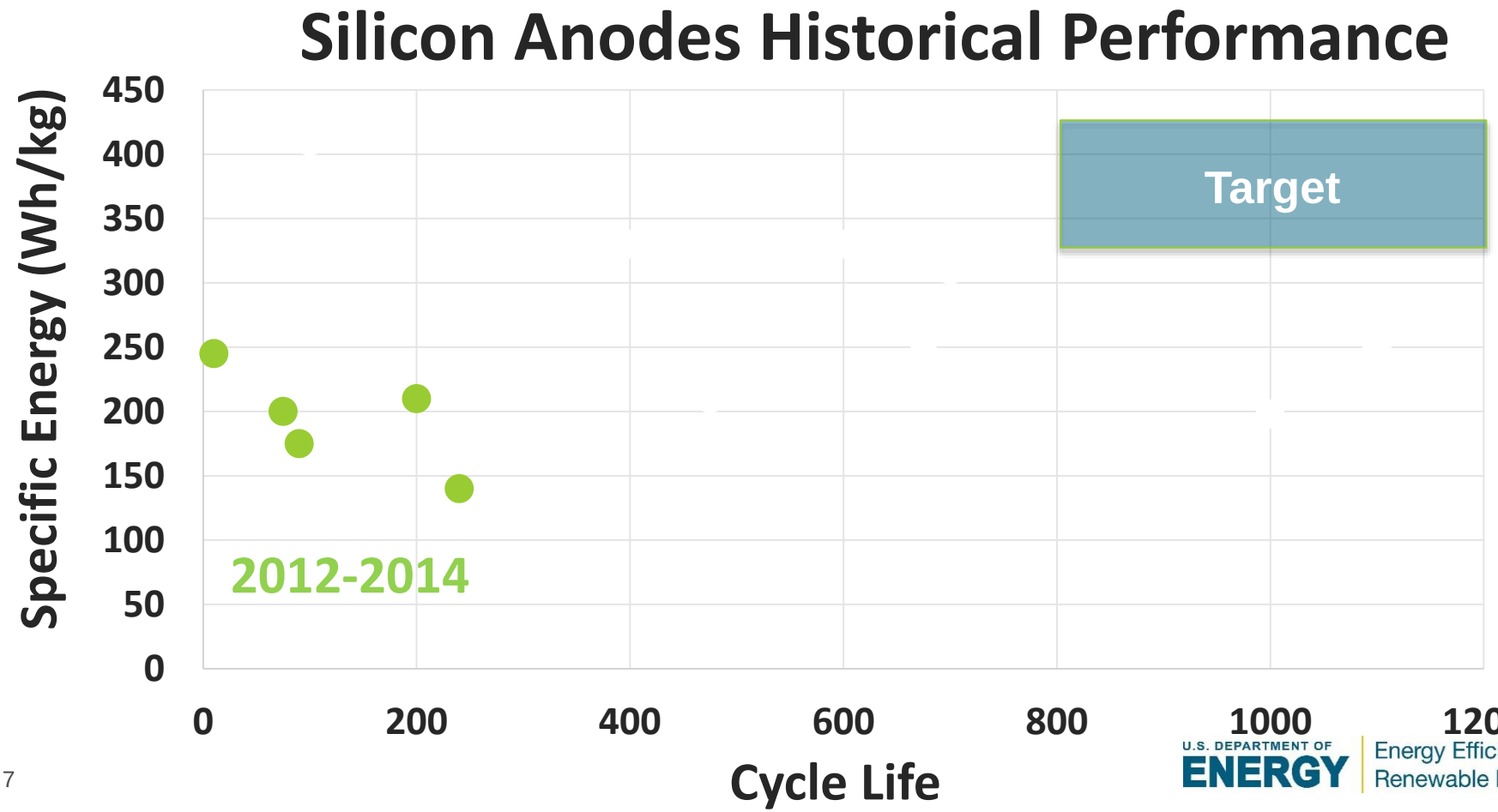
Silicon Anodes: Key Technical Results

Targets

- 1,000+ mAh/g
- 10 years & 1000 cycles

Challenges

- Large first-cycle irreversible loss
- Low cycle and calendar life / High capacity fade



