U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

OVERVIEW | BATTERIES R&D

Brian Cunningham
Program Manager, Vehicle Technologies Office

June 12, 2023



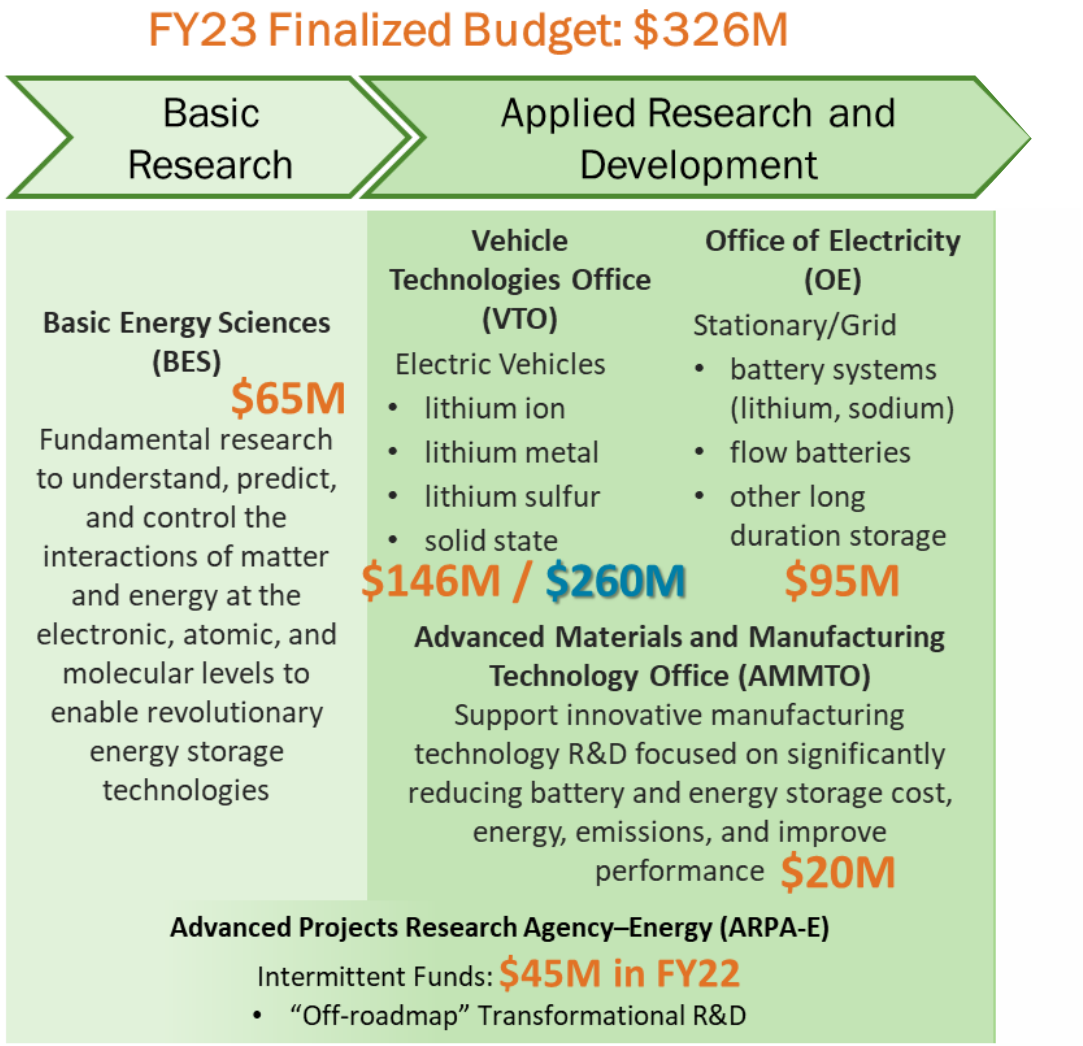





Overview

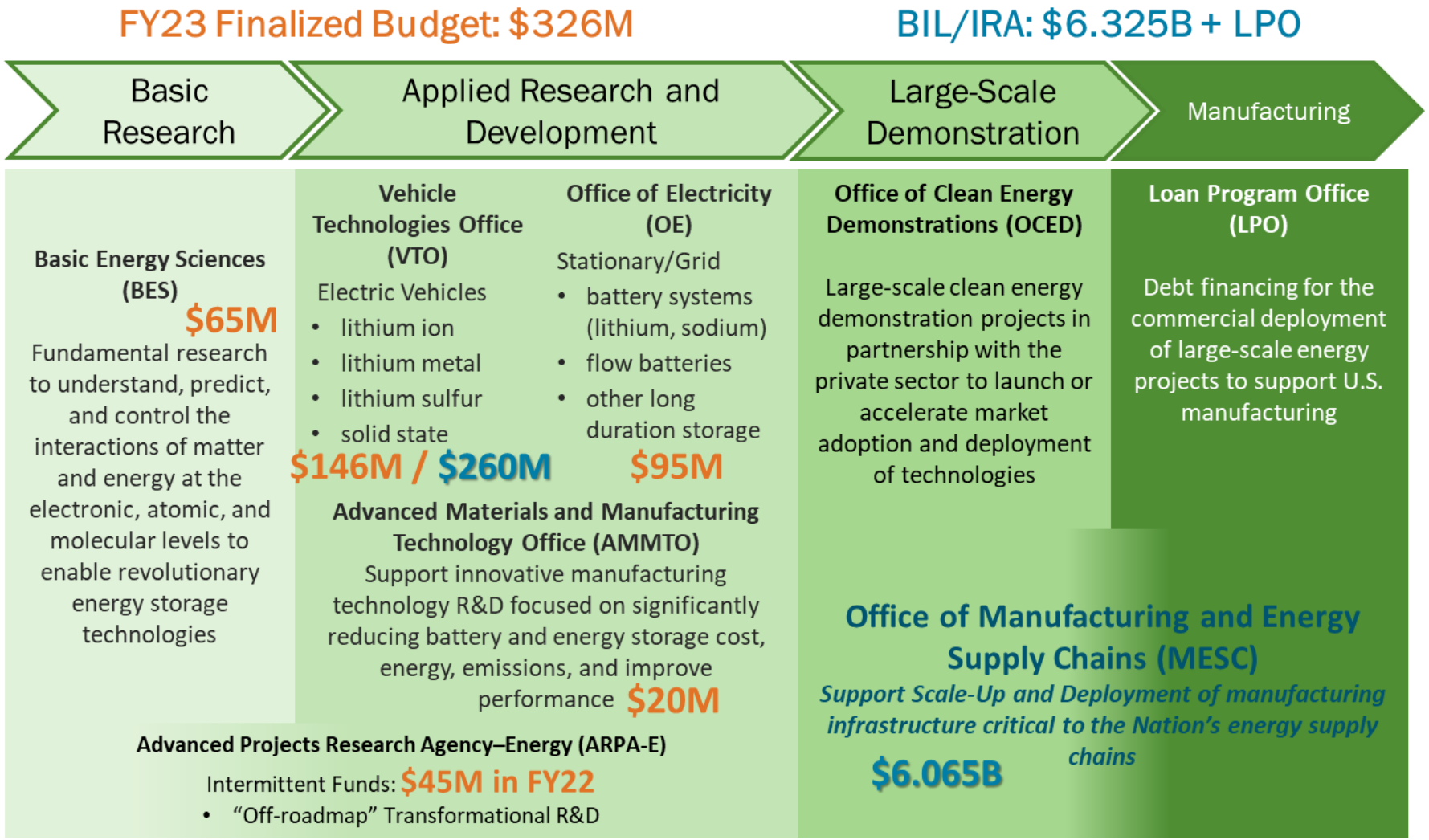
- DOE Battery and Energy Storage ‘Big Picture’
- Who We Are
- What We Do
- Battery Cost Success Story
- High Level Roadmap & Path Forward
- AMR Energy Storage Agenda

DOE Battery Innovation, Demonstration, Manufacturing Landscape



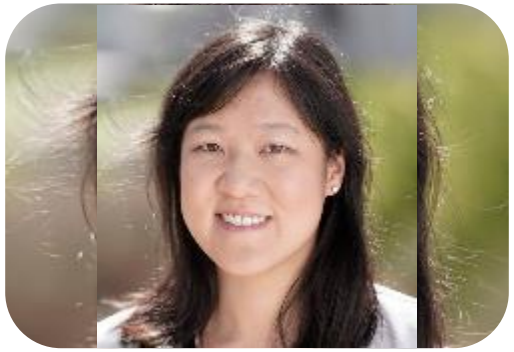
OTT FY21 Awards ~$1M. No FY23 funds enacted.

