

# Working with Berkeley Lab: It's easier than you think



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# Is “working with a national lab” a contradiction in terms?

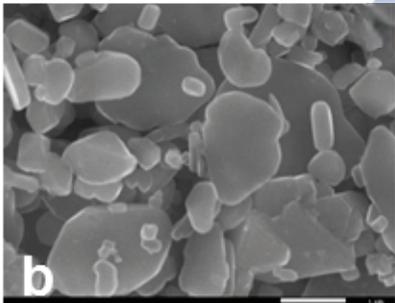
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1. Companies don't understand lab capabilities
2. National Labs don't work on industrially-relevant problems
3. Time dilates at National Labs
4. The number of forms to complete could fill the library of congress

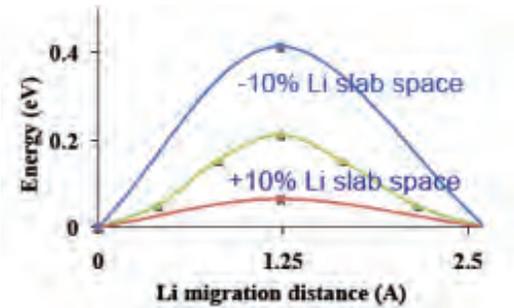
Berkeley Lab has done a lot of change this

# The core competencies

Fundamental properties (material, chemistry, morphology)



