Lawrence Berkeley National Laboratory

State of the Lab – Community Advisory Group

Paul Alivisatos, Lab Director | Nov 18, 2013

The budget Odyssey…

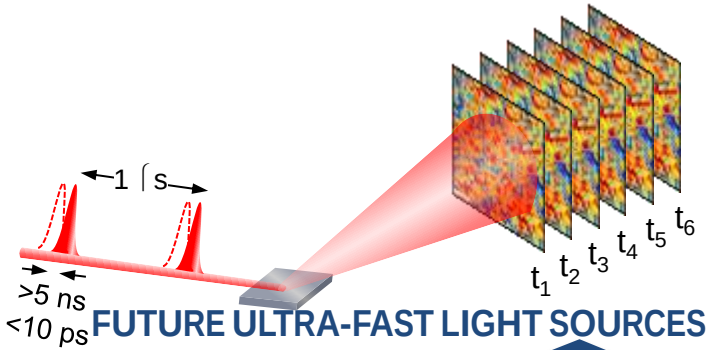
Discussion outline for State of the Lab

1. How is Berkeley Lab doing now?
2. What does our future look like?
3. Lots of time for discussion with the CAG.

What can we say about Berkeley Lab in 2013?

- Lawrence's team science approach endures—as does our bond to Cal
- Scientific discovery is thriving at the lab
- Our work on issues of energy and environment is serving national and global needs
- Our understanding of the universe is expanding
- Our ambitious 5-year strategy has been largely successful, and now is the time to assess initiatives and set new goals

A review of Berkeley Lab's strategic initiatives (2009-2012)



FUTURE ULTRA-FAST LIGHT SOURCES

LBNL helped lay scientific foundation of LCLS-II; will now concentrate on upgrading ALS

BIOSCIENCES CONSOLIDATION & MISSION-READY FACILITIES

Revise plan in light of budget environment and new opportunities in coordination with UCB

carboncycle2.0

COMPUTATION & NETWORKING

GOOD COMMUNITY RELATIONS

SAFETY IS ELEMENTAL

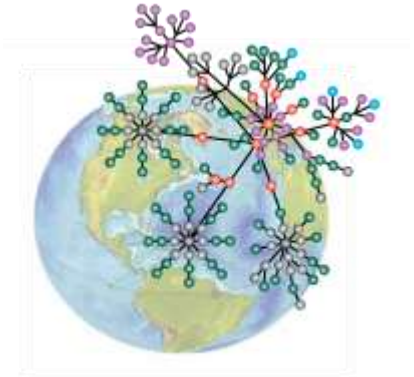
SAFE AND EFFICIENT LAB

Successes (JBEI, JCAP, JCESI FLEXLAB…) form a springboar for energy innovation initiative…

Deepen with con

Substantial safety culture gains, focus on operational culture to become more efficient

Berkeley Lab's strategic initiatives under development



MICROBES TO BIOMES

EXTREME DATA SCIENCE INITIATIVE

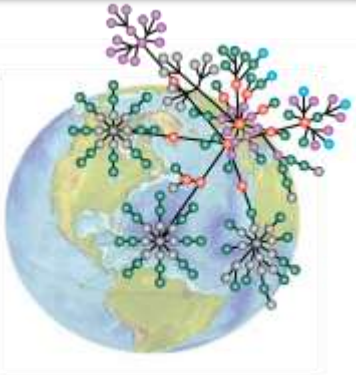
DIFFRACTION-LIMITED ALS FOR MATERIALS & BIOLOGY

ENERGY INNOVATION

DIVERSITY & INCLUSION

SERVICE TECHNOLOGIES FOR SCIENCE

Berkeley Lab's strategic initiatives under development



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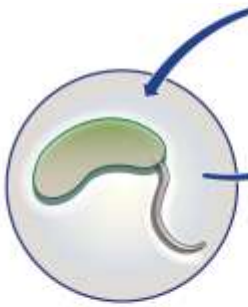
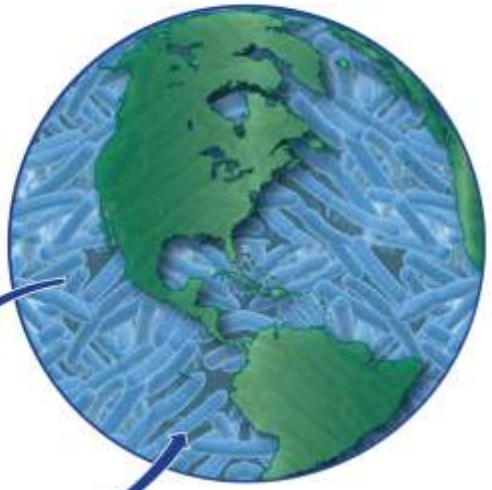
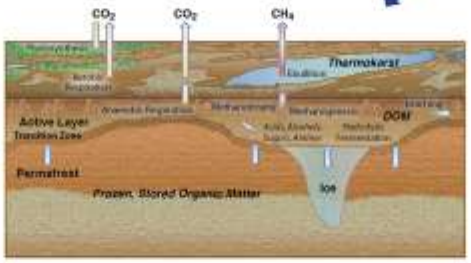
How do microbes act together to regulate a major ecological system (biome)?

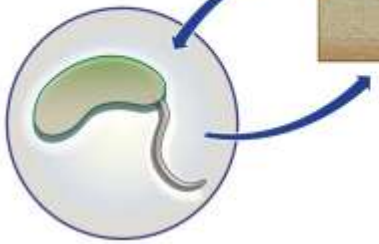
Microbes play a greater role in determining our health and our environment than we had previously thought

100 trillion microbes in a human body









100s of millions of microbes in a gram of soil

5-part series on the human microbiome:

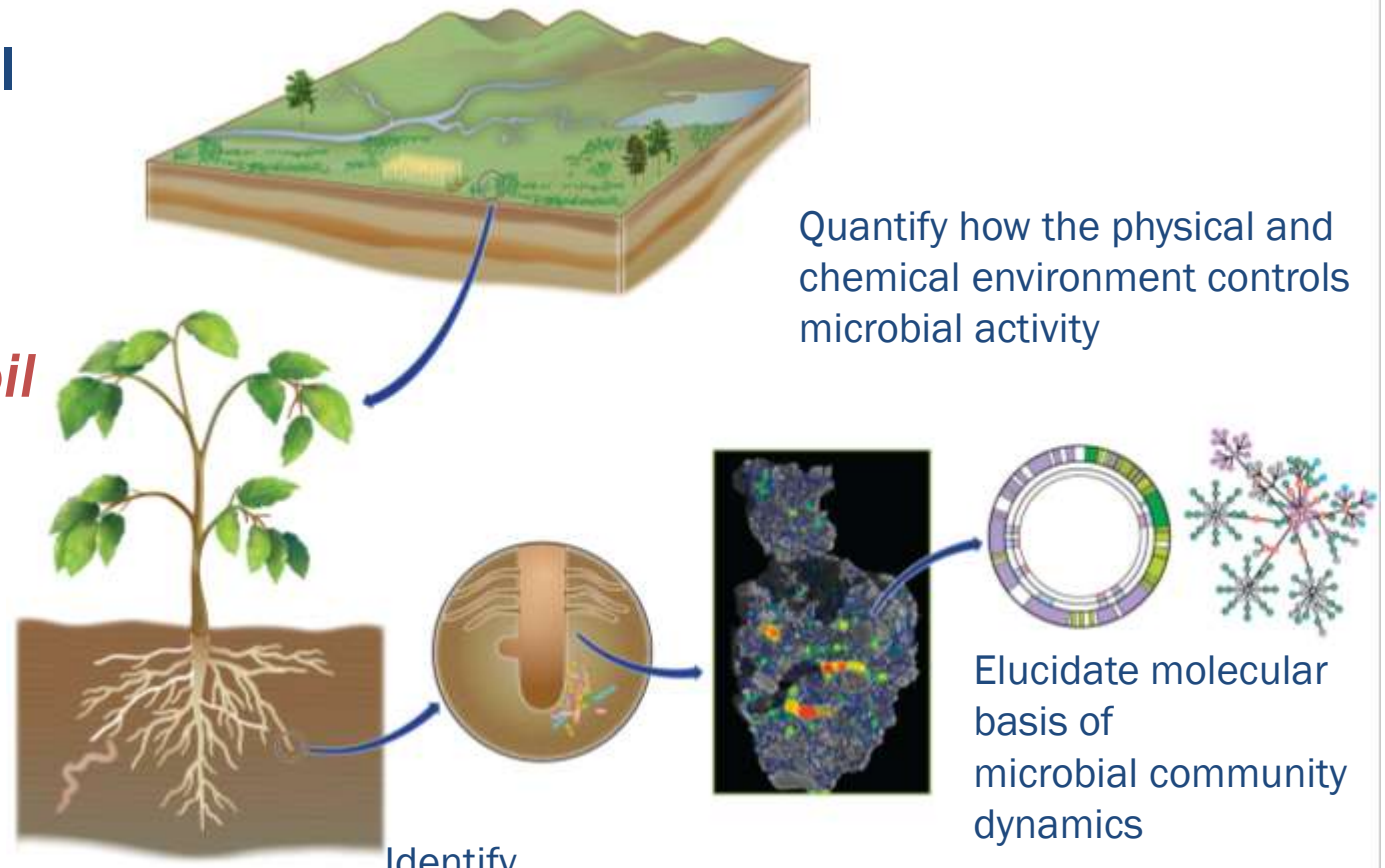
http://n.pr/1f8p0ka

originally aired 11/4 – 11/18

npr

Microbes to Biomes Initiative at Berkeley Lab

How do microbial communities function in and regulate highly complex *plant-soil* systems?



