Berkeley Lab:
National Lab with a Global Mission

Presented at the

March 17, 2011
meeting of the
Community Advisory Group

by

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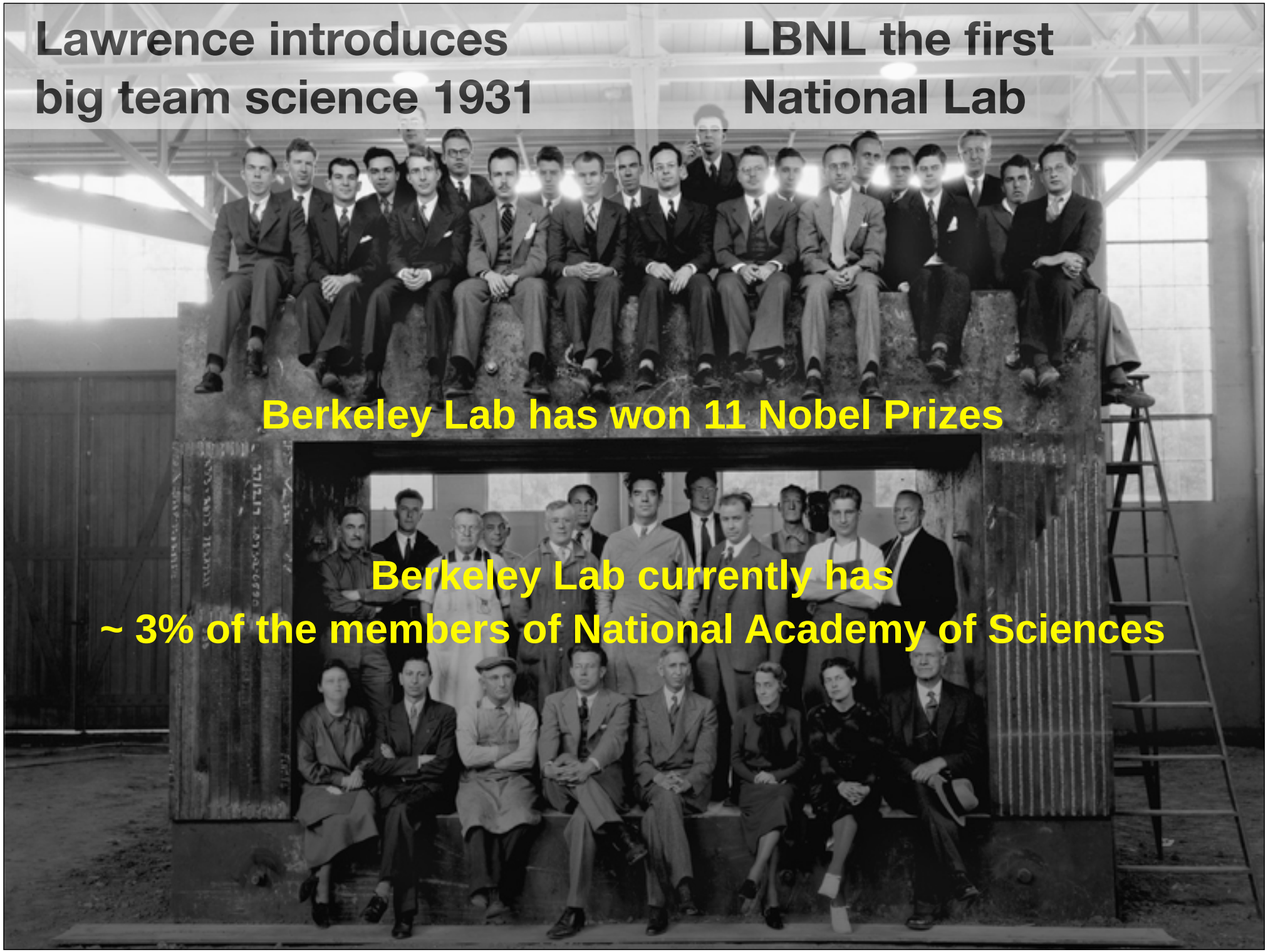