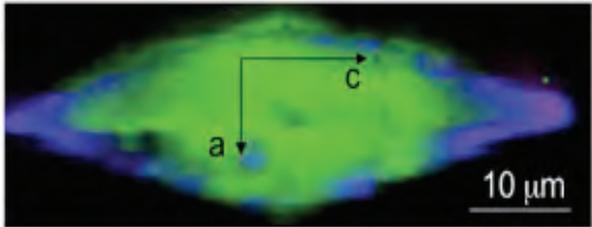
New materials



Theory



Devices

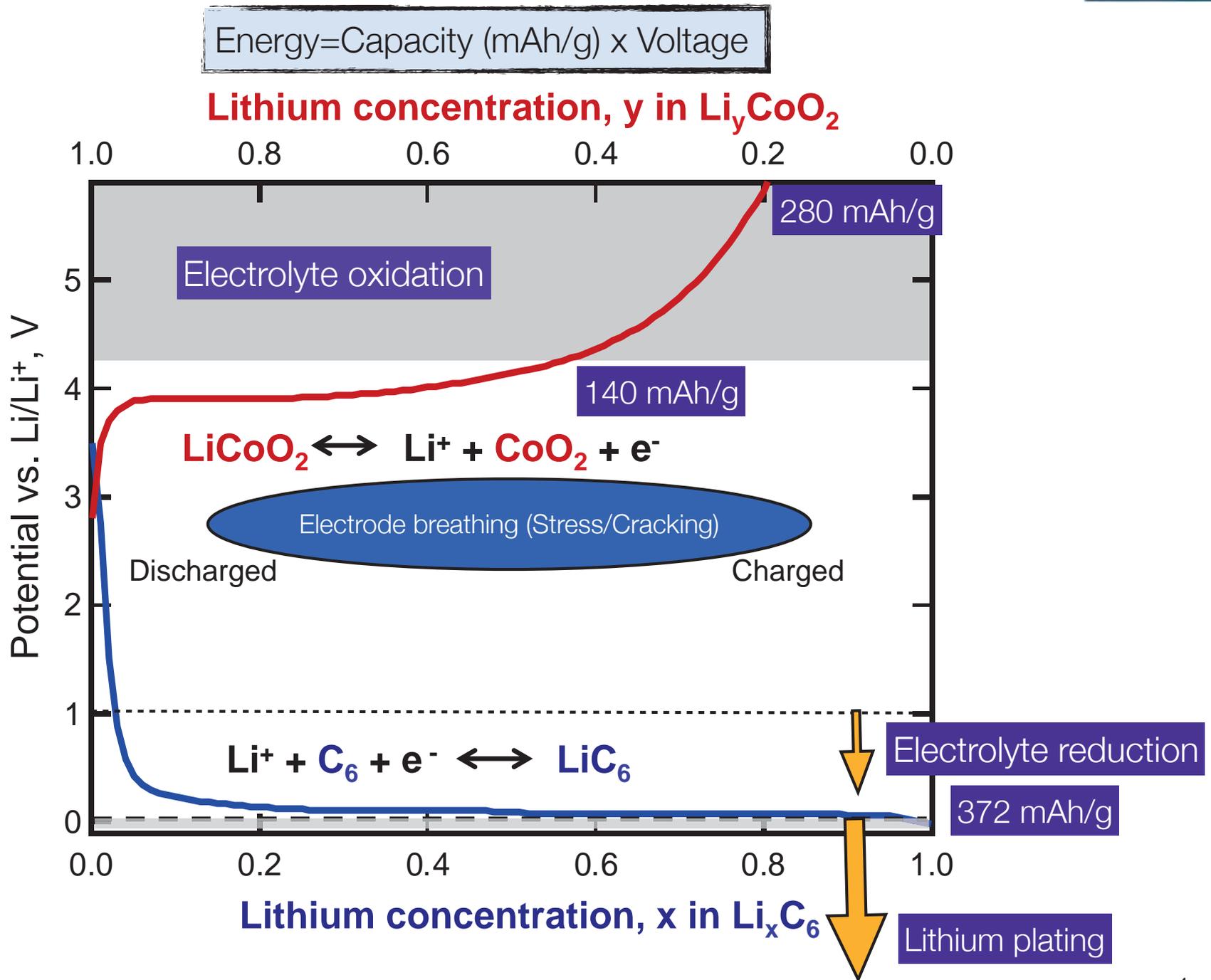


Advanced characterization

Real-world performance



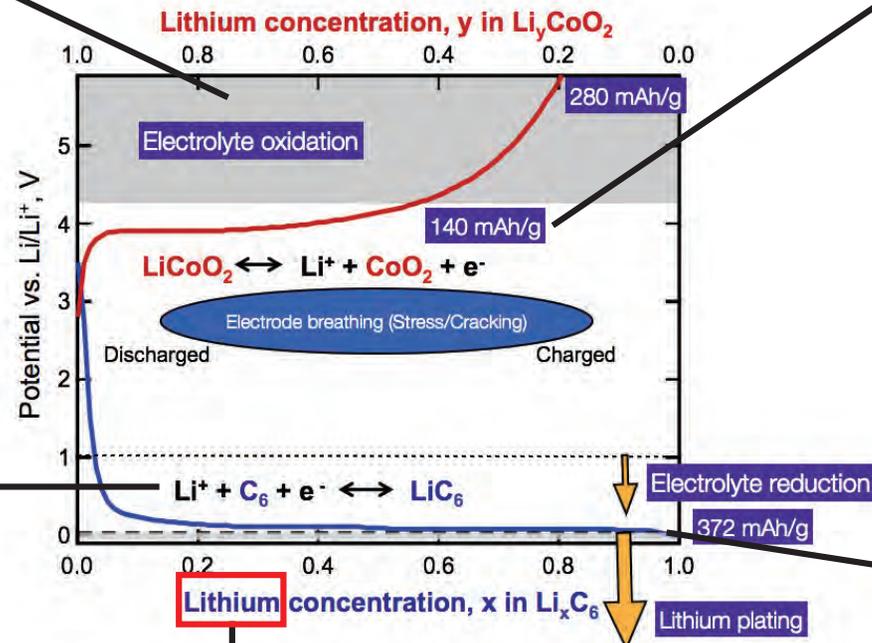
# Focus areas of research: Li-ion and beyond



