



# Energy Storage Grand Challenge at the Office of Electricity

Eric Hsieh

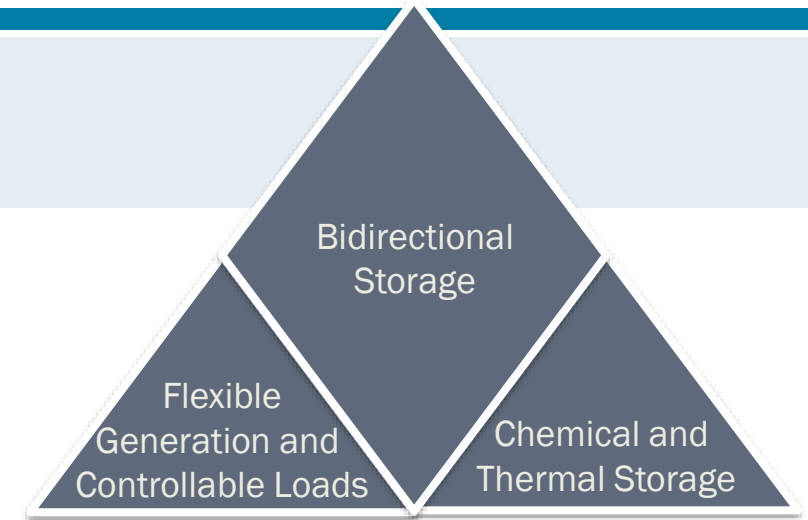
4 February 2020



DOE

# The Energy Storage Grand Challenge

- Vision: By 2030, the U.S. will be the world leader in energy storage utilization and exports, with a secure domestic manufacturing supply chain independent of foreign sources of critical materials