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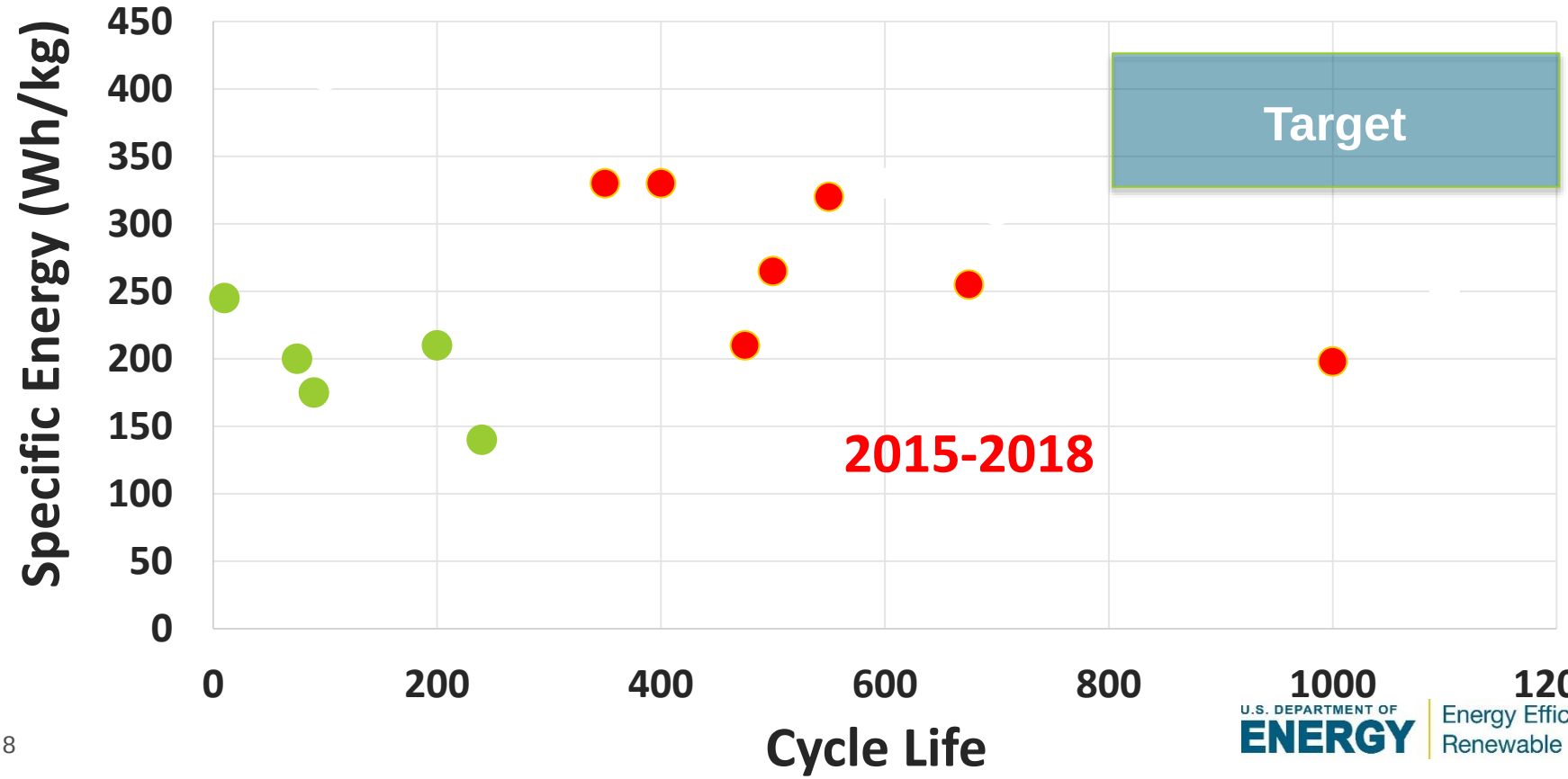