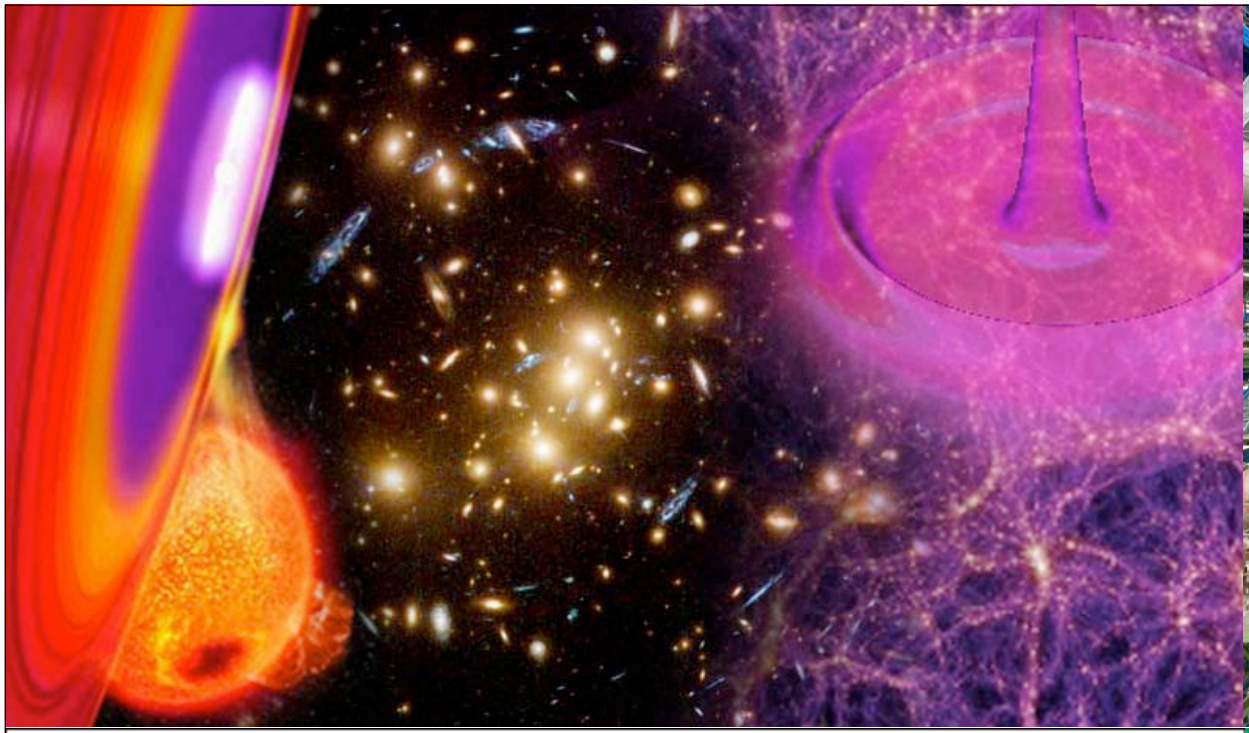
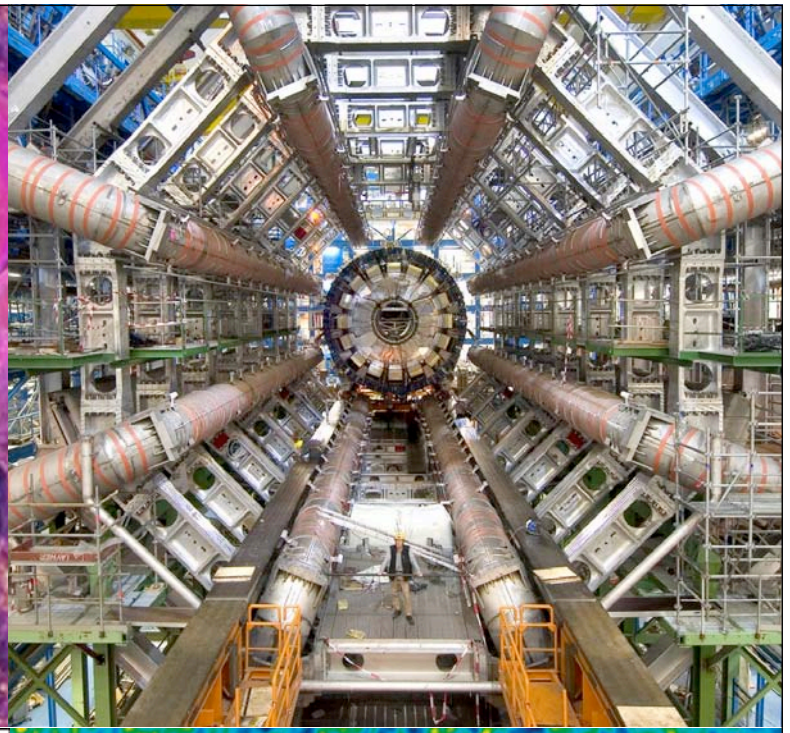
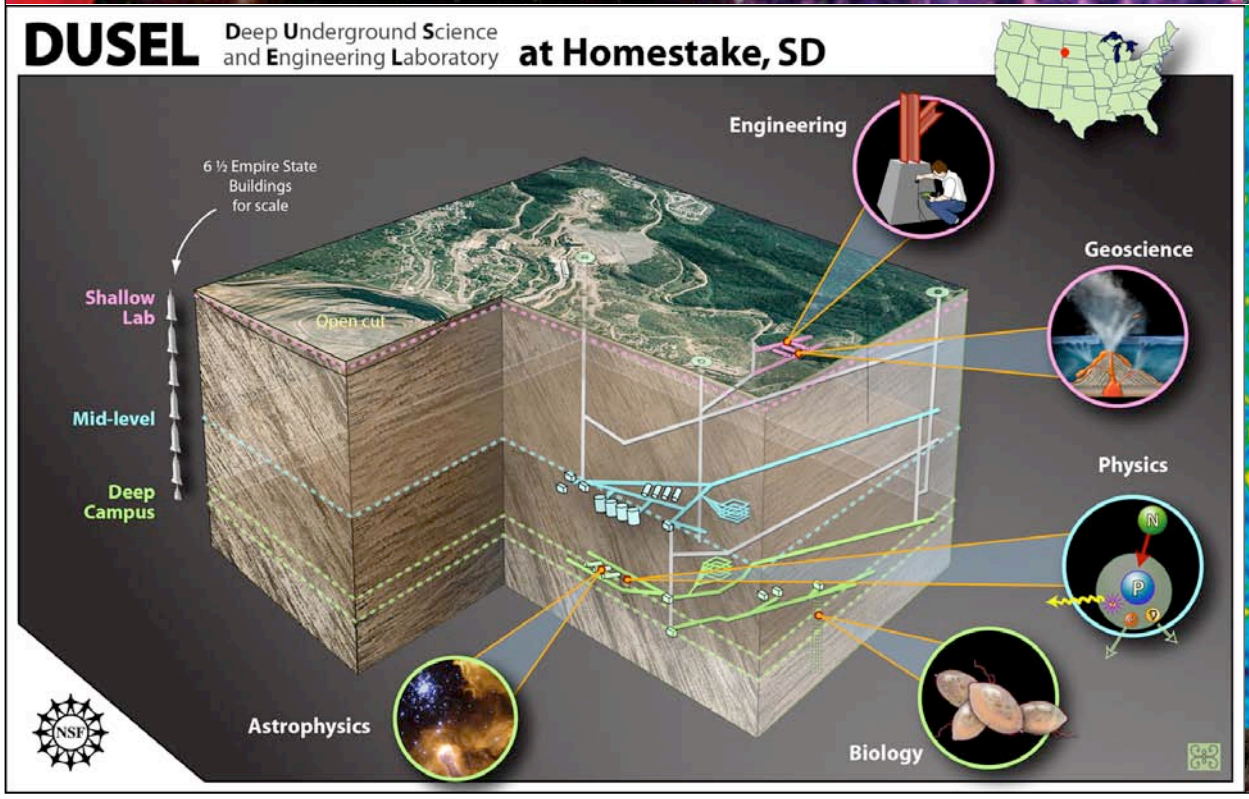
BERKELEY LAB
Lawrence Berkeley National Laboratory