# Focus areas of research-Li-ion and beyond

Enable high voltage cathodes (>4.3 V)

Sulfur and air cathodes:  
>1000 mAh/g vs. 140-180 mAh/g

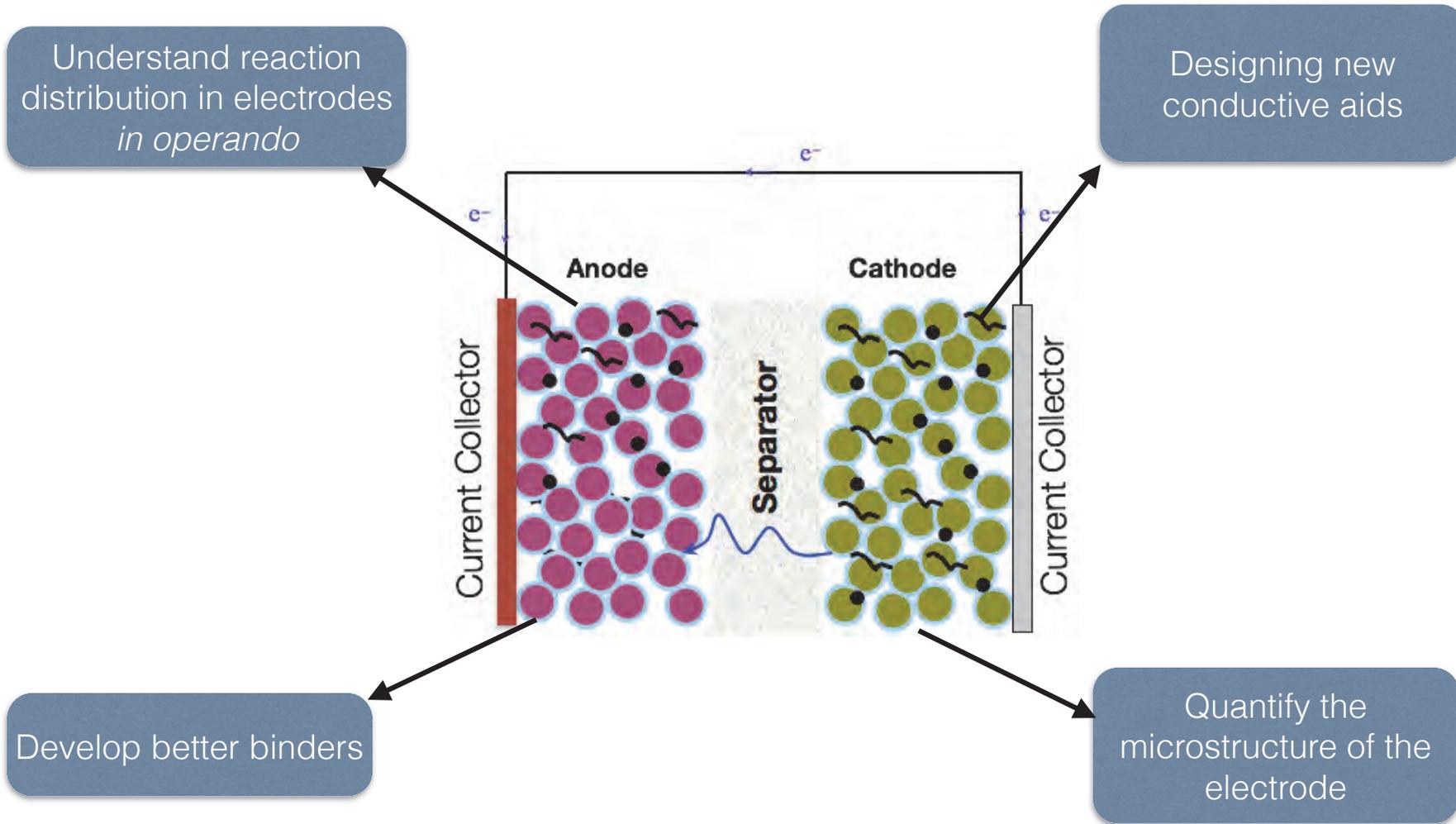


Silicon and tin anodes:  