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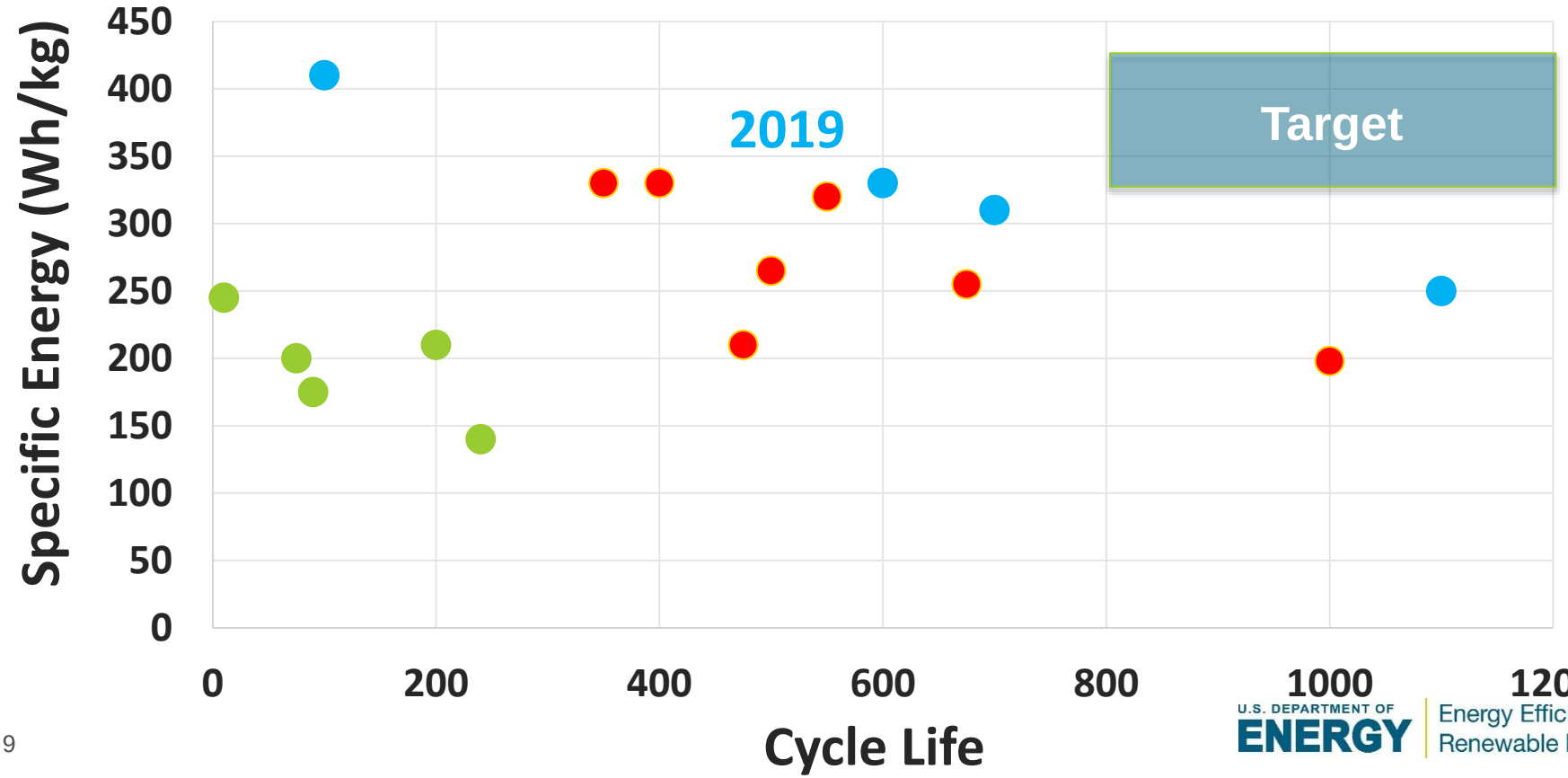