Science

ARPA-E

EERE

OE

NE

FE

OTT

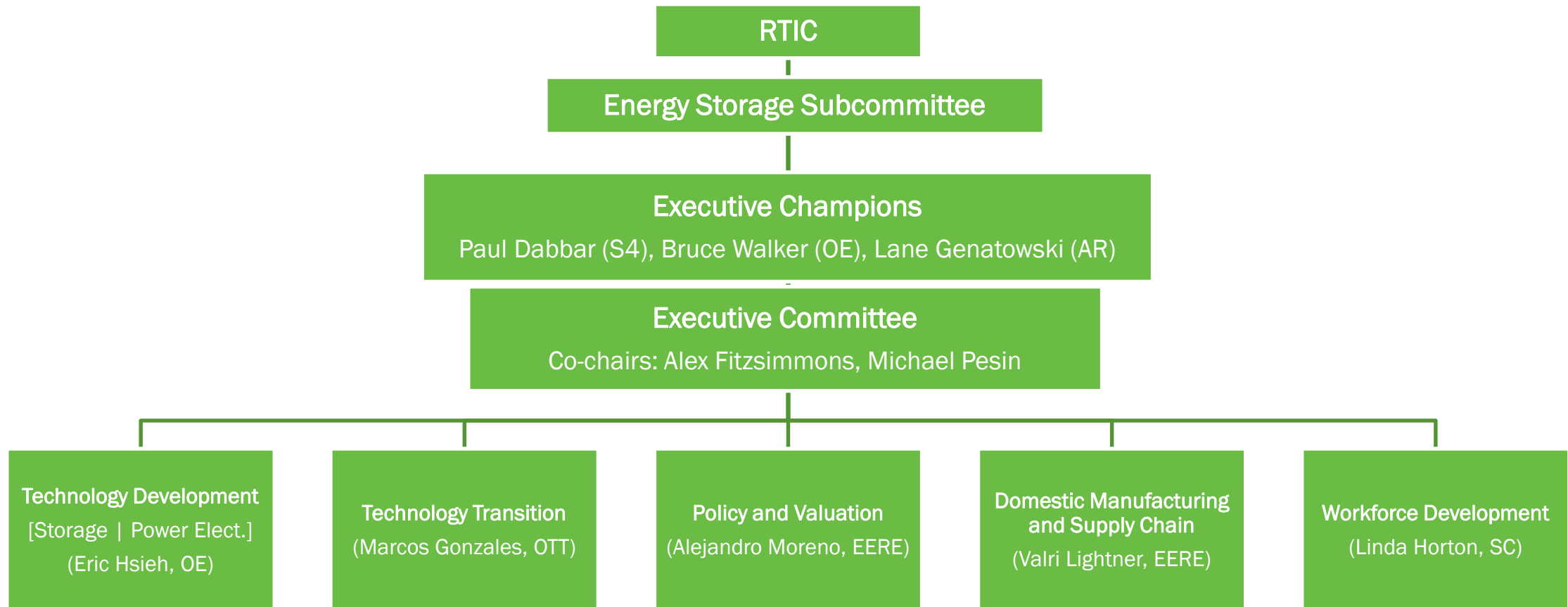
LPO





DOE

# Energy Storage Grand Challenge: Organizational Structure





DOE

## Energy Storage Grand Challenge Focus Areas

- **Mission:** The Energy Storage Grand Challenge will focus resources from across the DOE to create a comprehensive program to accelerate the development and commercialization of next-generation energy storage technologies and sustain U.S. global leadership in energy storage, through the following objectives:

### Technology Development

- Establish ambitious, achievable performance goals, and a comprehensive R&D portfolio to achieve them.

### Technology Transition

- Accelerate the technology pipeline from research to system design to private sector adoption through rigorous system evaluation, performance validation, siting tools, and targeted collaborations

### Policy and Valuation

- Develop best-in-class models, data, and analysis to inform the most effective value proposition and use cases for storage technologies.

### Domestic Manufacturing and Supply Chain

- Design new technologies to strengthen U.S. manufacturing, recyclability, and reduce dependence on foreign sources of critical minerals

### Workforce Development

- Train the next generation of American workers to meet the needs of the 21st century grid and energy storage value chain