Quantify how the physical and chemical environment controls microbial activity

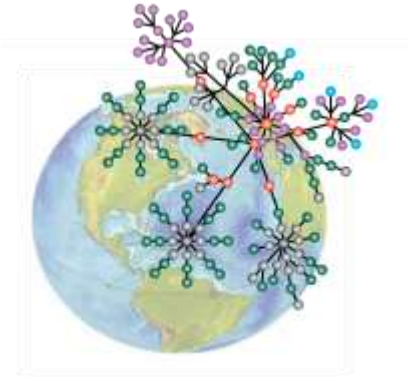
Discover Mineral-Microbe-Metazoan-Plant interactions that influence nitrogen fixation, carbon sequestration, and water holding capacity

Identify determinants of microbial community assembly

Elucidate molecular basis of microbial community dynamics

How will ecosystems respond to climate change?

Berkeley Lab's strategic initiatives under development



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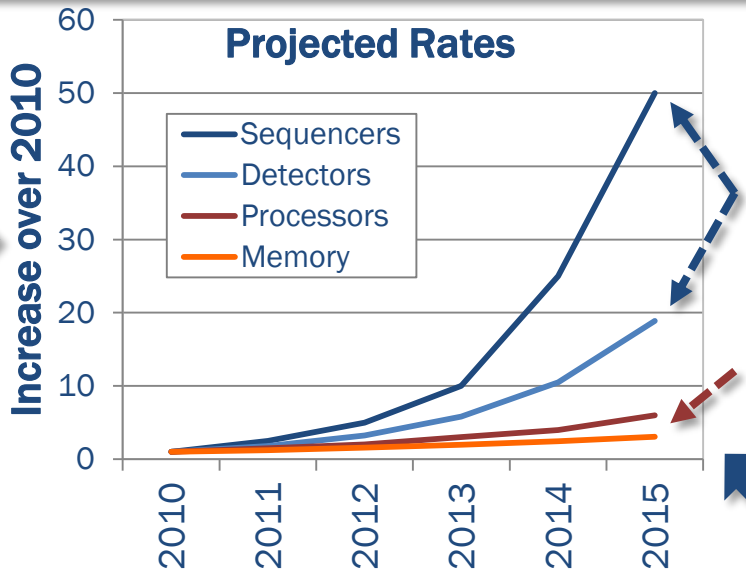
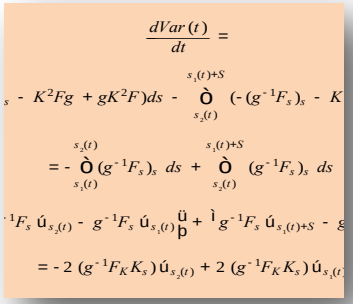
Extreme Data Science Initiative at Berkeley Lab

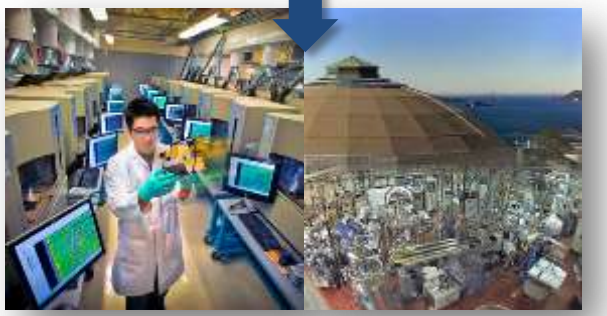
networking



Data collection from sequencers and detectors continues to outpace **growth in computing power**



applied math and software

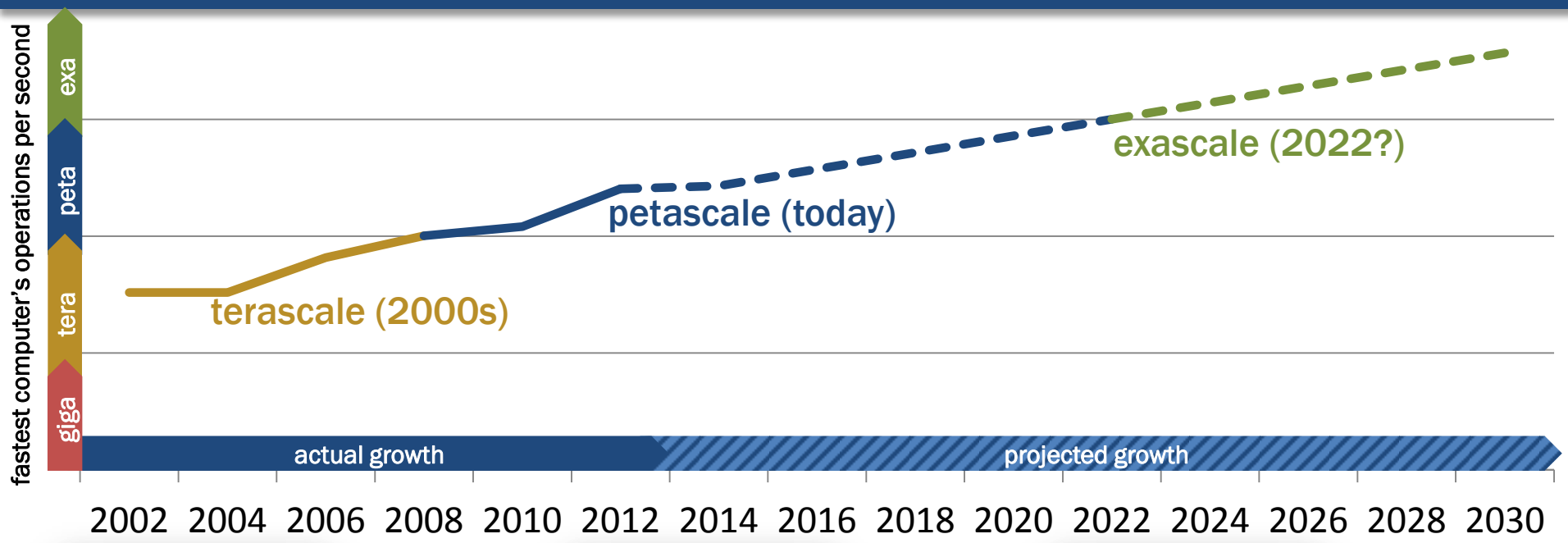


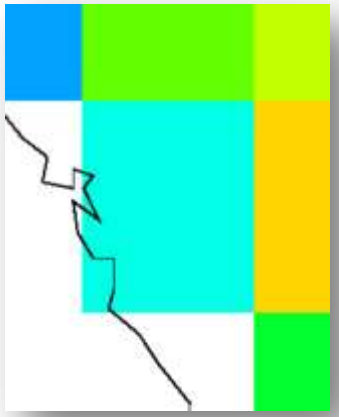
team science & user facilities

supercomputing

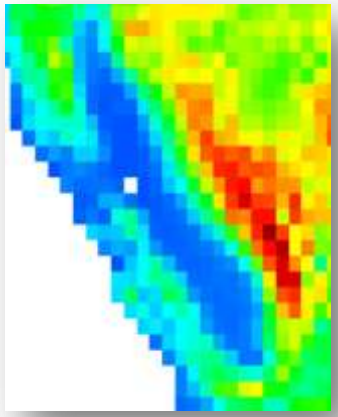
Leverage Berkeley Lab talent and our new computing infrastructure to enable new modes of inquiry and discovery from scientific data sets

The scientific computing revolution is already transforming some fields of research such as climate science