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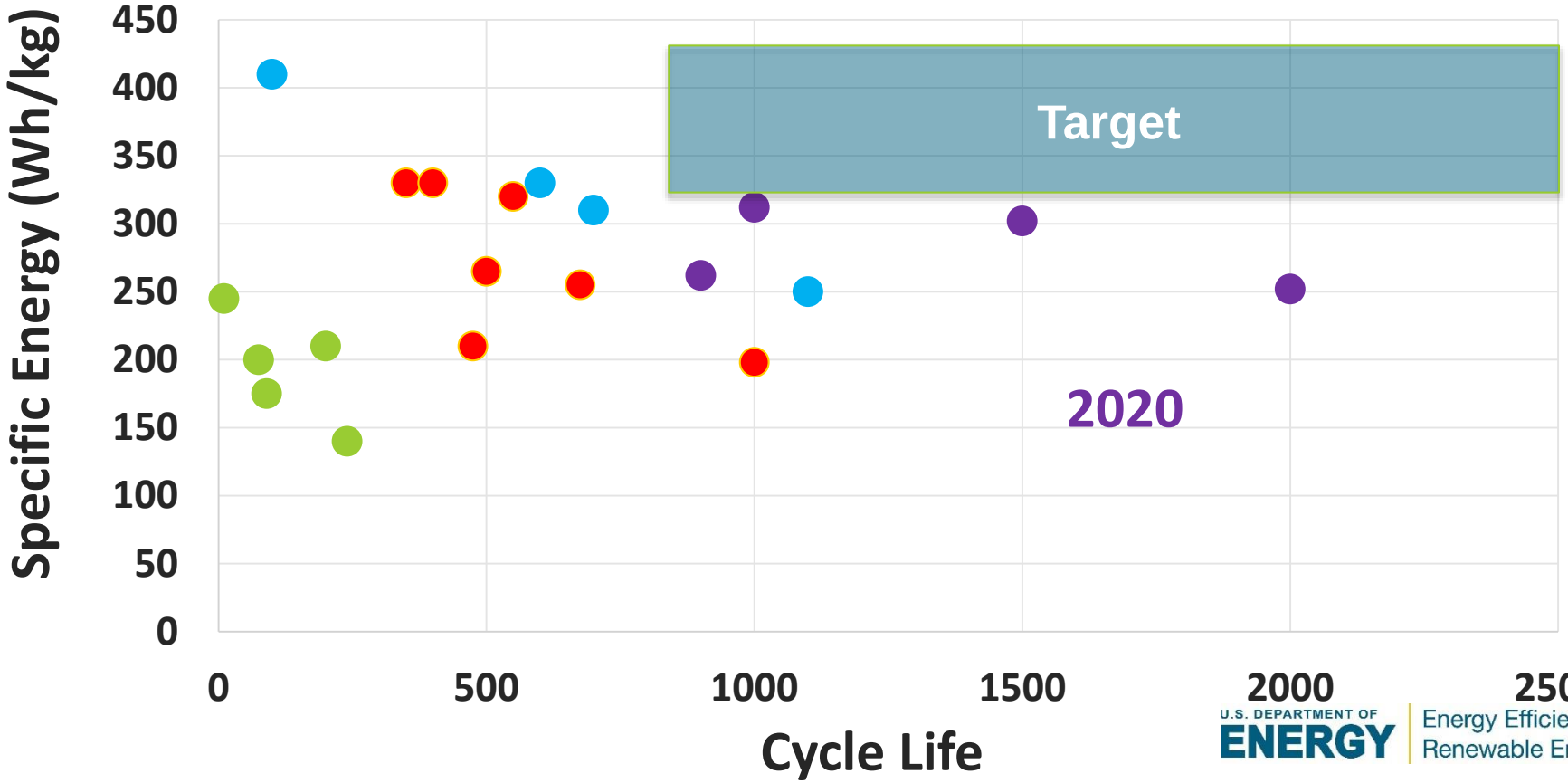