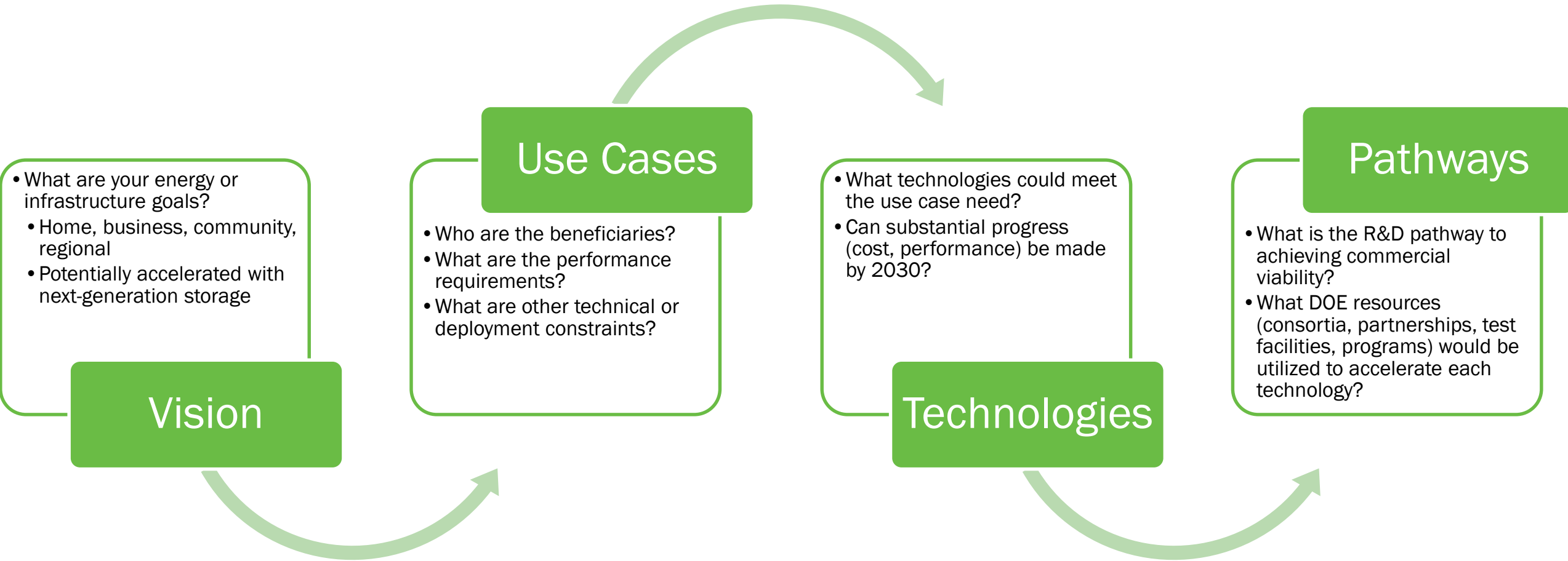


DOE

# Technology Development



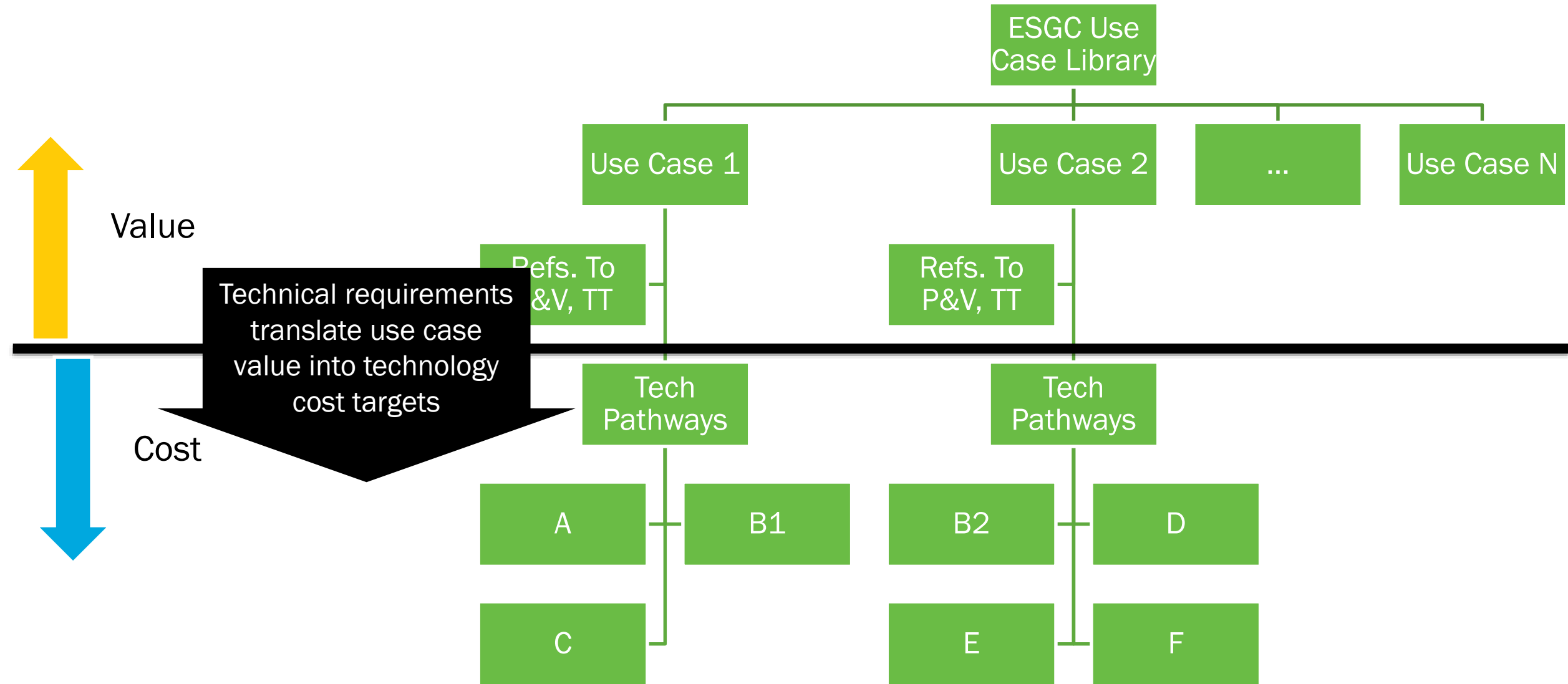
# Technology Development: A Use Case-Informed R&D Strategy