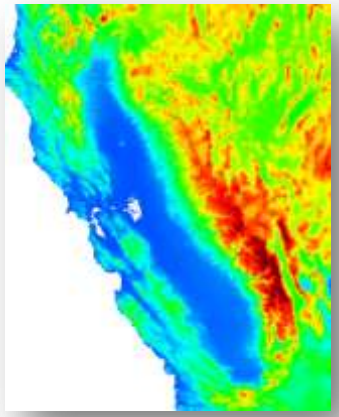




2006
~200km



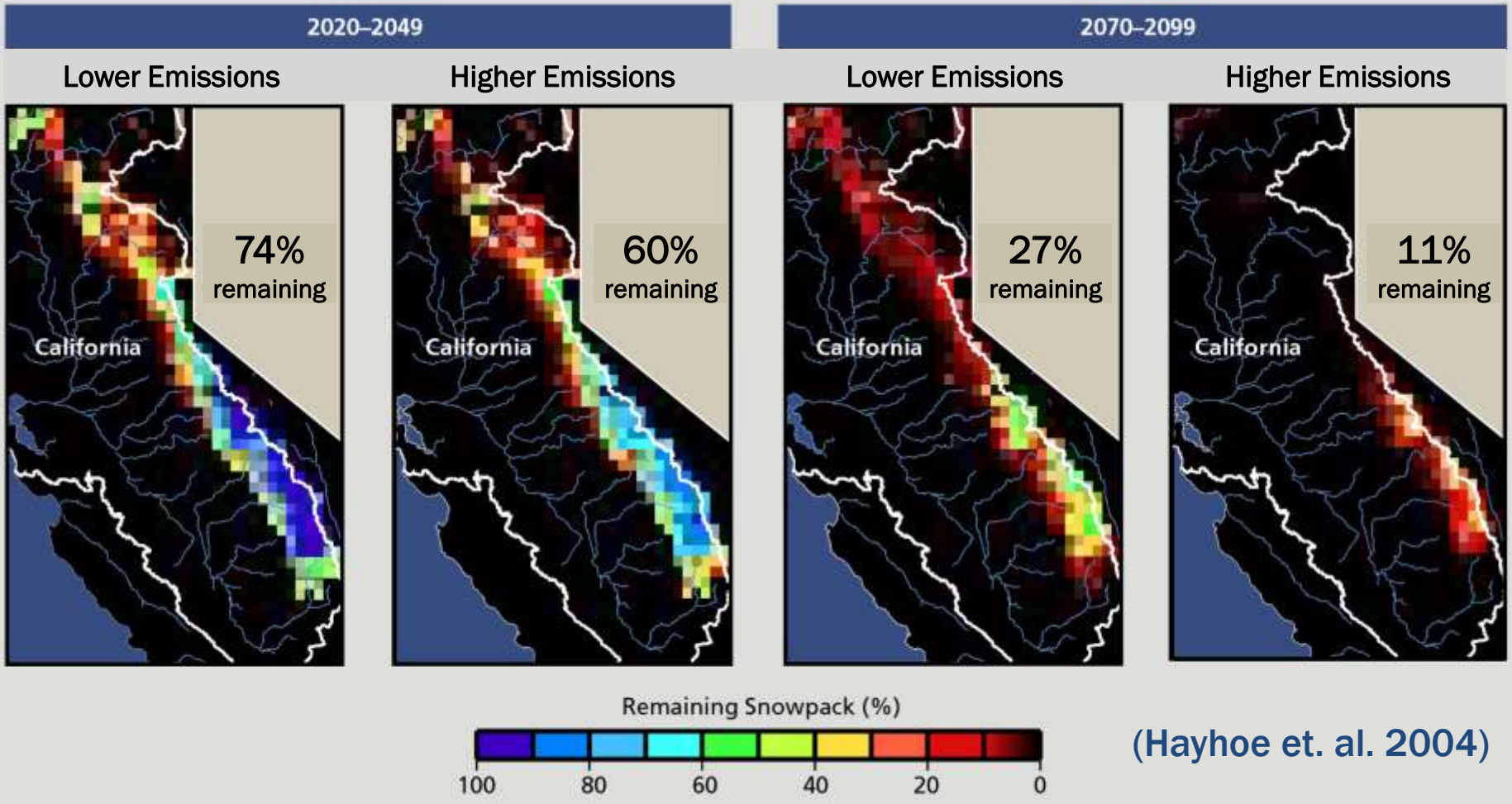
2012
~25km



2022
~1km

...next: computing power will help us understand complex microbial communities

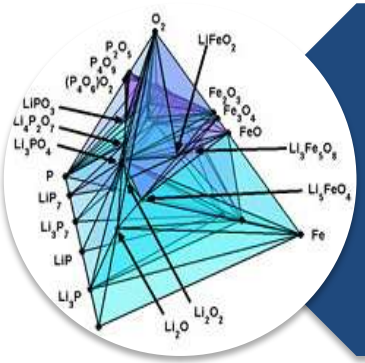
Latest Climate Models Applied to CA Snowpack



(Hayhoe et. al. 2004)

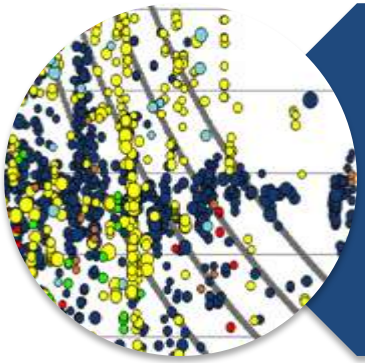
How will ecosystems respond to climate change?

Great opportunity for scientific data to impact more (every?) science discipline



Materials Project

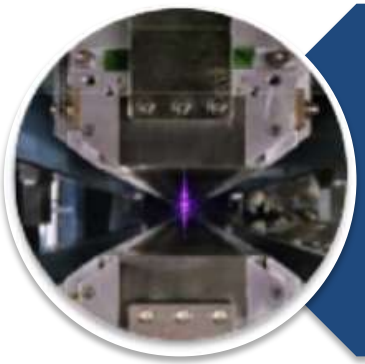
Discover materials before they are made – 30,000 solids, 4,000 users



Materials & Chemistry

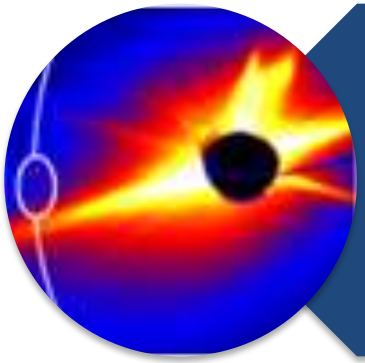
New batteries, catalysts, active windows…

from petabytes to exabytes



ALS data project

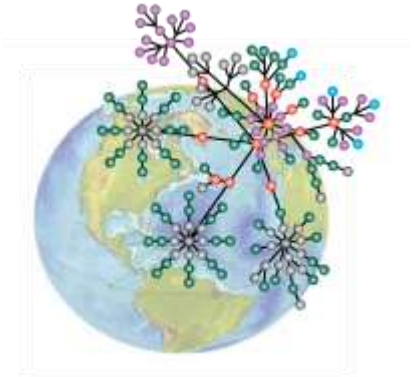
10 Tb/ day today and growing exponentially



Light Sources

Crawlers aiding in the formulation of hypotheses?