DOE Battery Innovation, Demonstration, Manufacturing Landscape



OTT FY21 Awards ~$1M. No FY23 funds enacted.

Who We Are



Tina Chen



Haiyan Croft



Thomas Do



Tien Duong



Nicholas Eidson



Jake Herb



Simon Thompson

Who We Are



Jack Deppe



Rachel Korkosz



Bryant Polzin



Stephanie Spence

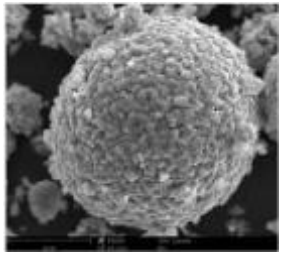
VTO Energy Storage R&D Overview and Strategy

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

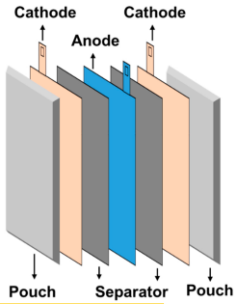
GOALS: **By 2025** bring pack level costs down to **$100/kWh**
By 2030 bring pack costs down to **$75/kWh**
*Critical Materials-free, use of recycled materials, and capable of fast charge

Energy Storage R&D

Battery Materials Research (BMR) TRL 2-3



Applied Battery Research (ABR) TRL 3 - 4



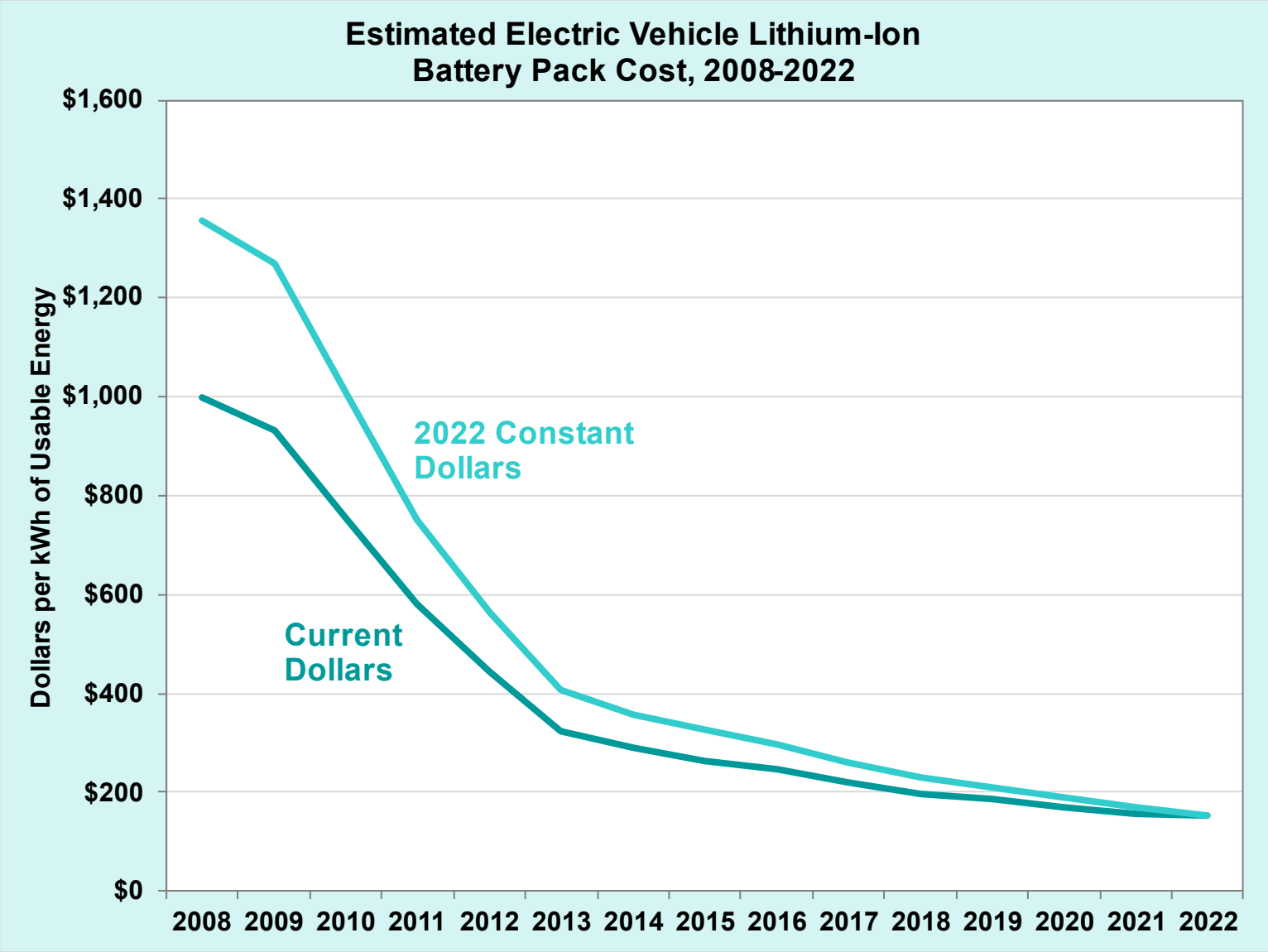
Battery Development TRL 3 - 6

USABC
UNITED STATES ADVANCED BATTERY CONSORTIUM

Battery Testing, Design, & Analysis



DOE Modeled Battery Pack Cost



2022 modeled cost of a 300-mile

EV Battery Pack:

- $130/kWh$_{Rated}$
- $153/kWh$_{Useable}$

EV battery Cell

- $104/kWh$_{Rated}$
- $122/kWh$_{Useable}$

The cost is based on a production volume of 100,000 batteries per year and is derived for batteries that are projected to meet DOE performance targets.

The cost estimate is derived using the peer reviewed and publicly available BatPaC battery cost modeling software developed at Argonne National Laboratory. DOE-funded battery developers have submitted EV battery cost estimates, using the USABC battery cost model, in this same range.