DOE

# Use Case Connections to Other ESGC Tracks





# Use Case Connections to Other ESGC Tracks

## Technology A

### R&D Pathway

- Basic
- Applied
- Validation
- Demo

### Manufacturing

- X
- Y
- Z

### Workforce Requirements

- A
- B

## Technology B1

### R&D Pathway

- Basic
- Applied
- Validation
- Demo

### Manufacturing

- X
- Y
- Z

### Workforce Requirements

- A
- B

## Technology B2

### R&D Pathway

- Basic
- Applied
- Validation
- Demo

### Manufacturing

- X
- Y
- Z

### Workforce Requirements

- A
- B

## Technology N

### R&D Pathway

- Basic
- Applied
- Validation
- Demo

### Manufacturing

- X
- Y
- Z

### Workforce Requirements

- A
- B





DOE

# Technology Pathway Example: Concept to Commercialization

Increasing Levels of Integration

Materials

Device

BOP + Power Electronics

Grid Integration

Investment

Operations

Value/ Revenue

End of Life

Foundational Science

Materials R&D

Materials scaling

Device Prototyping

Component Validation

Scalable Manufacture

Controls Interop.

Large Scale Testing

Commercial Validation

Market Access

High-Value Deployments

Wide Bankability

Cross-cutting research consortium

Application-aware development capability

Performance and safety testing capability

Demonstration and validation program

Manufacturing scale program

ESGC: Accelerate the Path from Concept to Commercialization

Pumped-Storage Technology Development (ANL, INL, NREL, ORNL, PNNL)

Modeling and Economic (NREL, ORNL, Sandia, PNNL, ANL)

ReCell (ANL, NREL, ORNL)