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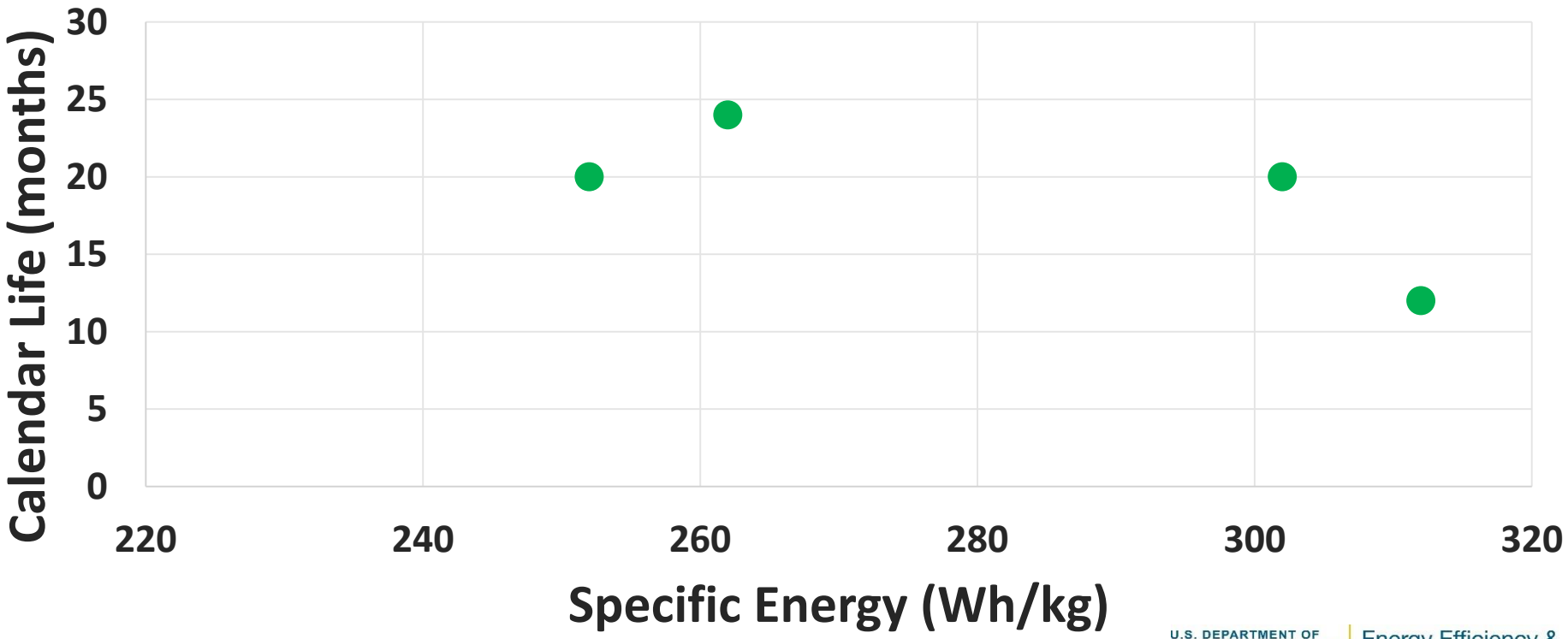

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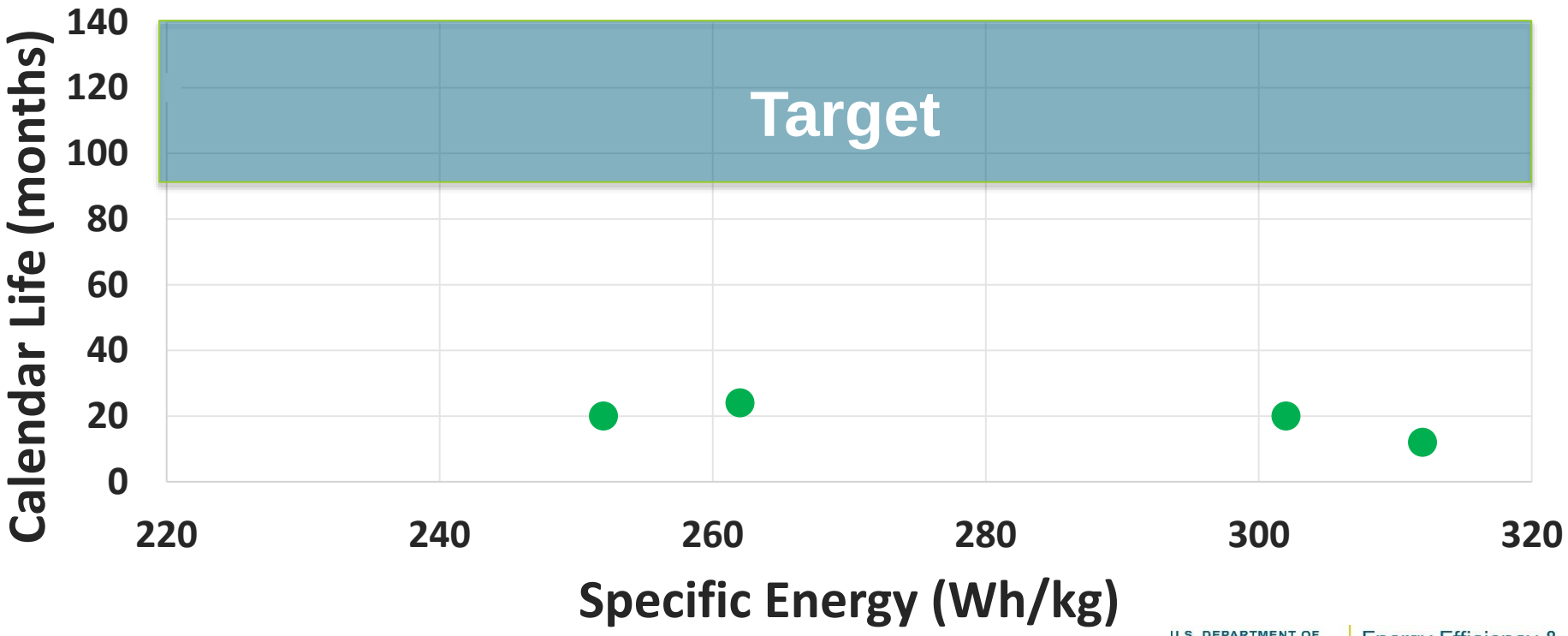

