# Berkeley Lab **Energy Storage Center**

Noël Bakhtian **Executive Director** June 13, 2022







Bringing Science Solutions to the World

## Administration's **Climate Change Goal**

- Create a carbon pollution-free power sector by 2035
- Create a net zero emissions economy by no later than 2050.



## **Evolving National Energy Needs**





### Remoteness & Resilience

**Evolving Grid** 



High-Energy Industry



## **Evolving Global Energy Needs**



Source: BloombergNEF

# Global cumulative battery storage energy capacity

# Why Berkeley?



### **LBNL** National User Facilities



PLANNING



## Expertise, Capabilities, Culture, & Ecosystem



the DOE labs and experiments. 910









## Lawrence Berkeley National Laboratory The Birthplace of Lithium Battery Electrochemistry

1954

## **BETTER BATTERIES**

Charles William Tobias established the **Electrochemical Research Program** at Berkeley Lab in **1954** - the first program of its kind. His work paved the way for the development of rechargeable lithium battery technologies that helped to revolutionize the portable electronics industry.







## Berkeley Lab Energy Storage Center

Harness, guide, and galvanize the expertise, capabilities, and innovation across Berkeley Lab resulting in the science, technology, and policy to accelerate real-world energy storage solutions together with partners around the world, to enable the nation's transition to a clean, affordable, and resilient energy future.

















### **Energy Storage Expertise @Berkeley Lab**

## **FLEXLAB**<sup>®</sup>









































Materials Discovery, Characterization, & Diagnostics



Energy Storage Expertise @Berkeley Lab

Compressed air storage in porous media

### Controlling virtual storage: Shifting loads to alleviate curtailment





## **Emerging Focus Area: Bringing Battery Production to the U.S.**

### **Challenge: Co/Ni Supply Chain**



### Layered (Current)

### **V.**

Disordered (Future)





**A** Solution: DRX





geothermal extraction

# Federal Opportunities/Efforts: EO, FCAB, Li-Bridge

## **Executive Order**

https://www.whitehouse.gov/ briefing-room/presidential-actions/ 2021/02/24/executive-order-onamericas-supply-chains/



## 1 yr report: Feb 2022

DOE (VTO-led) State Department DOD Commerce

. . . .

"encourages cooperation and coordination across the U.S. Government agencies' advanced battery efforts and seeks to develop a healthy domestic ecosystem."

https://www.energy.gov/eere/ vehicles/federal-consortiumadvanced-batteries-fcab

## **Federal Consortium for Advanced Batteries**

## Li-BRIDGE

**Bridging the lithium** battery supply chain gap

energystorage.lbl.gov/li-bridge



**Industry Forums -> White Papers Expected CY2022** 









## **Center Focus Area: Energy Storage Designed to Deploy**



(i.e. thermal/H<sub>2</sub>)

**Systems Solutions** 

# Federal Organization & Pull







www.energy.gov/energy-storage-grand-challenge





seeks to reduce the cost of clean hydrogen by 80% to **\$1** per **1 kilogram** in **1 decade** 



establishes a target to reduce the cost of grid-scale energy storage by **90%** for systems that deliver 10+ hours of duration within the decade.

https://www.energy.gov/policy/energy-earthshots-initiative





Reduce storage costs by **90%** from a 2020 Li-ion baseline...

...in storage systems that deliver **10+** hours of duration

Affordable grid storage for clean power – any time, anywhere

9/22/21 DOE Storage Shot Summit







...in 1 decade



# California Opportunities

## **SB100 Report** (CEC, CPUC, CAISO)





Battery



Battery storage build rates need to increase by nearly eightfold\*\*

## **Governor's Budget**

- •\$380M for Long Duration Energy Storage (2 years)
- Lithium Valley Incentives



# Activities at LBNL enabling long-duration storage

New technology development

Techno-economic analysis

Strategic initiative funds novel technologies for lowcost, long duration storage

Economic analysis of novel storage systems to determine market fit and uncertainties



Cost analysis for large, long-duration thermal storage systems

Novel composites as high-T thermal storage media

Outreach and partnerships

Outreach and partnerships to connect LBNL expertise to industry, government, and academia

## LONG DURATION **ENERGY STORAGE**

ASSOCIATION OF CALIFORNIA

QurEnergyPolicy's **ENERGY LEADERS WEBINAR SERIES** 



**Stakeholder Round Table: Overcoming Market, Regulatory, and Finance Challenges for Long-Duration Storage Technologies** 

## Emerging Focus Areas (CrossCuts): Equity Workforce

### Community of Practice (COP) at Nexus of Energy Storage & Energy Justice



- LBNL stood up COP in October 2021
- Open to all across national labs (inclusive) with potential to expand
- 71 people on the list to date



## **Collaborate with Berkeley Lab**

## Activities



Ideation, teaming, (virtual) Lab tours, project scoping, joint proposal drafting



Testing samples, validate research, and/or sharing technical information



Access to User Facilities (in person or remote)



Technical support & access to equipment/ experts/teams, co-develop technology



Access to Federal and State funding, additional partners



Commercialize Lab intellectual property, create startup



Embed employee at Lab, join startup incubator





## Mechanisms

- Informal discussion
- Non-Disclosure Agreement (NDA)
- Memorandum of Understanding (MOU) ٠
- Material Transfer Agreement (MTA)
- NDA or Data Use Agreement (DUA) ٠
- User Agreements ٠
  - Non-proprietary (no-cost, merit review, publish results)
  - Proprietary (cost recovery) 0
- Sponsored research agreements
- Technical assistance agreements
- Joint grant proposals to SBIR/ STTR, TCF, & larger programs
  - DOE, CEC, DOD, DARPA, NSF, etc. 0
- Licenses
- Lab Affiliate Program, ٠
- Cyclotron Road @ Berkeley Lab

## BERKELEY LAB NATIONAL ENERGY STORAGE SUMMIT JUMPSTARTING AMERICA'S ENERGY STORAGE FUTURE

### MARCH 8–9, 2022





**Energy Secretary Jennifer Granholm** & **GM CEO Mary Barra** 

### national-energystorage-summit.lbl.gov









## **57** Countries **49** States

**Day 1: America's Battery Production Revolution: From Resource to Recharge** 

**Day 2: Driving Accelerated Energy Storage Discovery-to-Deployment for Decarbonization** 





# **Storage in CA: Critical Mass & Global Impact**

- CA boasts >130 energy storage companies and **13** academic/research institutions
- CA leads the nation in energy storage patent filings and startup funding raised
- CA also leads the nation in energy storage deployment
  - 1514MW Advanced Storage procured
  - 717MW Advanced Storage installed
  - 565MW procured in 2018 to replace peaker plant (world's largest ES procurement)
  - 867MW secured for behind-the-meter storage through 2024





## **ENERGY STORAGE MANUFACTURING SCIENCE & DEMO FACILITY**

## Concept

- A pilot manufacturing science and demo ightarrowfacility dedicated to emerging energy storage technologies whose purpose is to accelerate federal deployment goals and align with State, LBNL, and UC priorities
- Nor Cal MSDF focused on both long and short duration innovative next generation storage science, technologies, and manufacturing processes
- So Cal companion facility focused on current gen Li-Ion technologies consistent with Lithium Valley













## Find Out More: Energy Storage Center



## **Connect!**

## **Noël Bakhtian**

**Executive Director** Berkeley Lab Energy Storage Center Lawrence Berkeley National Laboratory

noel@lbl.gov

## www.energystorage.lbl.gov