Lawrence introduces
big team science 1931
LBNL the first
National Lab


Lawrence introduces
big team science 1931
LBNL the first
National Lab
Berkeley Lab has won 11 Nobel Prizes
Berkeley Lab currently has
~ 3% of the members of National Academy of Sciences






DUSEL
Deep Underground Science and Engineering Laboratory
at Homestake, SD
Engineering
6 ½ Empire State Buildings for scale
Shallow Lab
Open cut
Mid-level
Deep Campus
Geoscience
Physics
N
P
Astrophysics
Biology
NSF

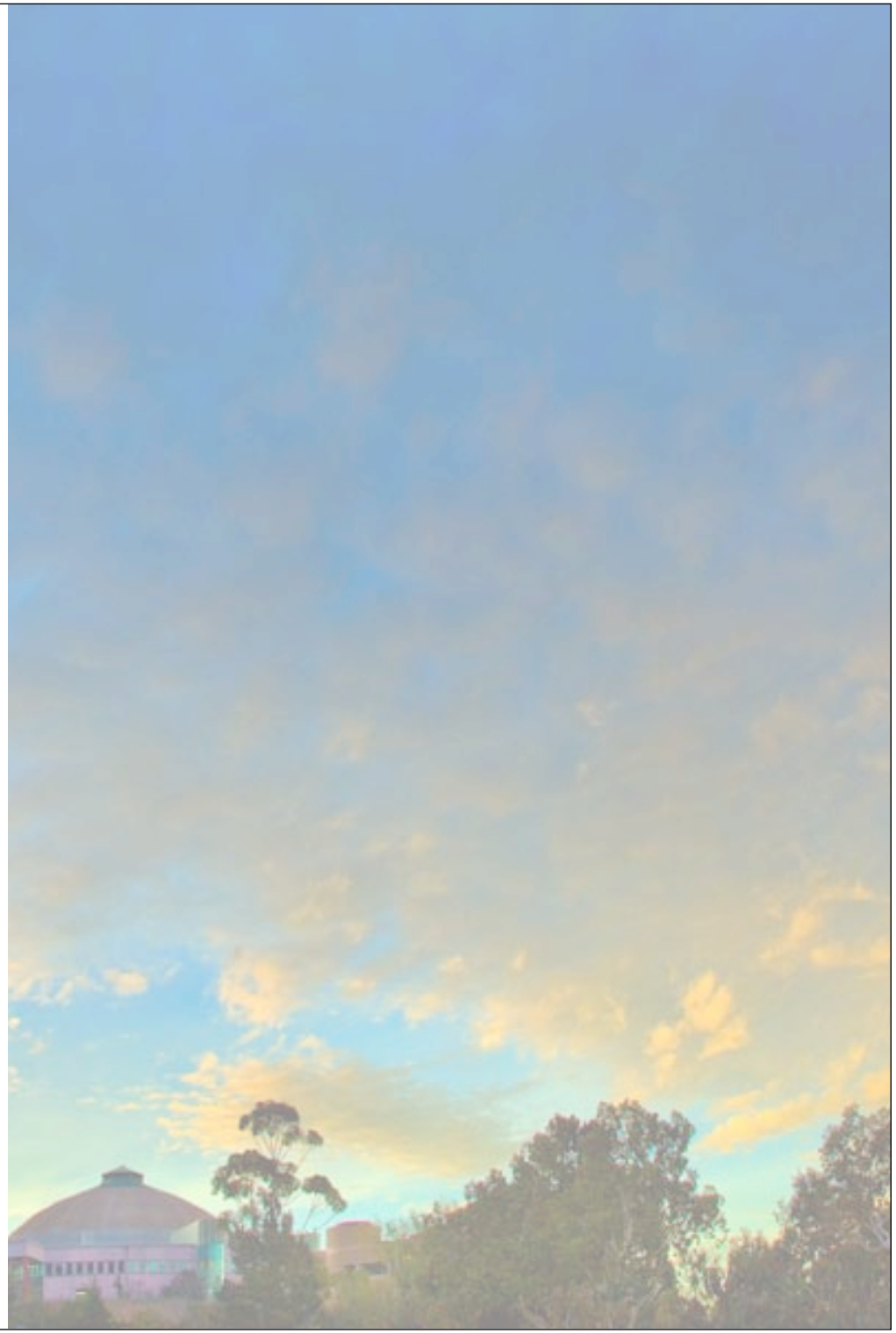

BigBOSS
The Ground-Based Stage-IV BAO Experiment

Berkeley Lab Today

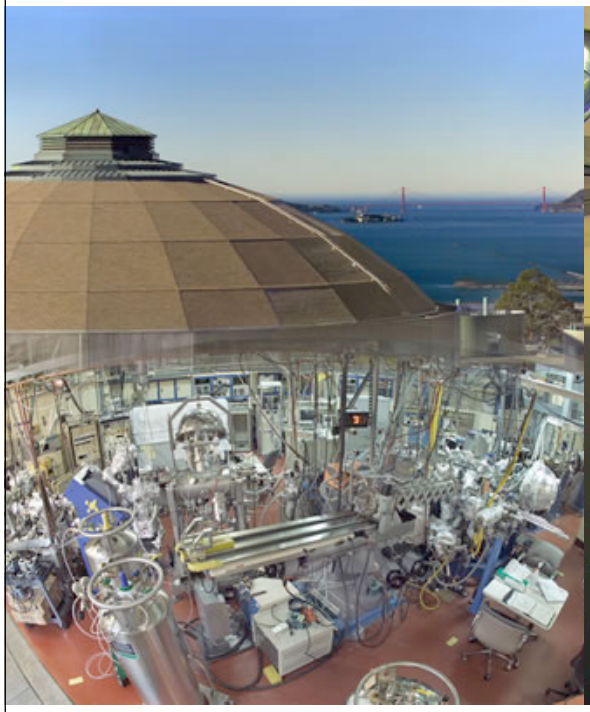
- Engage the Lab in the greatest scientific and technical challenges of our times
- Foster and harness the creativity of outstanding individuals
- Work collectively across disciplines and boundaries to find solutions