3-10x capacity vs.  
graphite

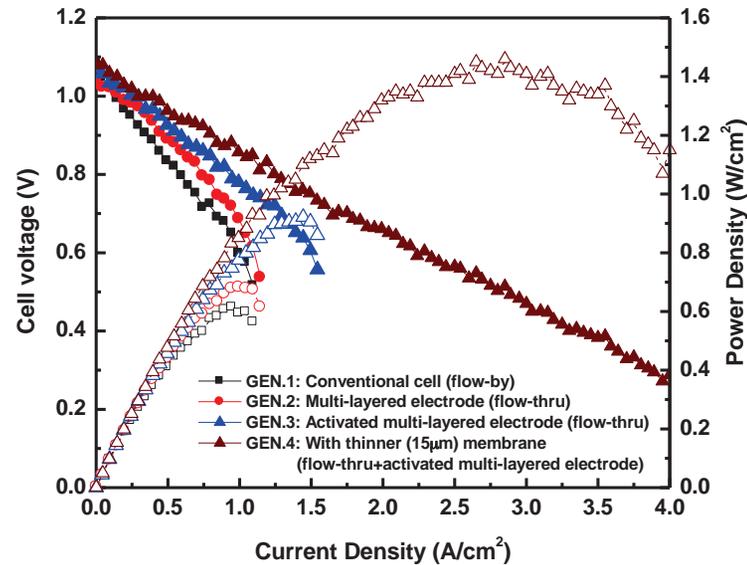
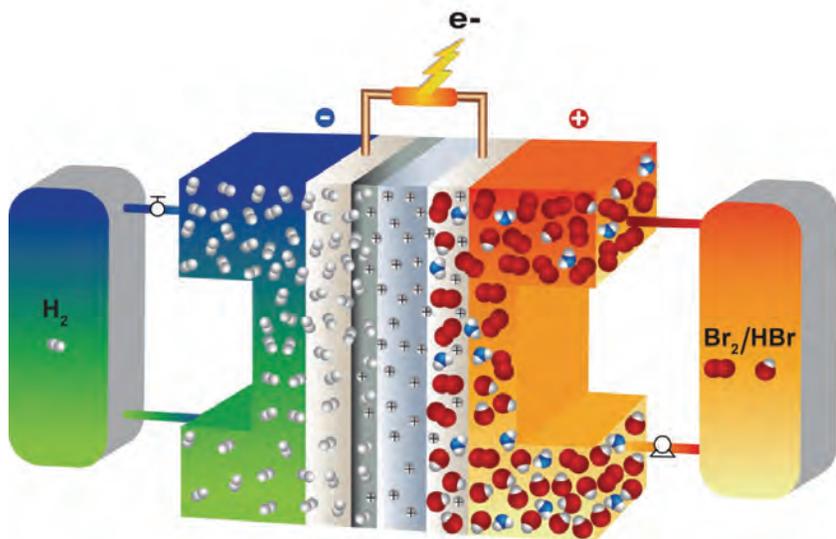
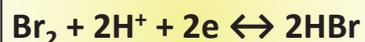
Lithium metal anode: 10x  
capacity vs. graphite at  
lower potential