Berkeley Lab's strategic initiatives under development



MICROBES TO BIOMES

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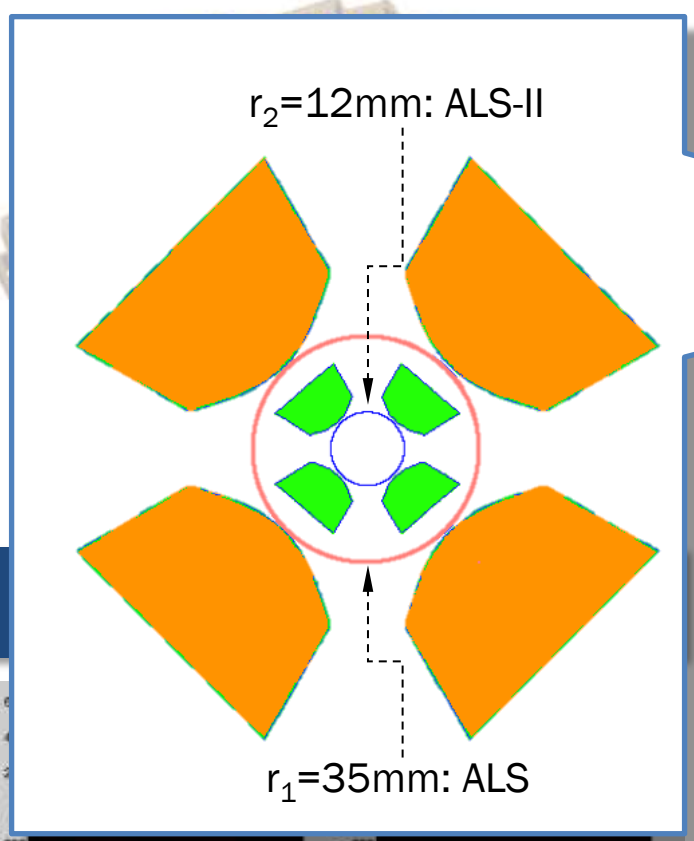
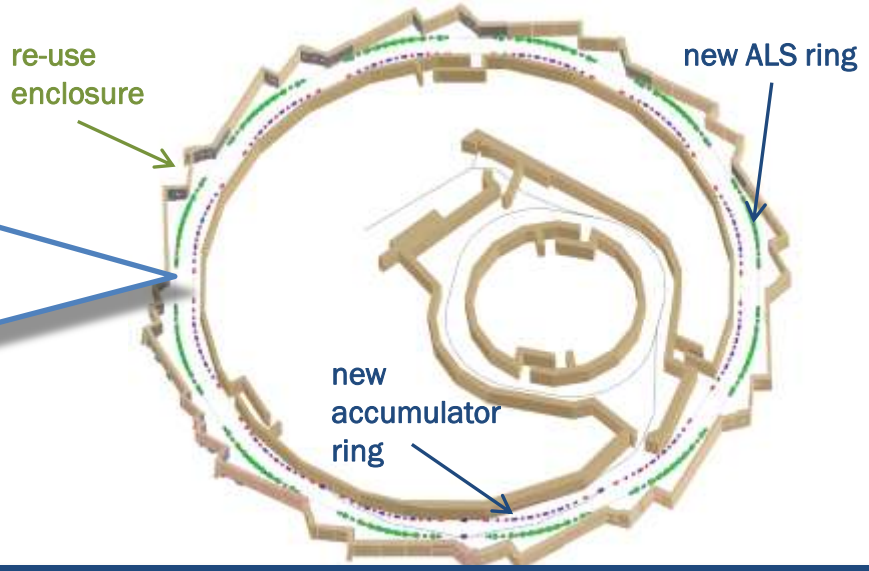
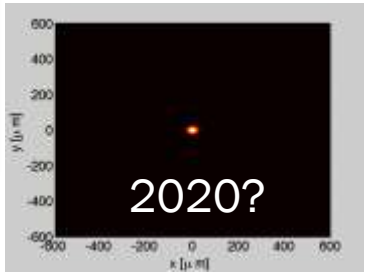
SERVICE TECHNOLOGIES FOR SCIENCE

Diffraction-limited Advanced Light Source upgrade





Diffraction-Limited ALS (ALS-II)



- A better microscope to see inside batteries, solar cells, proteins…
- **Re-use the landmark building and ring enclosure** ***(no conventional construction required)***

Upgrade will enable fine resolution maps of energy devices and living things

ALS-II: even better tools for science, *in the existing building*

- Sunlight to electricity
- Sunlight to fuel
- Batteries
- Fuel Cells
- CO_2 Capture & Seq.
- Combustion
- Catalysis

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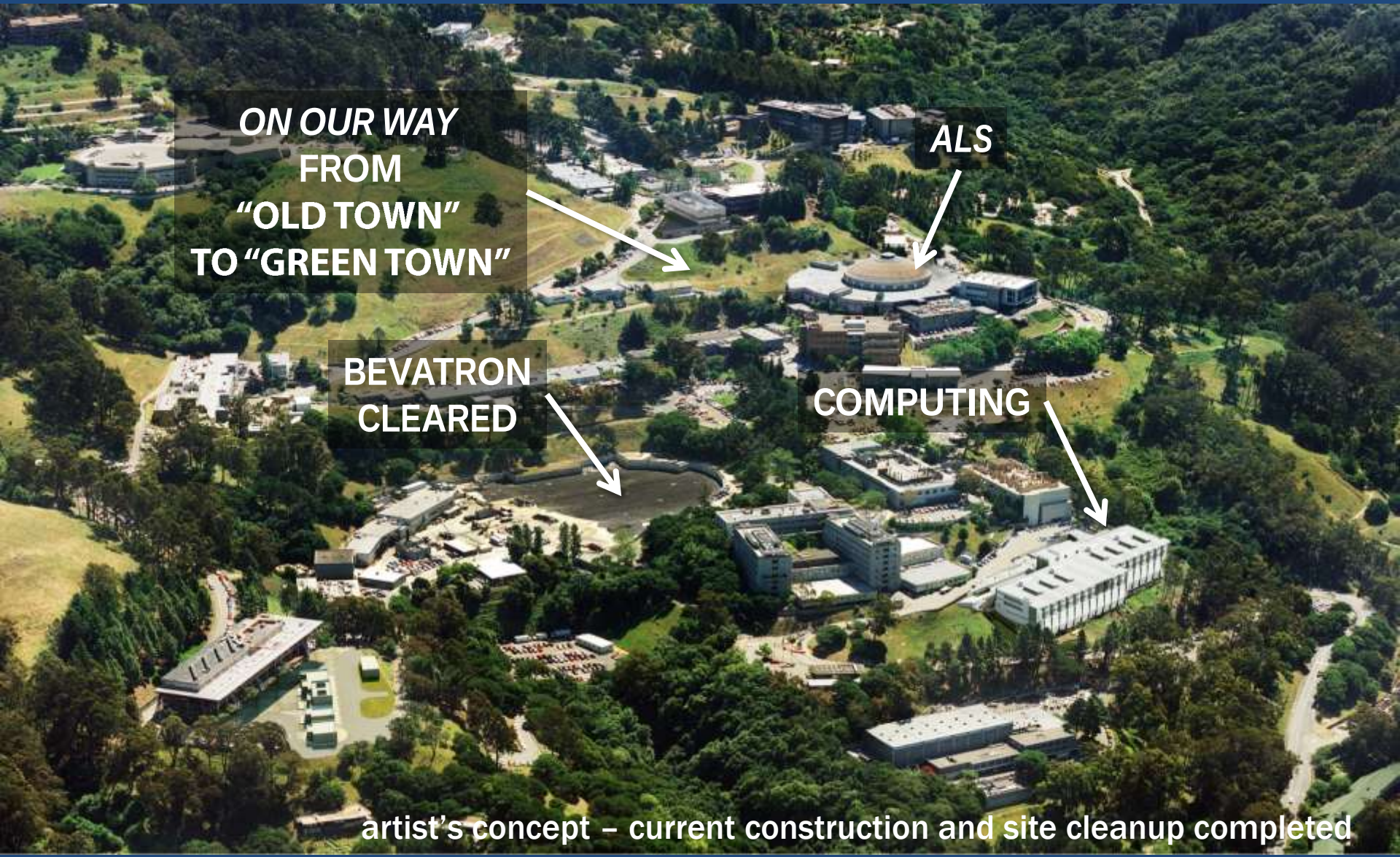
Re-enforcing nature of the lab-wide science initiatives