SC

EERE

OE

OTT

OE

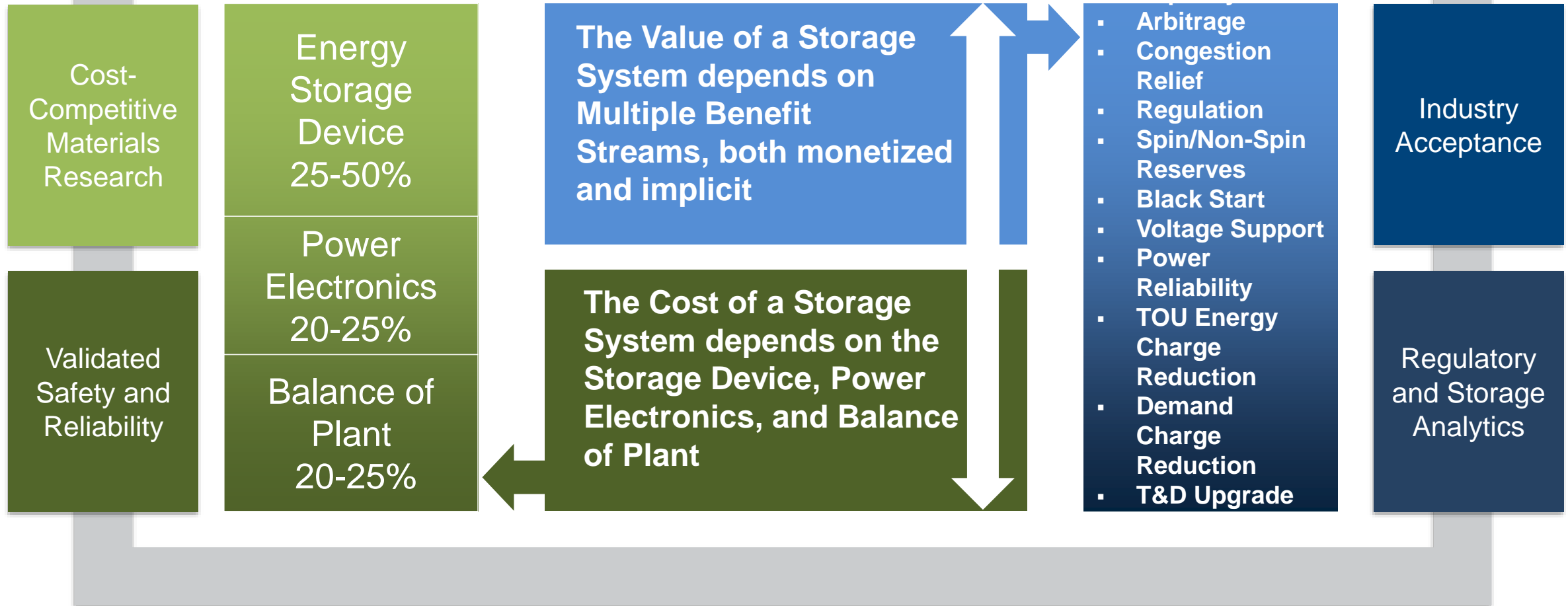
EERE

ARPA-E

GMLC

# Technology, Economics, and Policy to Accelerate Storage

## OE Energy Storage Program Focus Areas

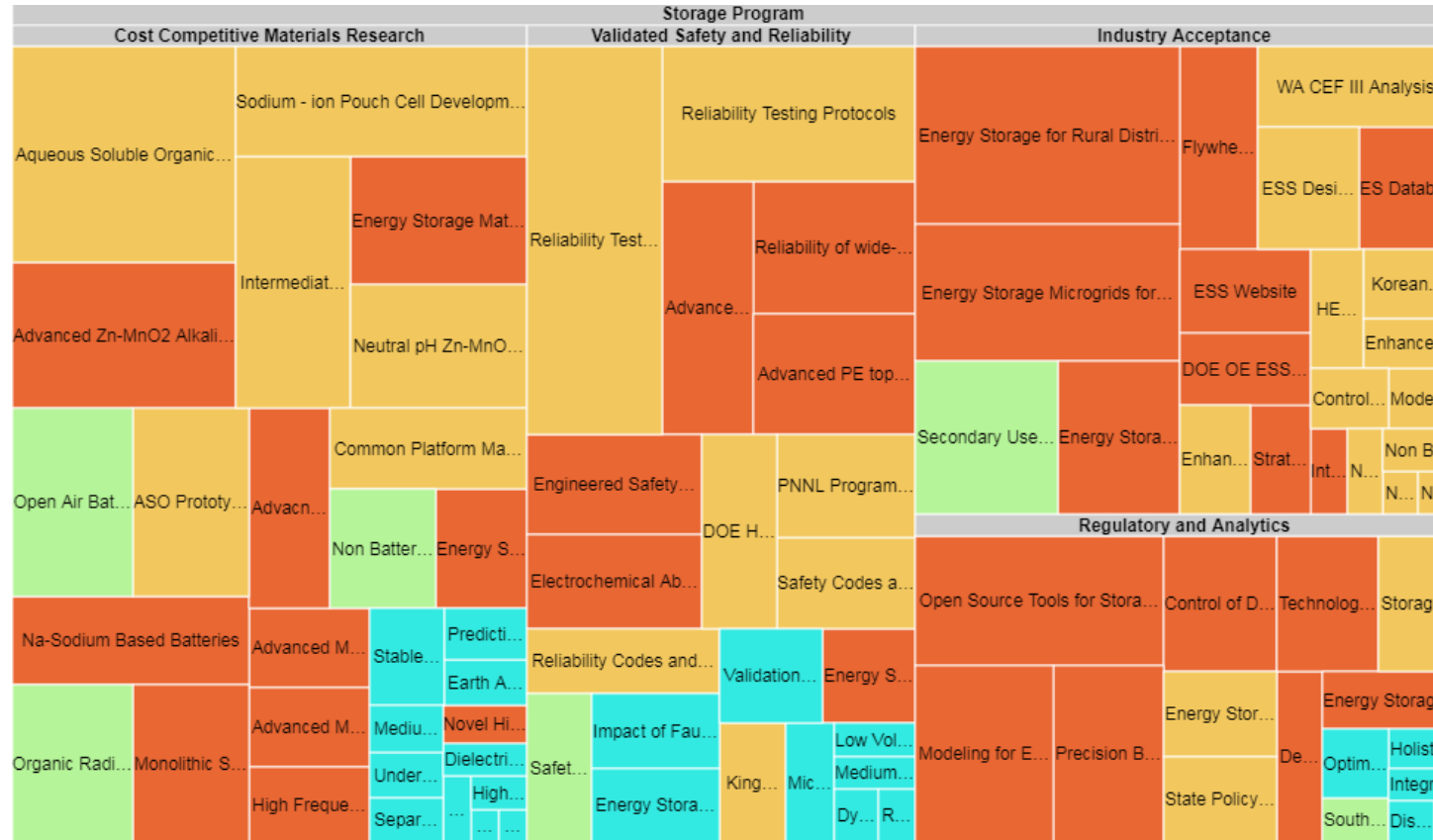


# OE Storage Program Overview and Projects

## OE Energy Storage Program Focus Areas

Cost-Competitive Materials Research