Magnesium/Calcium-ion batteries:  
2-3x capacity of lithium

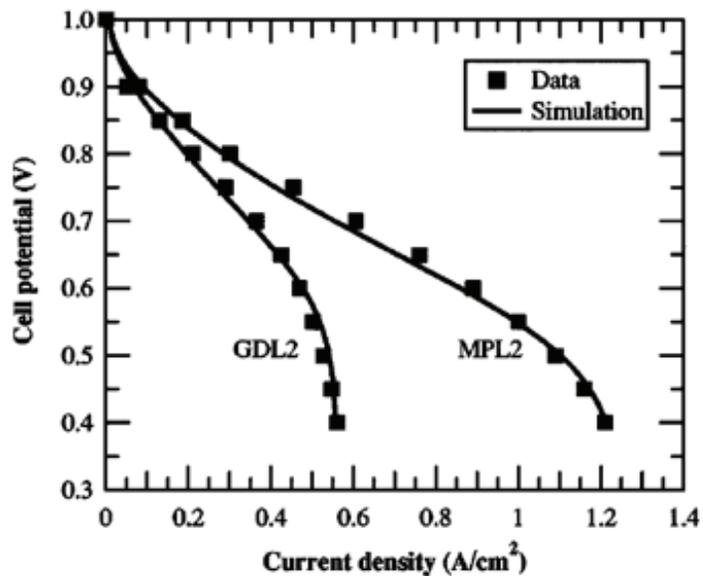
# Focus areas of research-Li-ion and beyond