DIFFRACTION-LIMITED ALS FOR MATERIALS & BIOLOGY

EXTREME DATA SCIENCE INITIATIVE

MICROBES TO BIOMES

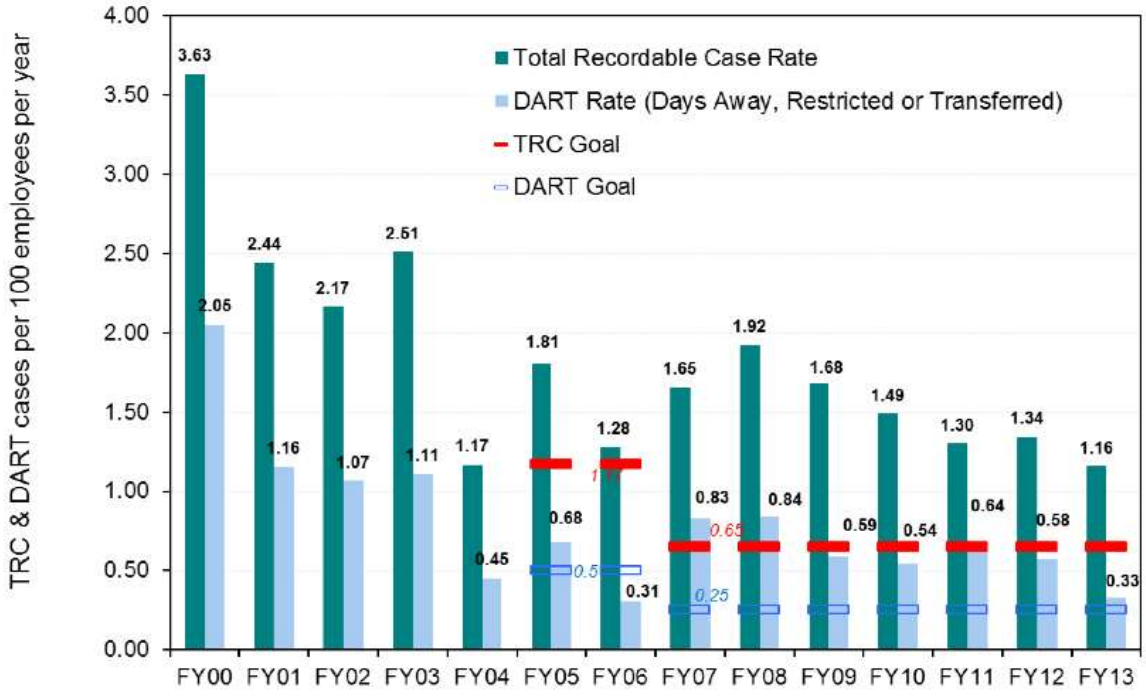
Mapping of science initiatives onto the Berkeley Hill site



artist's concept – current construction and site cleanup completed

Safety culture leads to better safety, despite record construction years

Fewer injuries even during period of much construction



Safer employees are more productive and healthier. (Side benefit: fewer days away from work lowers cost.)

Recordable injury rates continue solid declines *despite >10% reduction of operations budget* and *simultaneous large capital construction projects at Berkeley Lab*

Real world impact from the lab-wide science initiatives

DIFFRACTION-LIMITED ALS FOR MATERIALS & BIOLOGY

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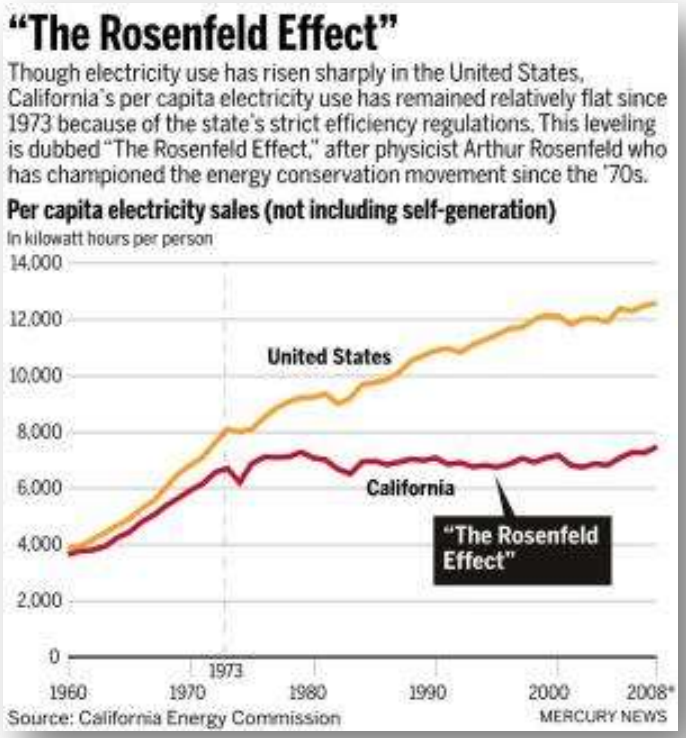
MICROBES TO BIOMES

ENERGY INNOVATION

Energy innovation: history of success



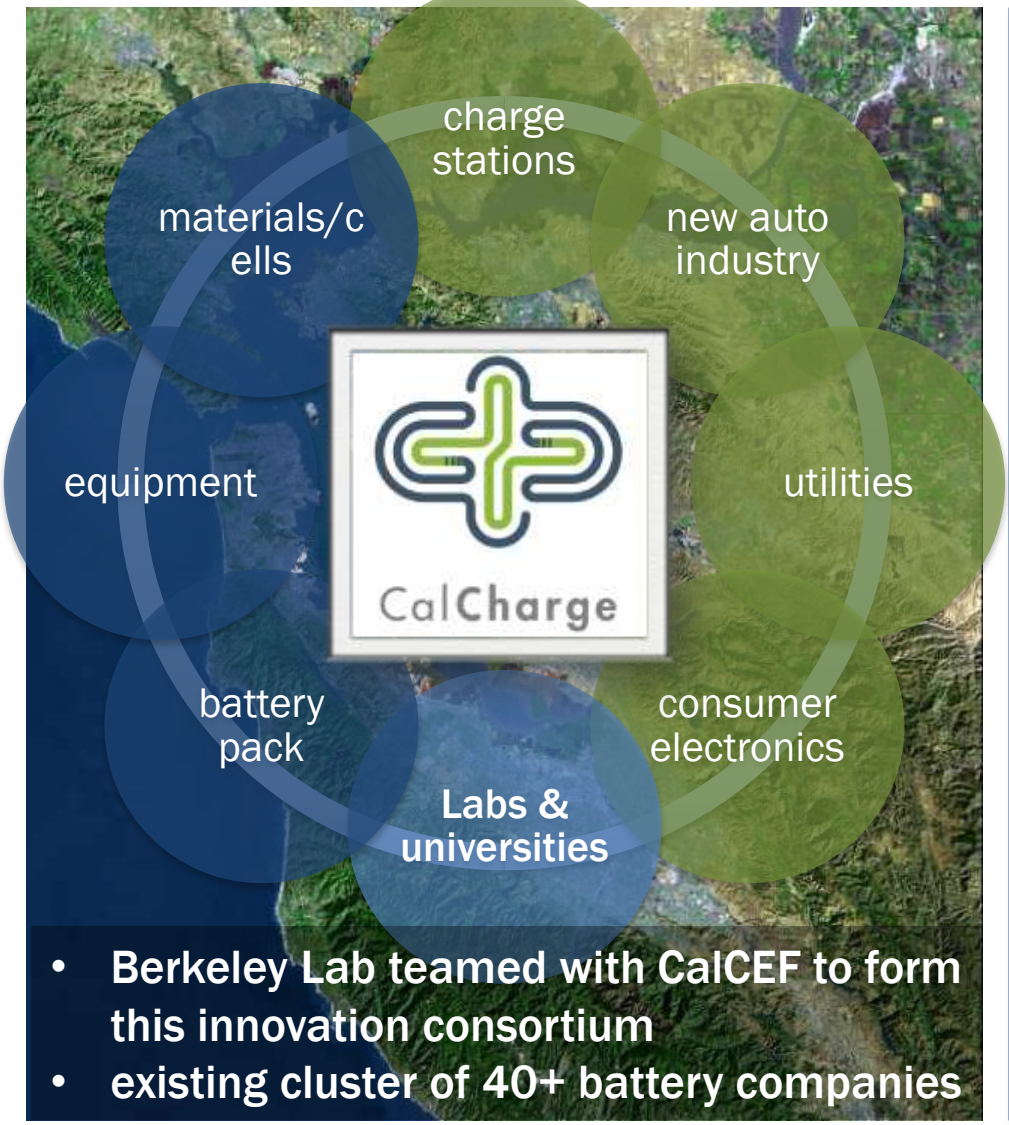
Technologies and Policies

- Efficiency standards (CA vs. US) and policy assistance
- Buildings, lighting technology
- Foundational work in lithium ion batteries

Startups

- 30 Berkeley Lab spinoffs contribute $695M to Bay Area and $2.8B nationally each year

Berkeley Lab continues to impact technology and policy



- Berkeley Lab teamed with CalCEF to form this innovation consortium
- existing cluster of 40+ battery companies