- Create and share unique tools for science
- Initiatives with scale and urgency
- This is the “Berkeley style” that created LBNL and put UCB on the world science map

Mission Areas of Berkeley Lab Today

- Global energy and environment issues
- Biological sciences for energy,environment and health
- Energy and Matter in the Universe
- Computational science
- Provide world-class **infrastructure and team environment** for researchers...



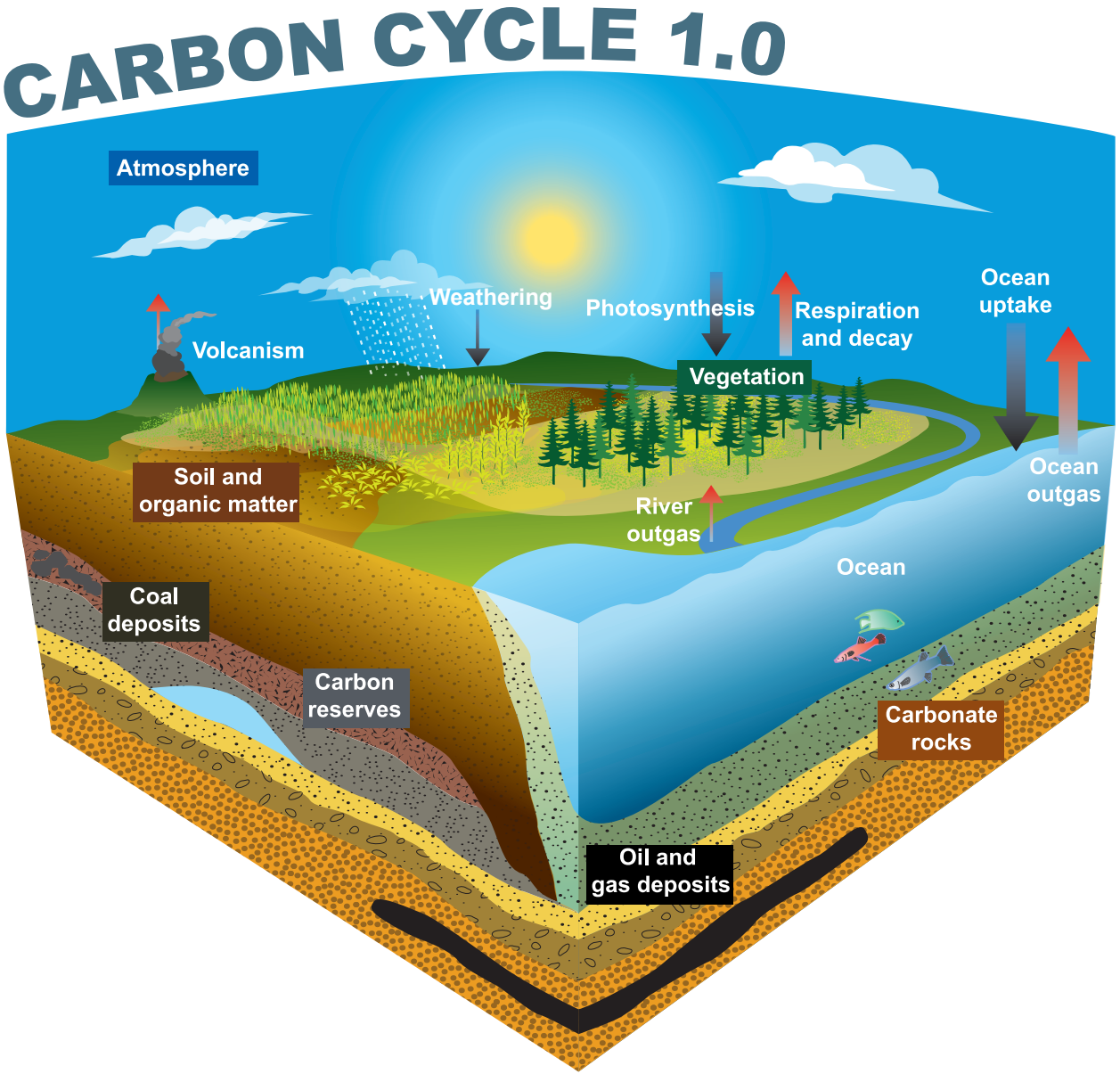
World-Class User Facilities and Research Institutes Underpin Today's LBNL



Societal needs in energy and environment challenge basic science to rise to a new level

For a new sustainable energy system to emerge we will need new observational tools capable of probing still-hidden realms of science