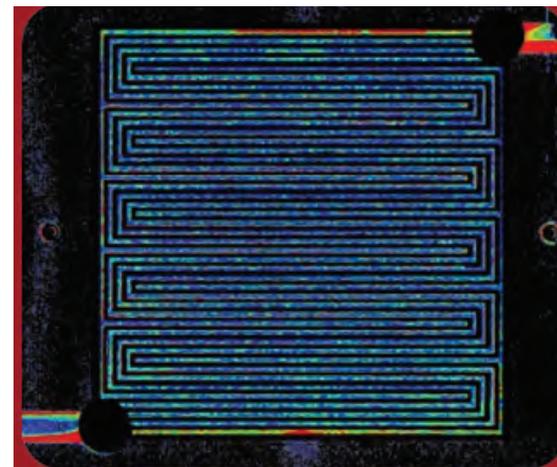
# Flow batteries for grid scale storage



Device improvements



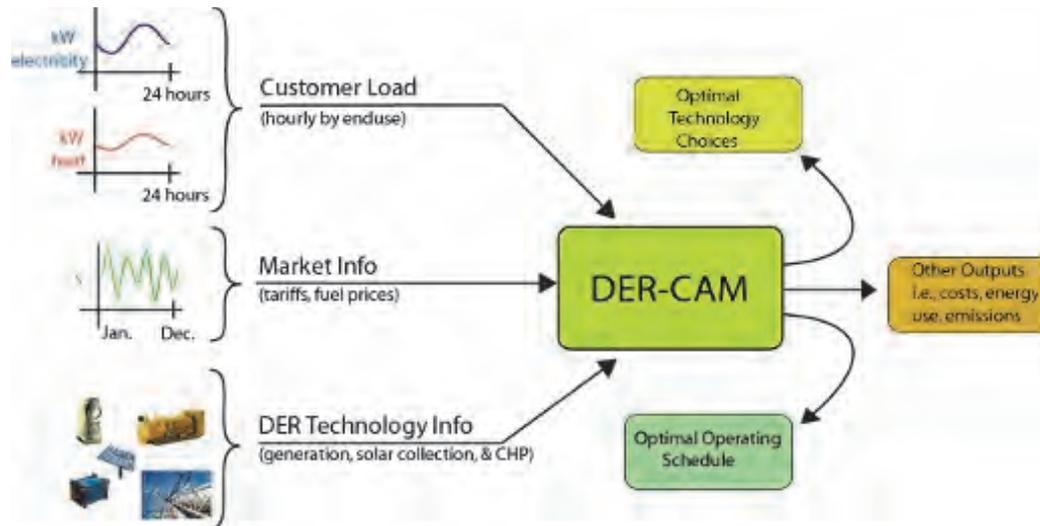
Modeling



Device diagnostics

# But its more than just about technology

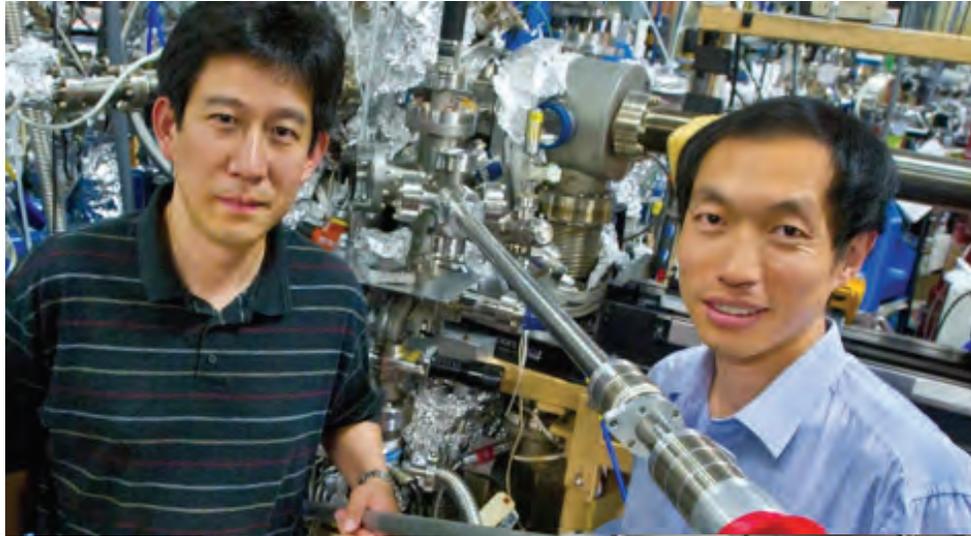
## The Distributed Energy Resources Customer Adoption Model (DER-CAM)



FLEXLAB: An advanced buildings test bed.



# How can you use these capabilities/facilities?



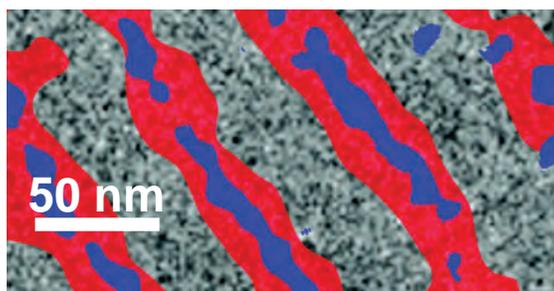
Our aim is to make our labs into an user facility