Los Angeles Times

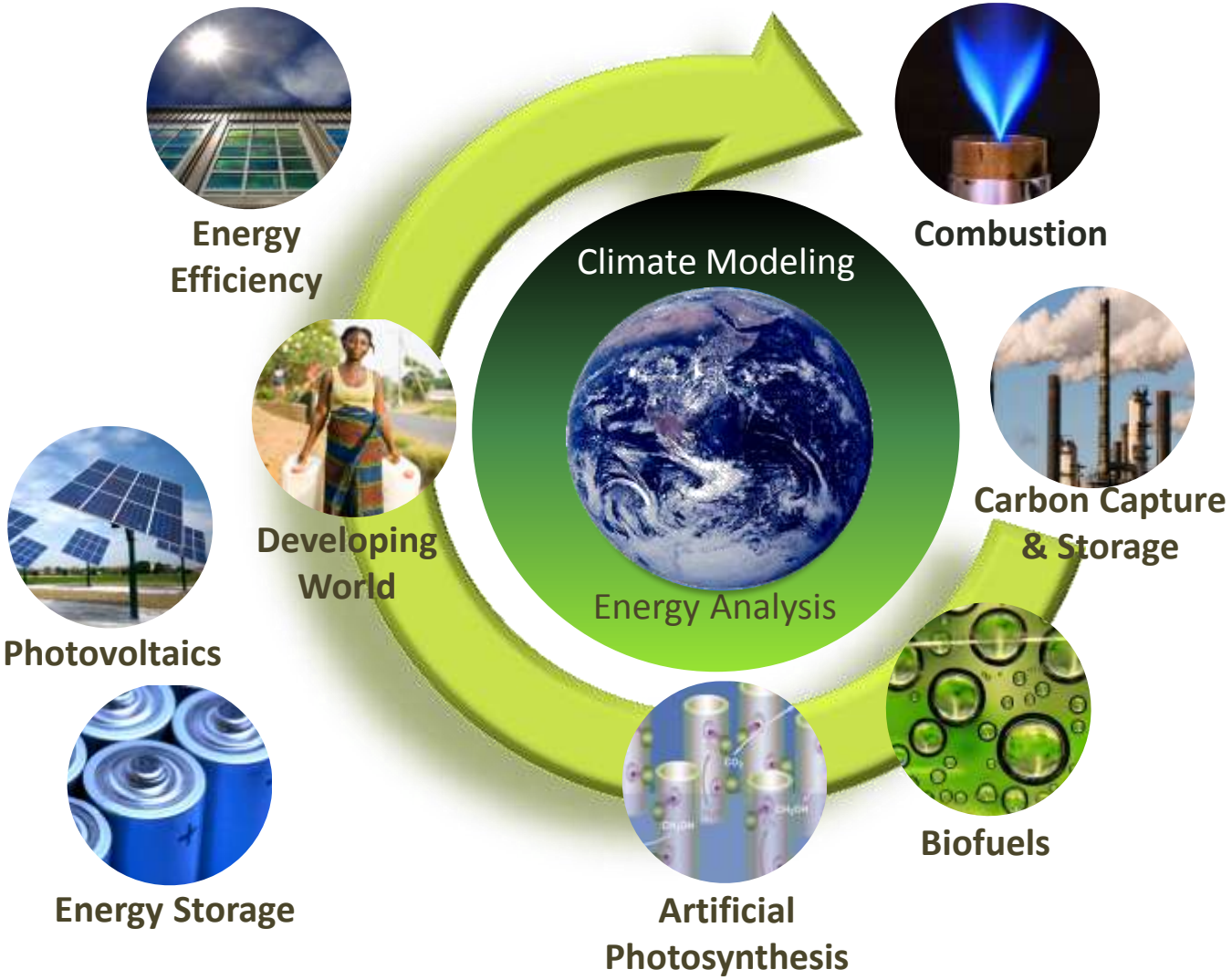
November 4, 2013

California must adopt aggressive climate-change policies, report says

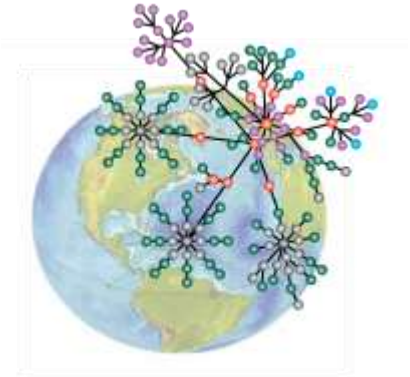
California will fall short of its goal to slash greenhouse gas emissions by midcentury unless it adopts aggressive policies to fight climate change, a new report says.

The state is still on track to cut emissions of carbon dioxide and other heat-trapping gases to 1990 levels by 2020, according to a report released Monday by the U.S. Department of Energy's Lawrence Berkeley National Laboratory.

CC2.0 has created more opportunities for energy innovation impact



Berkeley Lab's strategic initiatives under development



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Implicit bias is very real, even in the scientific community

Why Are There Still So Few Women in Science? – NYTimes.com

Why Are There Still So Few Wo...

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The New York Times

WORLD | U.S. | N.Y.

Why Are T

At the Solvay Conference on Physics in 1927, the only woman in attendance was Marie Curie (bottom row, third from left).

Mondadori Portfolio, via Getty Images

By EILEEN POLLACK
Published: October 3, 2013

Pro ... es of the United States of America

In a ... universities rated the ... ale or female nam ...

- F ...
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Test yourself!
Discover more about your own biases at:

implicit.harvard.edu

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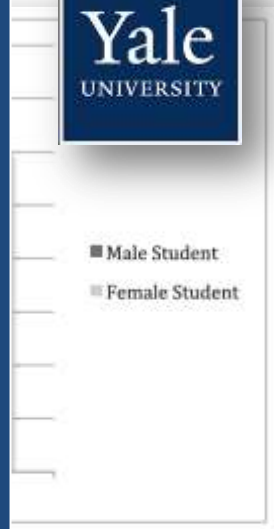


...dent gender condition ...ferences are significant ...bers reflecting a greater ...male student condition = 63,

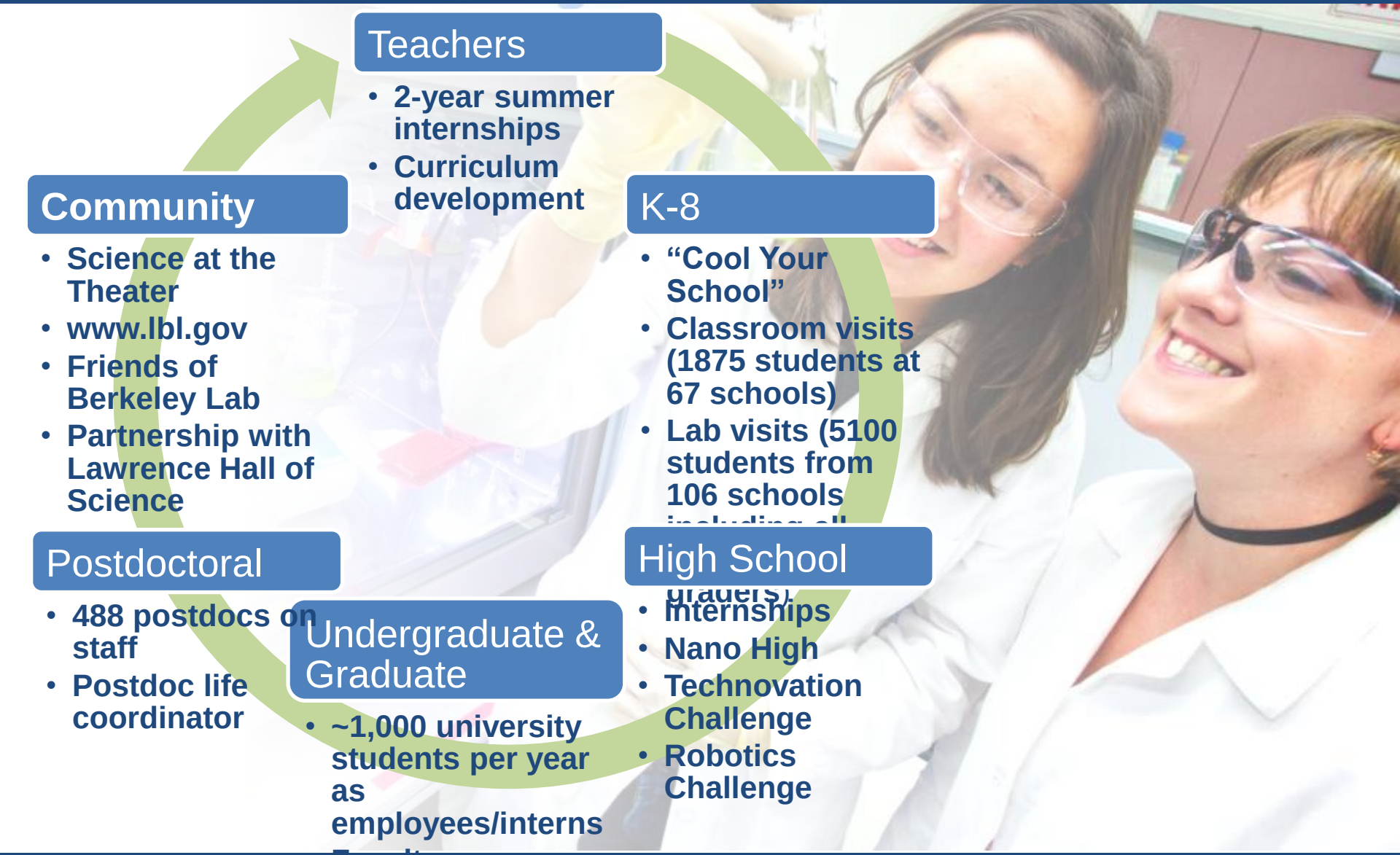
PNAS | October 9, 2012 | vol. 109 | no. 41 | 16475