Validated Safety and Reliability

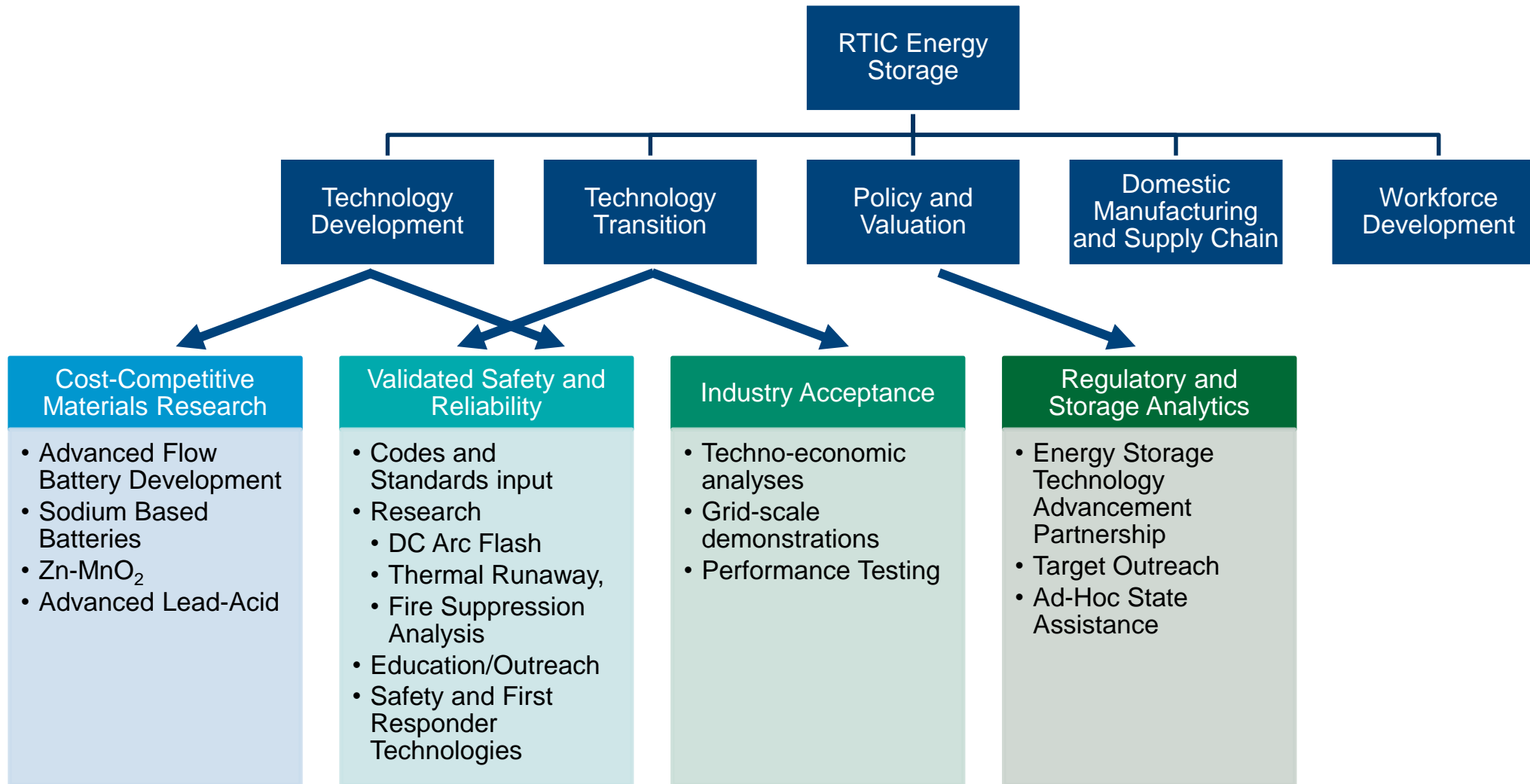


Industry Acceptance

Regulatory and Storage Analytics

SNL PNNL ORNL University

# Energy Storage Grand Challenge Focus Areas



# ESGC Technology Development and OE Storage


## “Guidepost” Use Cases









## Tech Neutral Requirements



## OE Technology Pathways



-  Disaster Resilience and Recovery