DOE VTO Battery R&D: Near-, Next-, and Long Term

Improved Li-ion
Graphite/NMC

Projected Cell Specific Energy, Cost
300Wh/kg, $100/kWh

Current cycle life	> 1,000
Calendar life	> 10 years
Mature Manufacturing	Yes
Fast charge	Reduced cycle life
Cost positive recycling	No

R&D Needs
- Improved fast charge
- Low temperature performance
- Low/no cobalt cathodes
- Cost positive recycling

Next-Gen Li-ion
Silicon (-composite)/NMC

Projected Cell Specific Energy, Cost
400Wh/kg, ~$75/kWh

Current cycle life	> 1,000, for ~320 Wh/kg
Calendar life	~3-5 years
Mature Manufacturing	No
Fast charge	Yes, at BOL
Cost positive recycling	No

R&D Needs
- Improved calendar life
- Abuse tolerance improvement
- Low/no cobalt cathodes
- Cost effective and scalable pre-lithiation

Lithium Metal
Li metal/NMC or Sulfur

Projected Cell Specific Energy, Cost
500Wh/kg, ~$50/kWh

Current cycle life	> 400
Calendar life	TBD
Mature Manufacturing	No
Fast charge	Maybe
Cost positive recycling	No

R&D Needs
- Improved cycle and calendar life
- Protected lithium
- Dendrite detection and mitigation
- Cost effective manufacturing

For more info, attend our track sessions

June 13

- Morning: Overviews
  - Silicon
  - BMR
  - Battery 500
  - Cathode
- Afternoon: ReCell

June 14

- Morning: XCEL
- Afternoon: Processing & Manufacturing Science

June 15

- All Day: Solid State

*BMR, Battery 500, EACAM & DRX Cathodes, & Silicon projects will provide recorded posters