Why it matters so very much

- An expression of our core values
- The vision of the community we live in
- Our science will be less successful if we are not diverse and inclusive

Diversity and Inclusion: 5 Strategies to start

Science education key to diversity goal



Teachers

- 2-year summer internships
- Curriculum development

K-8

- "Cool Your School"
- Classroom visits (1875 students at 67 schools)
- Lab visits (5100 students from 106 schools

High School

- graders)
- Internships
- Nano High
- Technovation Challenge
- Robotics Challenge

Undergraduate & Graduate

- ~1,000 university students per year as employees/interns

Postdoctoral

- 488 postdocs on staff
- Postdoc life coordinator

Community

- Science at the Theater
- www.lbl.gov
- Friends of Berkeley Lab
- Partnership with Lawrence Hall of Science

Berkeley Lab's strategic initiatives under development

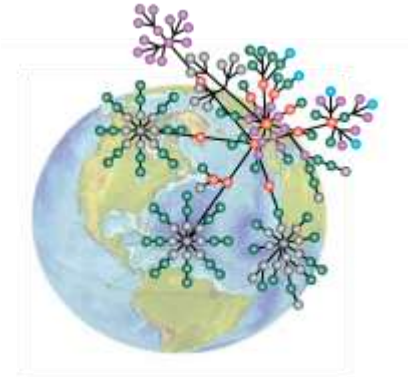


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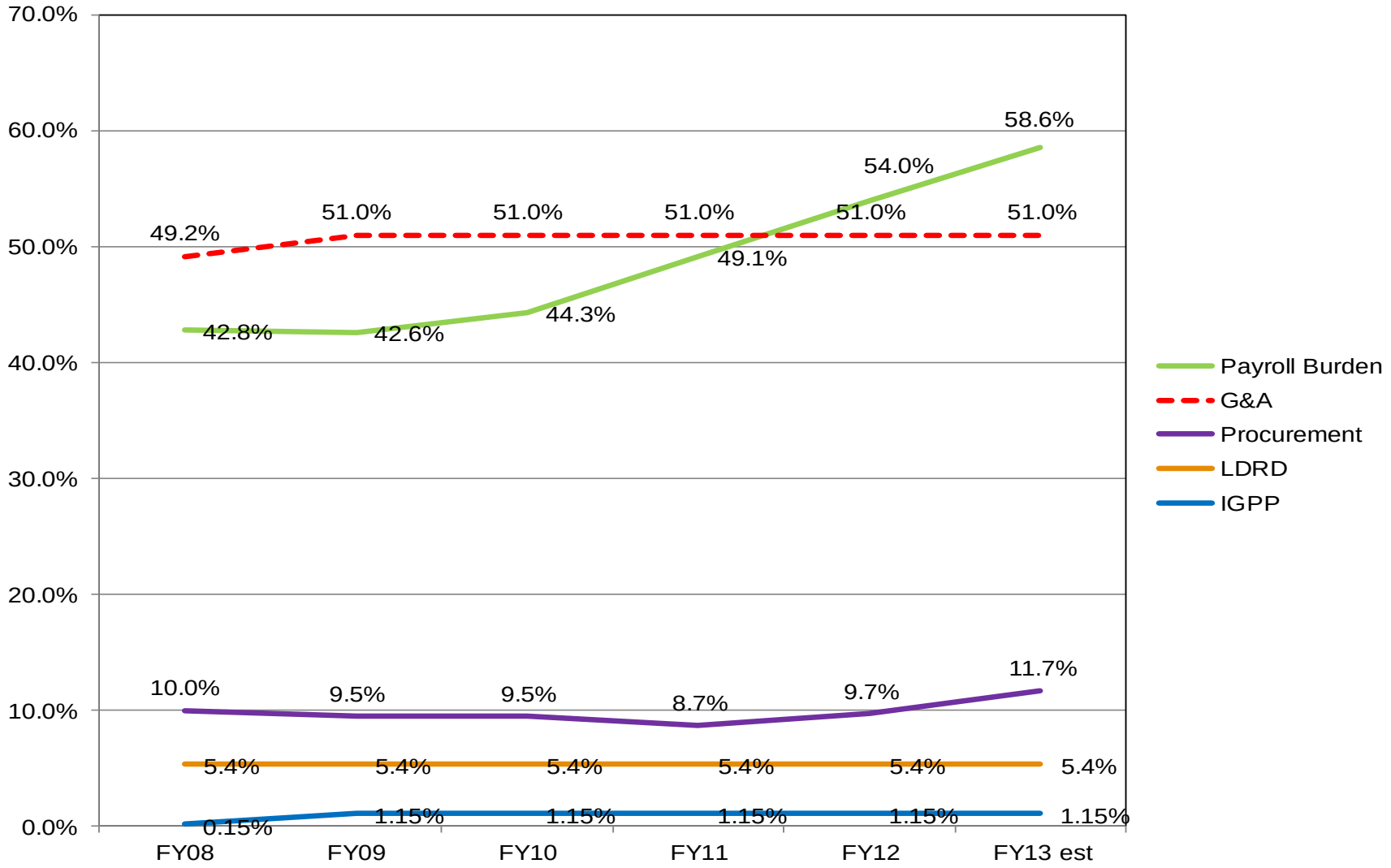
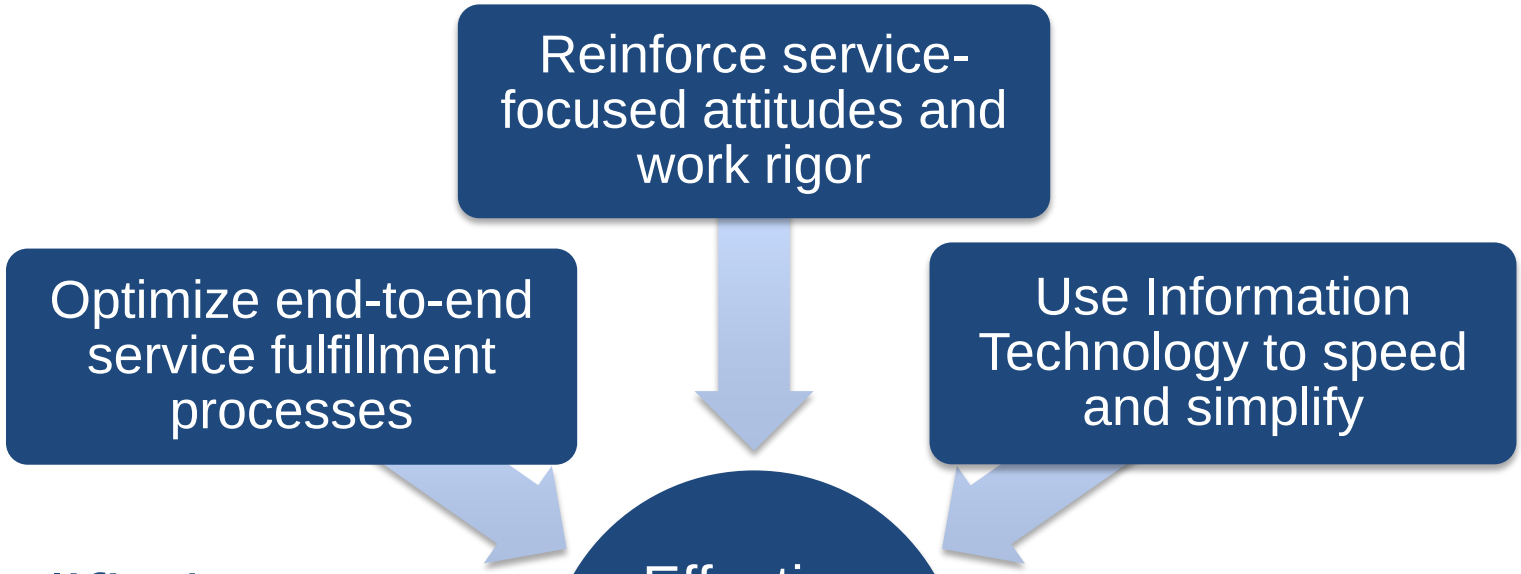
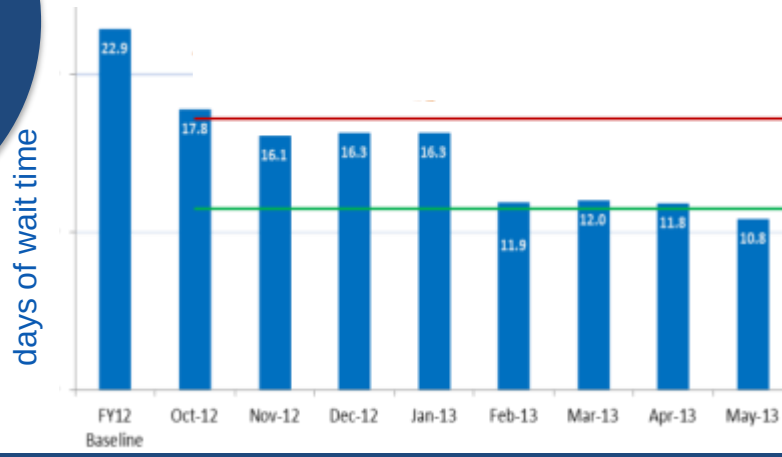
Illustration of the need to offset pension and health care cost escalation