-  Dependent Infrastructure
-  Reliability Under An Evolving Grid
-  Offshore, Island, and Extreme Environments
-  Grid Preparation for Electrified Transportation
-  Facility Flexibility, Efficiency and Value Enhancement

### Performance

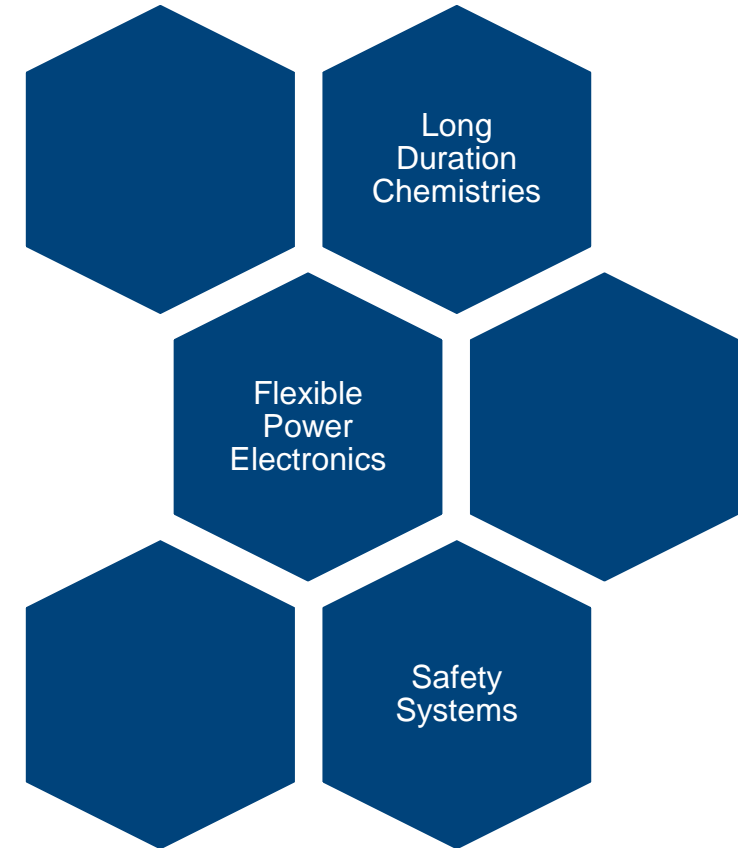
- Duration
- Cycles per Year
- Ramp Rate
- Response Time
- Lifetime