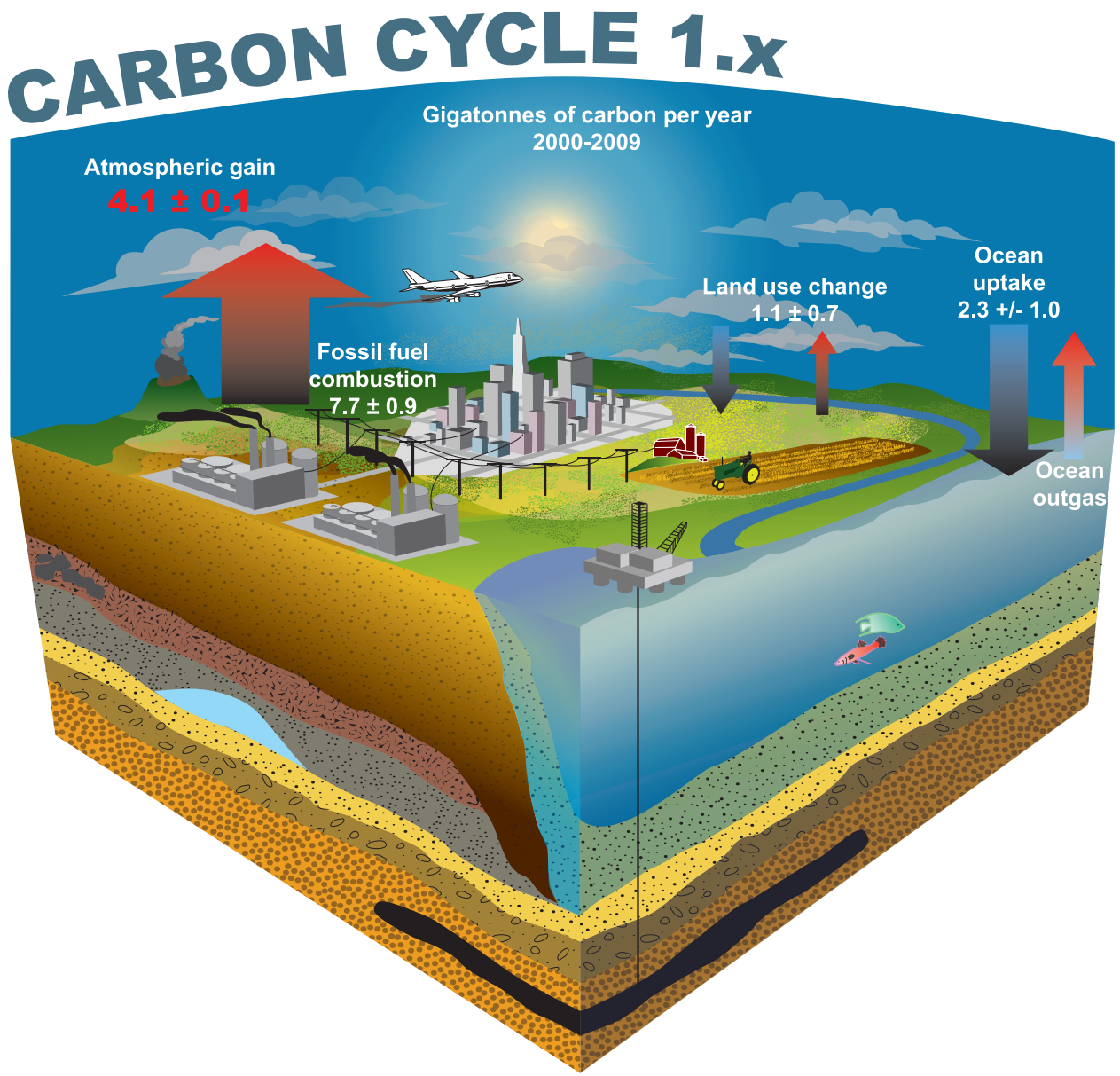
Carbon Cycle 1.0: relatively stable geochemical cycles



50,000 BC - 1750 CE

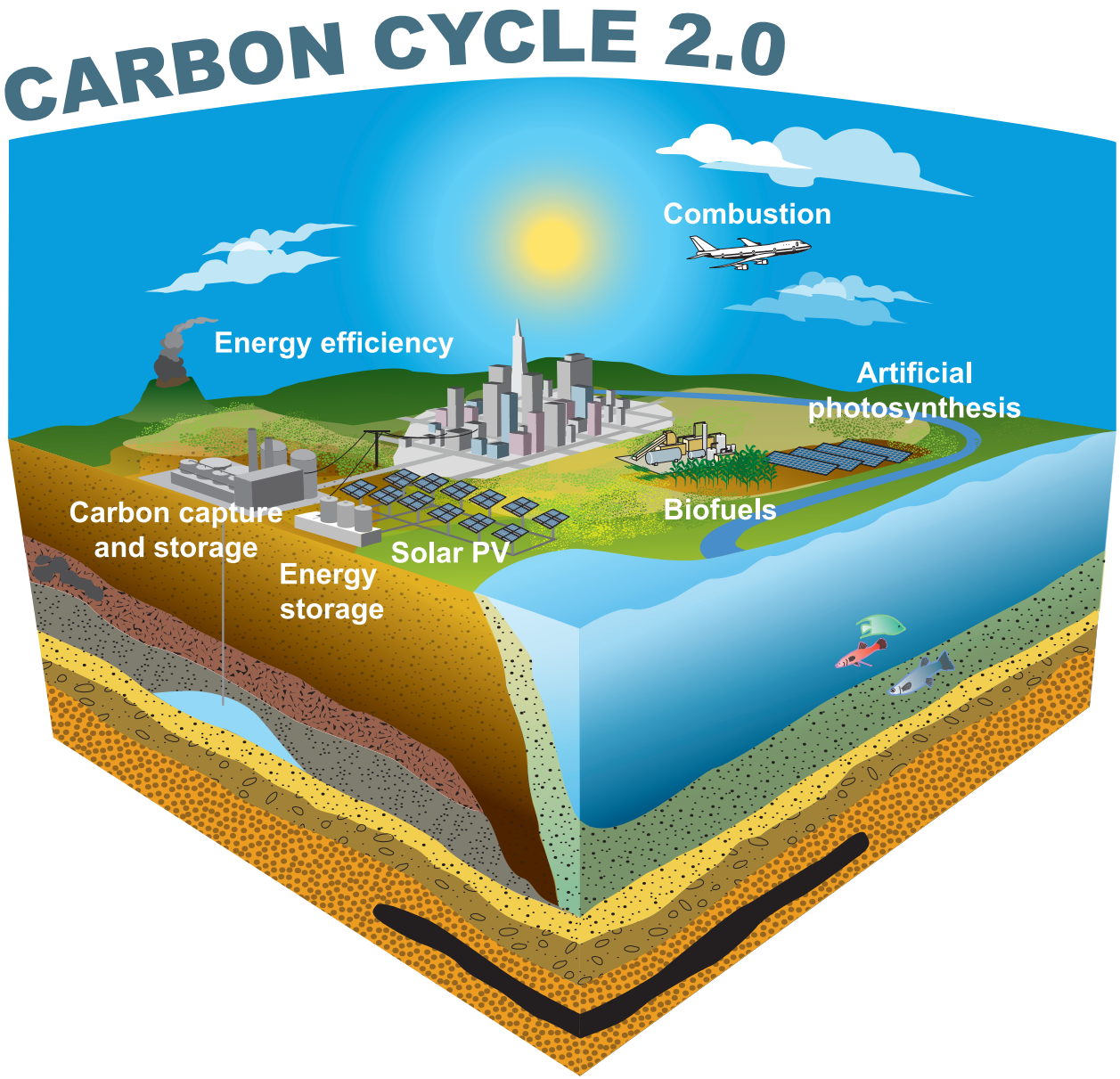
average net atmospheric gain: **0.0 ± 0.02** gigatons carbon per year