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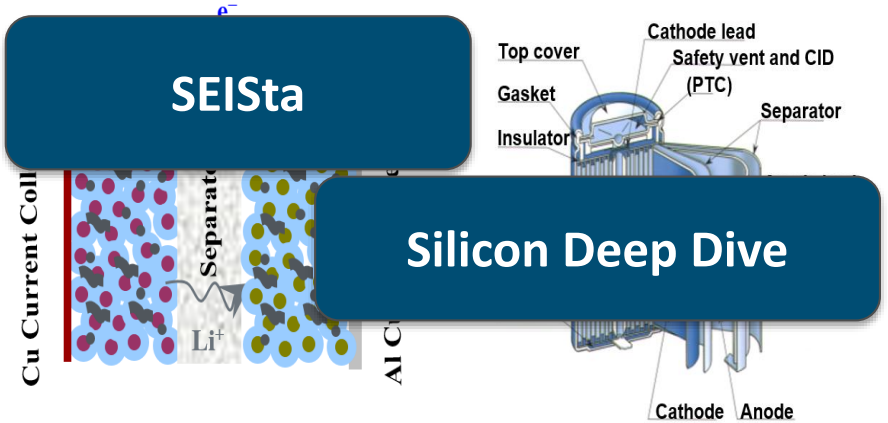
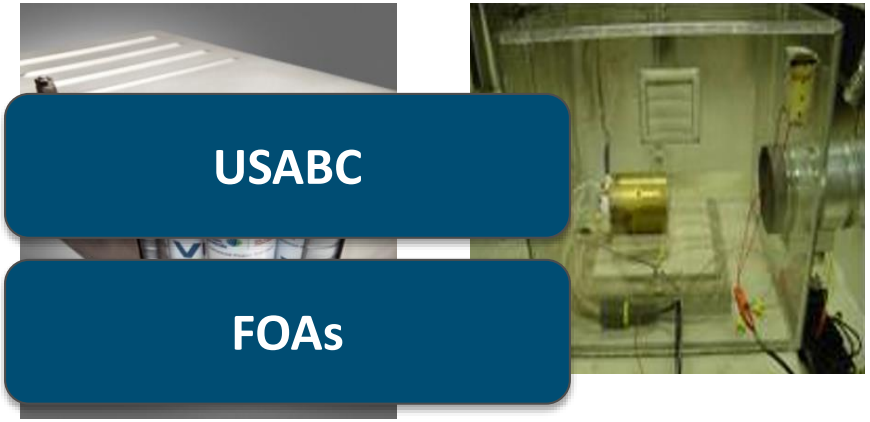


Silicon Deep Dive



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