Service technologies for science

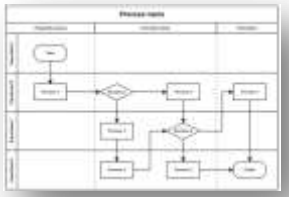


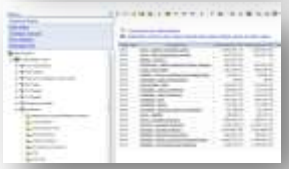
- Simplified processes
- Tied to metrics
- Driven by IT automation



Major investments in new financial and human resources service technologies

F$M





Simplified financial services
- Automated routing and status tracking
- Eliminate duplicate data entry

Better financial information for decision-making
- Dashboards
- Improved data capture & data structure
- Drag & drop query tools with download to Excel

Lower cost

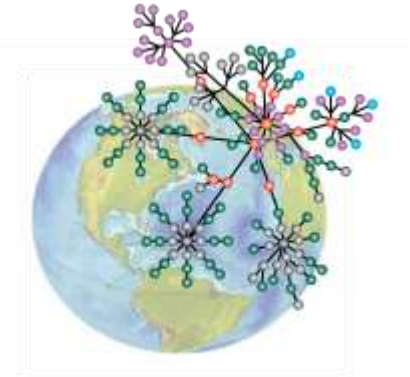
Workday

Automated, paperless routing
- Speed processing time, reduce cost

Better access for managers and employees
- Initiate and approve personnel actions

Smarter tools
- Integrated analytics and reports for workforce planning, compensation, performance management

Berkeley Lab's strategic initiatives under development



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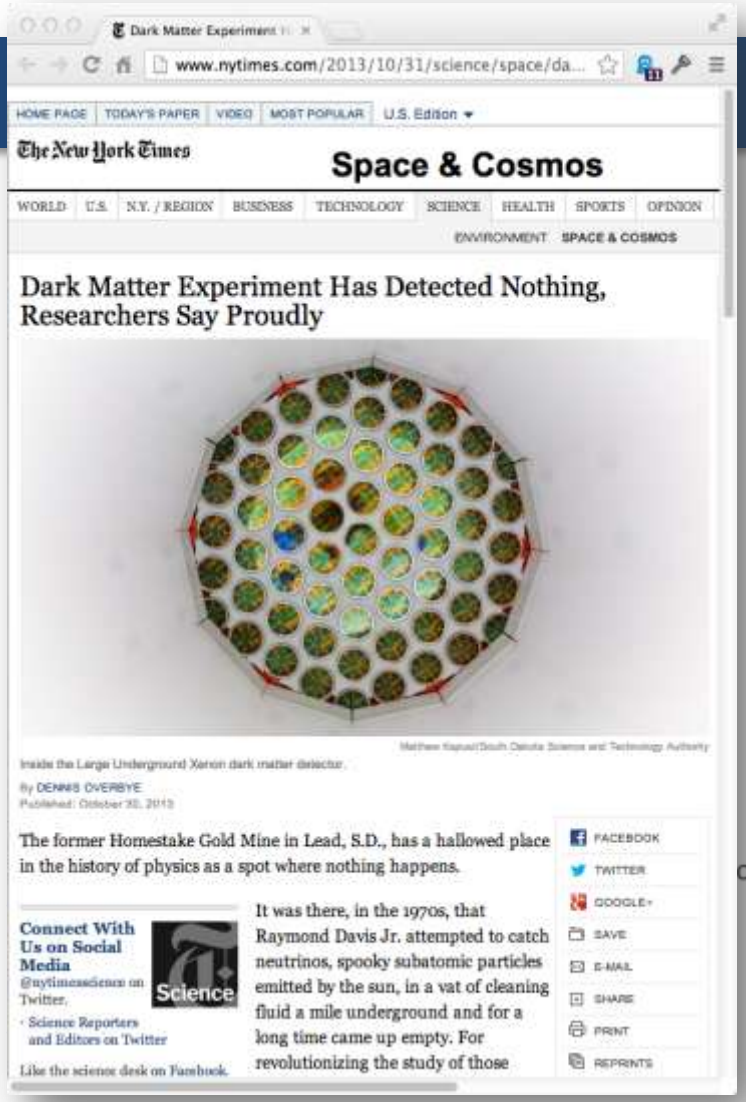
Experiments for studying 95% of the universe



Dark Matter Experiment

www.nytimes.com/2013/10/31/science/space/da...

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The New York Times

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Dark Matter Experiment Has Detected Nothing, Researchers Say Proudly

Inside the Large Underground Xenon dark matter detector.

By DENNIS OVERBYE

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The former Homestake Gold Mine in Lead, S.D., has a hallowed place in the history of physics as a spot where nothing happens.

It was there, in the 1970s, that Raymond Davis Jr. attempted to catch neutrinos, spooky subatomic particles emitted by the sun, in a vat of cleaning fluid a mile underground and for a long time came up empty. For revolutionizing the study of those

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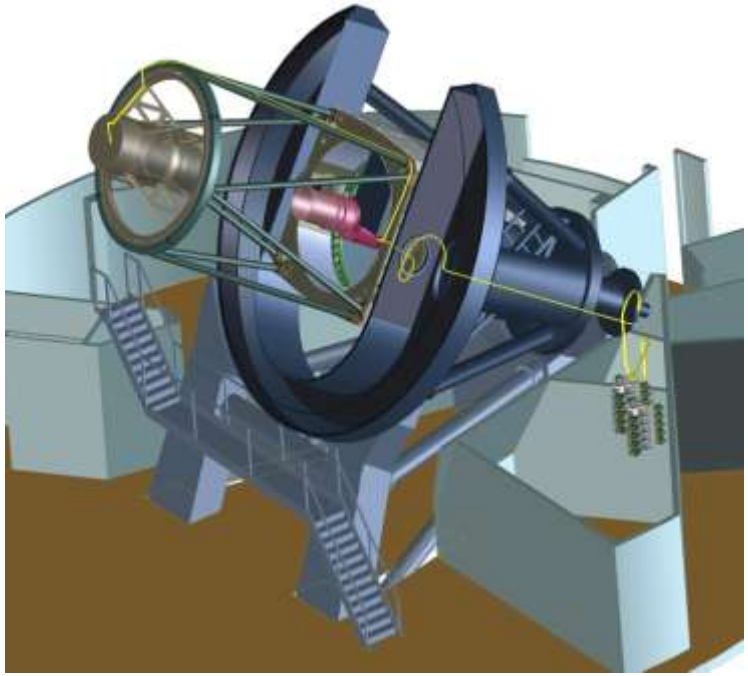
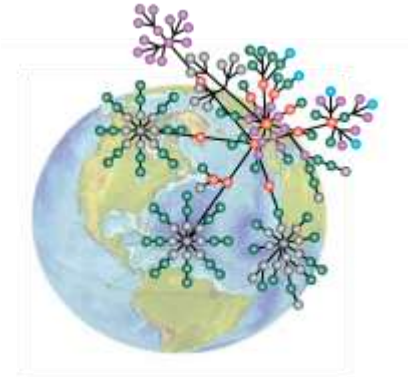
Dark Energy



- MS-DESI: map 20M galaxies and quasars to chart expansion of Universe at sub-percent precision
- To be located on Mayall telescope in Kitt Peak, AZ

Berkeley Lab's Carl Haber recognized with 2013 MacArthur Foundation "Genius Grant"

Berkeley Lab's strategic initiatives under development



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