# CalCharge: An industrial commons for batteries



Secret history of Silicon Valley,  
Steve Blank

## The battery equivalent



Revolutionary new materials  
and storage concepts



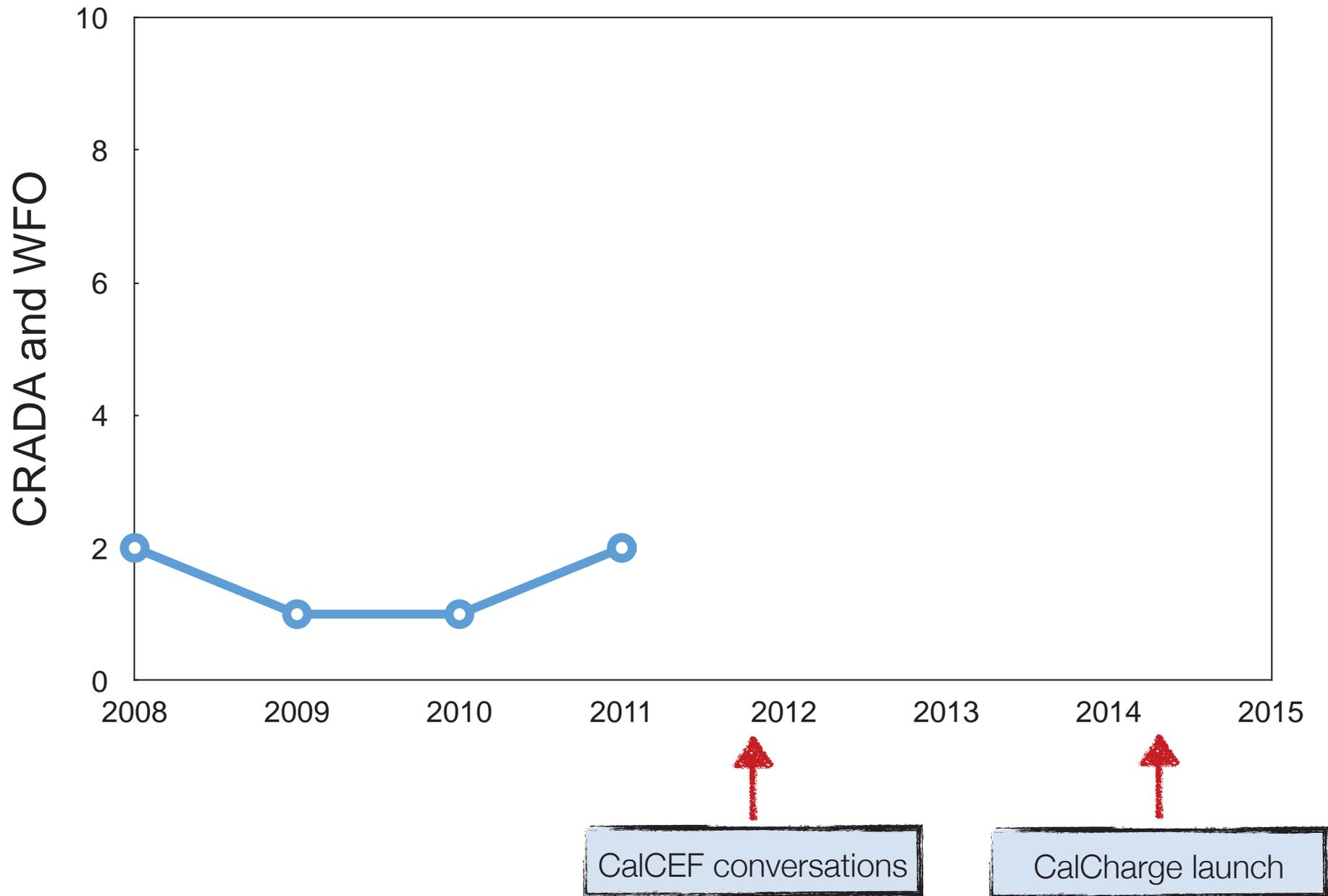
Industry



Markets for batteries (Vehicles,  
grid, vehicle-to-grid, second life)

Innovation will occur by co-locating R&D, manufacturing, and markets

# We are expanding our industry engagement



# “Embedded” Researcher Program

- We have researchers from companies working at LBNL



Cathode material synthesis and characterization

**HITACHI**  
Inspire the Next

*in situ* characterization of electrodes



Thermal storage development



**TOYOTA**

Characterization of battery behavior

Goal: Publish papers, gain knowledge, build a relationship

# Just starting: Proprietary Research

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- CalCharge CRADA allows LBNL, for the first time, to perform proprietary research
  - ▶ 5 year embargo on publications