Carbon Cycle 1.x: An increasingly perturbed system



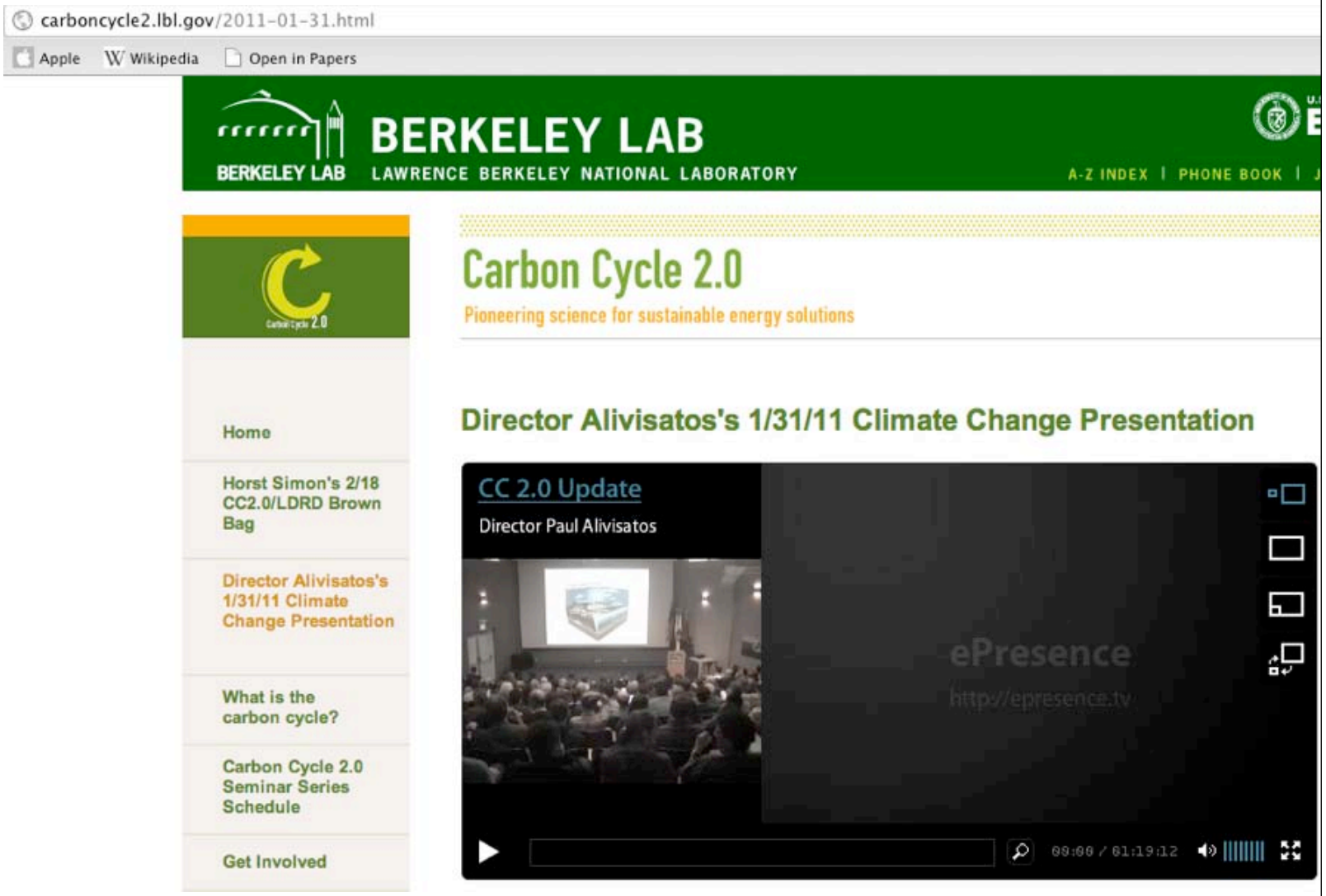
Net flux of C due to human activity ~100X natural geological flux

Carbon Cycle 2.0: Restoring balance to the carbon cycle



Balance can be restored while allowing for growth in population and well being

A technical presentation by me summarizing our knowledge of climate impacts of CO2 emissions is available at: carboncycle2.lbl.gov



Does an increase in atmospheric CO_2
influence the Earth's temperature? **Yes.**

Is CO_2 increasing, and is that increase due to human activity? **Yes.**

Can't we simply adapt to any changes
that might arise from changes in CO_2?
We don't know, but there are substantial risks...