### Operations

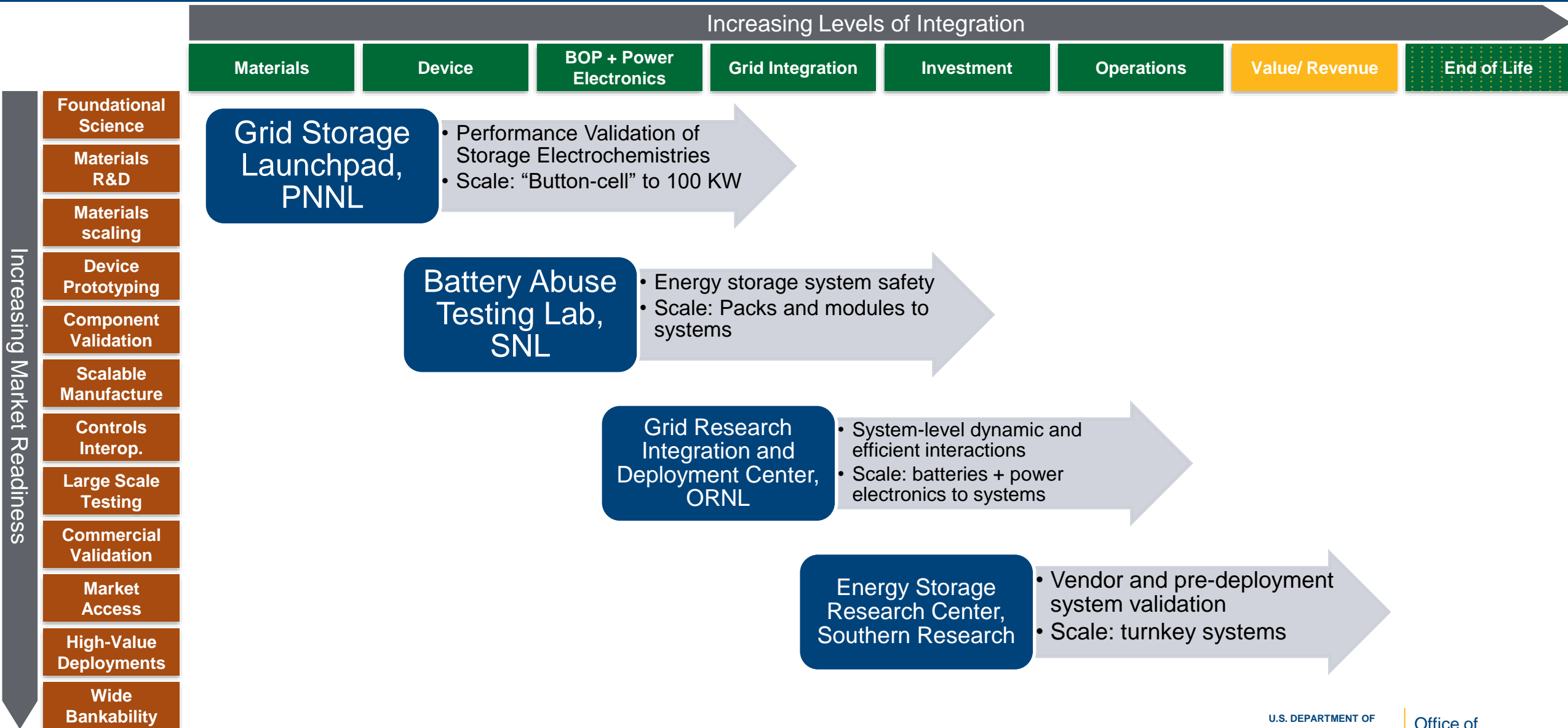
- Temperature
- Moisture
- Saline
- Emissions Runtime
- Noise Limits
- Flammability Risk

### Delivery, Installation, Connection

- Shipping weight limits
- Construction season
- Interconnection voltage



# Example OE Storage Ecosystem: Facility View



# Participate!

## ESGC Workshops

- March 2020
- <https://www.energy.gov/energy-storage-grand-challenge/energy-storage-grand-challenge>

## OE Events

- March 4-5, 2020 Safety and Reliability Forum
- September 2020 (TBD) Annual Peer Review
- [https://www.sandia.gov/ess-ssl/eventsnews/events\\_calendar/](https://www.sandia.gov/ess-ssl/eventsnews/events_calendar/)

## Workshops and Webinars

- <https://www.sandia.gov/ess-ssl/webinars/>

## Open Solicitations

- FY2020 SBIR: Safety Technologies for Grid Scale Battery Energy Storage Systems