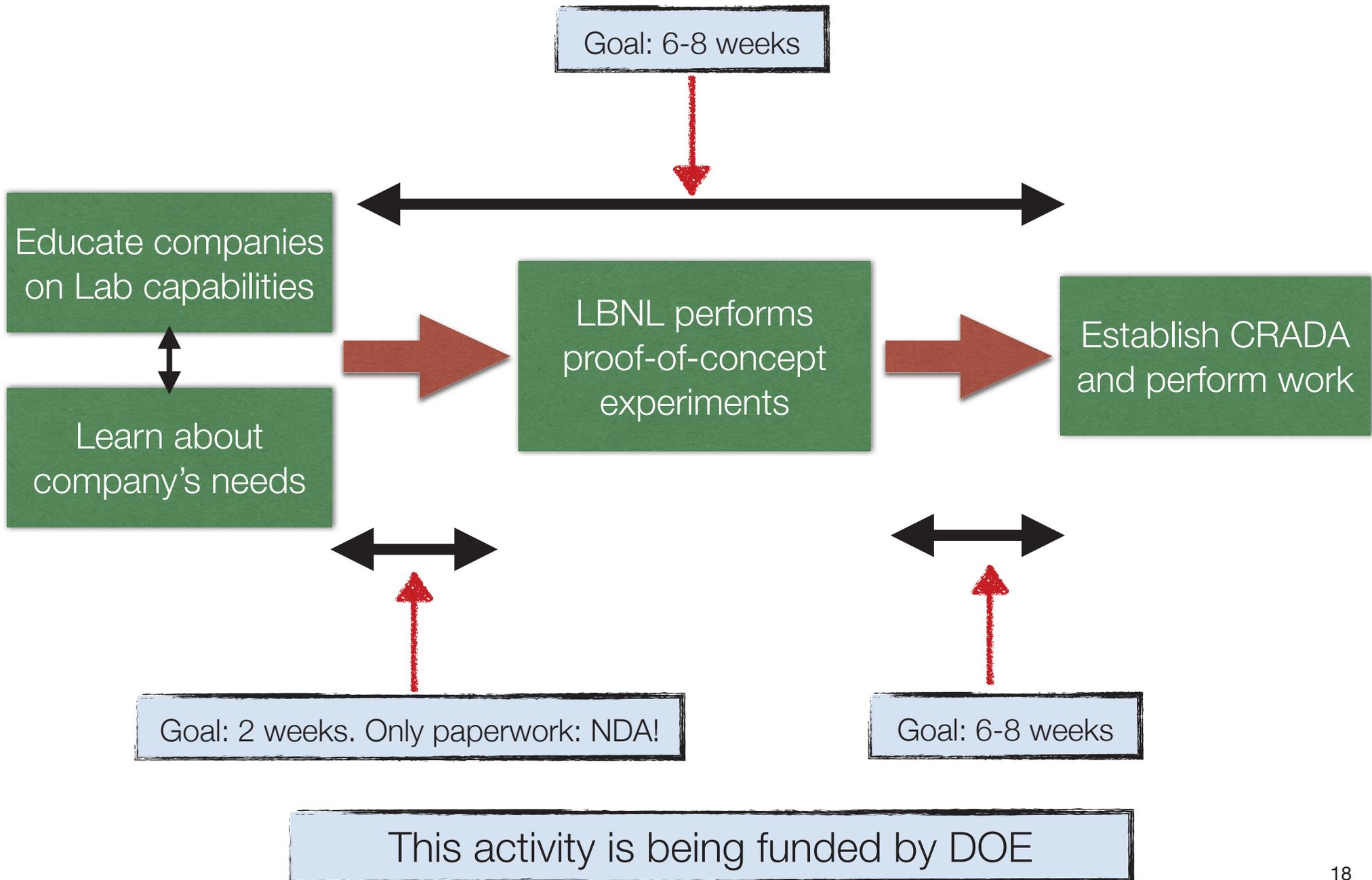
Goal: Accelerate technology. Fast. Confidentially

# Working with Berkeley Lab: It gets even easier



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# What you have seen till now



# Our plans for the next year

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1. Companies will have a liaison to help identify right technique/person
2. Establish an industrial advisory board to make us more responsive
  - If you are interested, please contact us
3. We will have more industry days
  - What would you like to see more/less?
4. In-depth workshops to train company personnel on various topics (e.g., battery testing, using characterization tools...)
  - What topics would you like us to focus on?

Please provide comments in the feedback sheets

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