Steve Chu's List

Gasoline and diesel-like **biofuels** generated from lumber waste, crop wastes, solid waste, and non-food crops;

Automobile batteries with three times today's energy density that can survive 15 years of deep discharges;

Photovoltaic solar power with a fully installed cost four times cheaper than today's technology;

Computer design tools for commercial and residential **buildings** that enable reductions in energy consumption of up to 80 percent with investments that will pay for themselves in less than 10 years;

Utility-scale energy storage systems so that variable renewable energy sources such as wind or solar power can become base-load power generators.

The Carbon Cycle 2.0 Initiative at Berkeley Lab

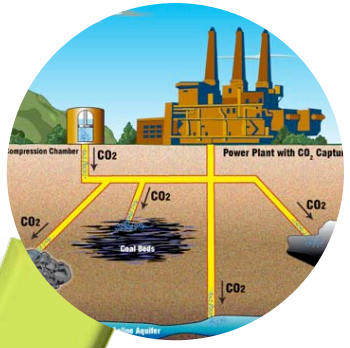
Efficiency

Combustion

Climate Modeling

Energy Analysis

Developing World

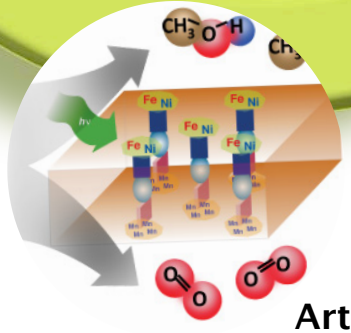


Carbon Capture & Storage

Solar PV

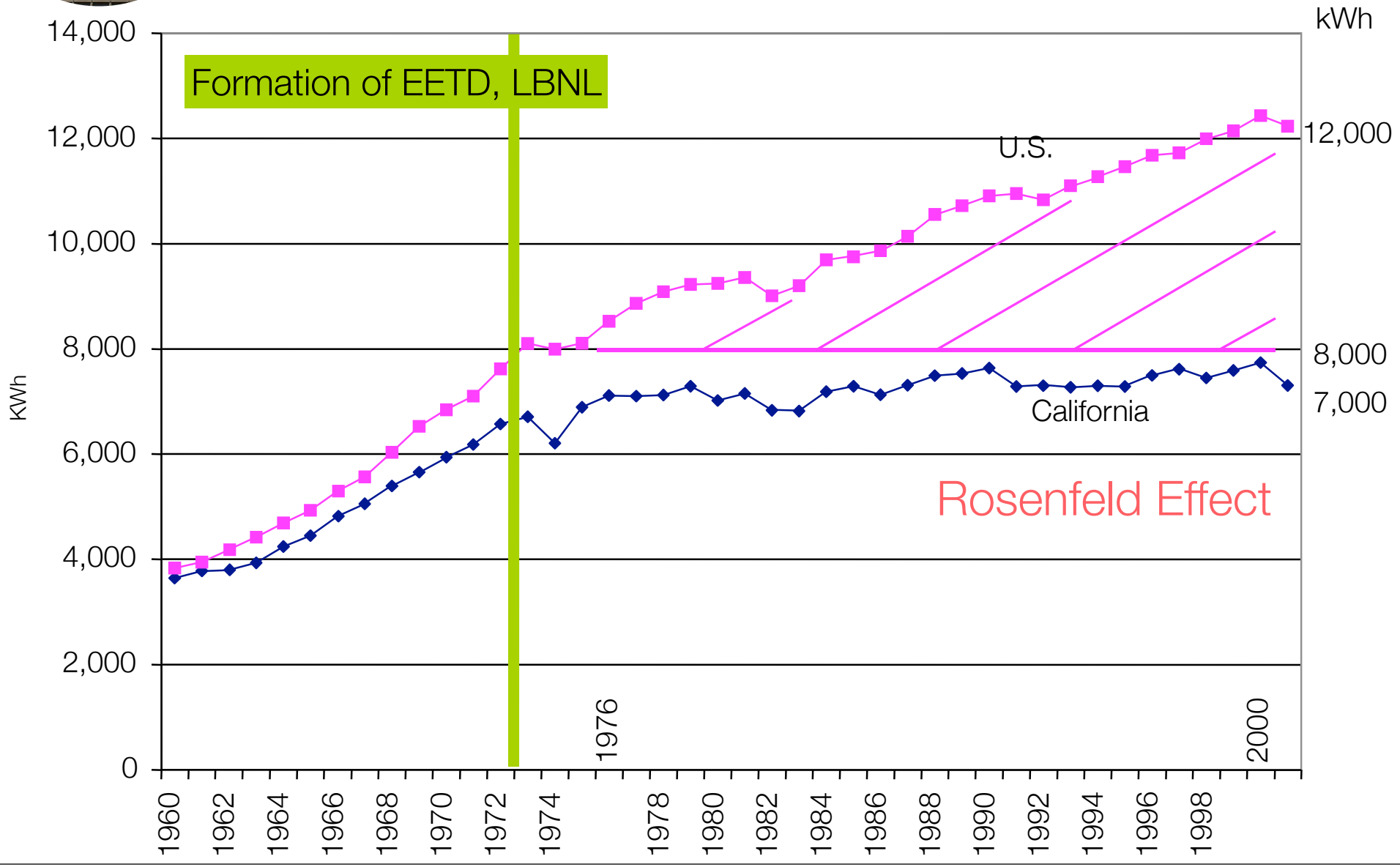
Biofuels

Energy Storage

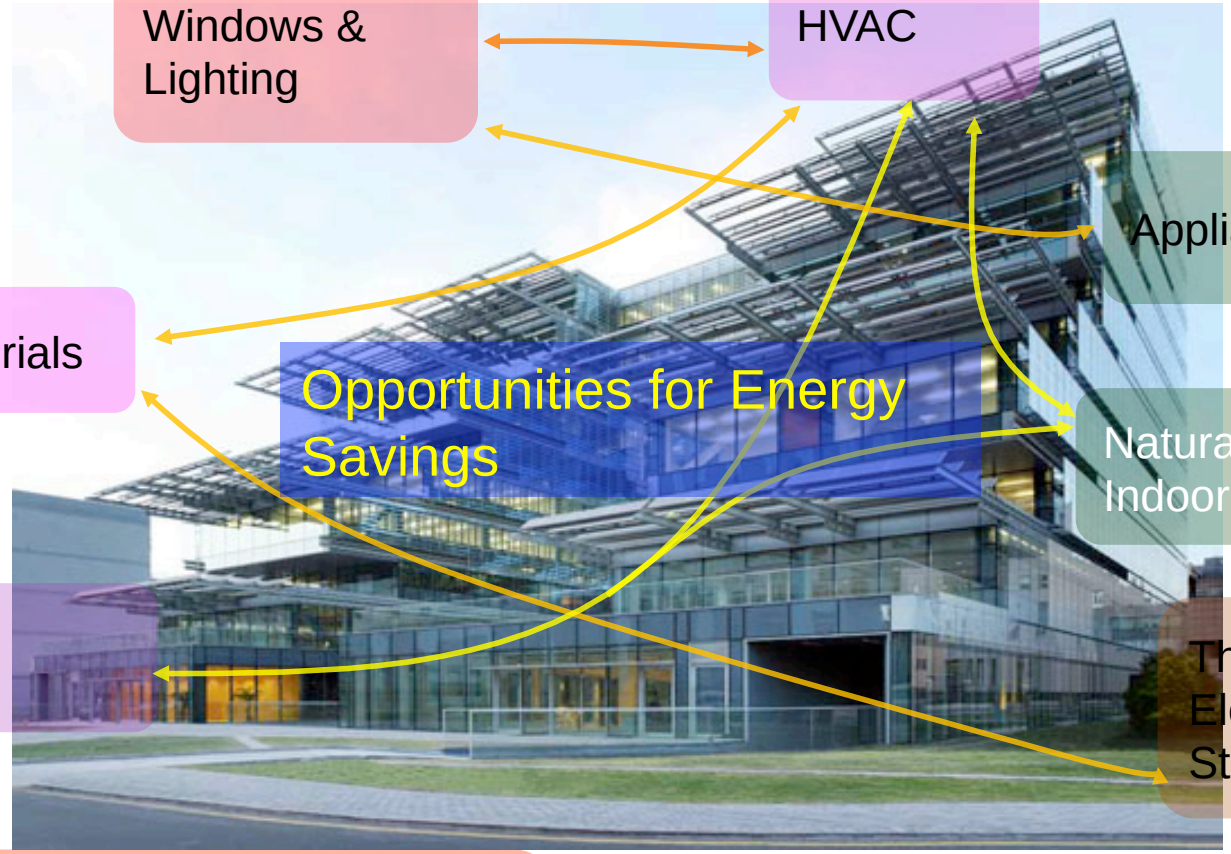


Artificial Photosynthesis

energy efficiency R&D and policy has held CA electricity consumption relatively flat vs. the US

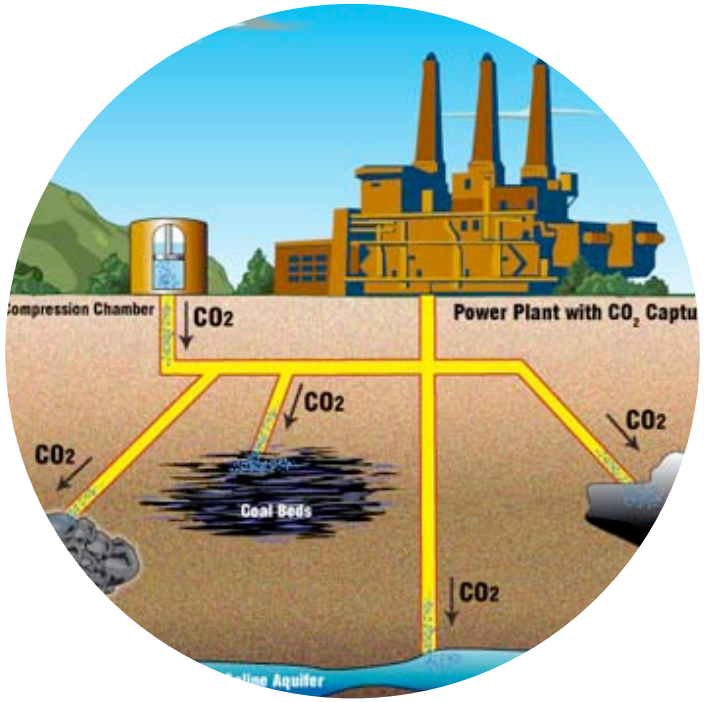


Building Efficiency- science and engineering drivers



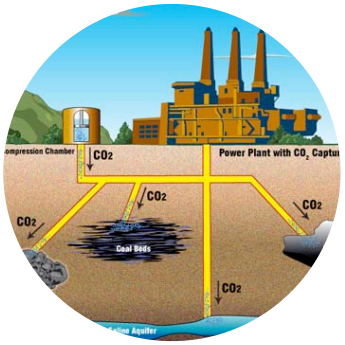
Building SPICE:
Buildings Design and Energy Analysis Tools

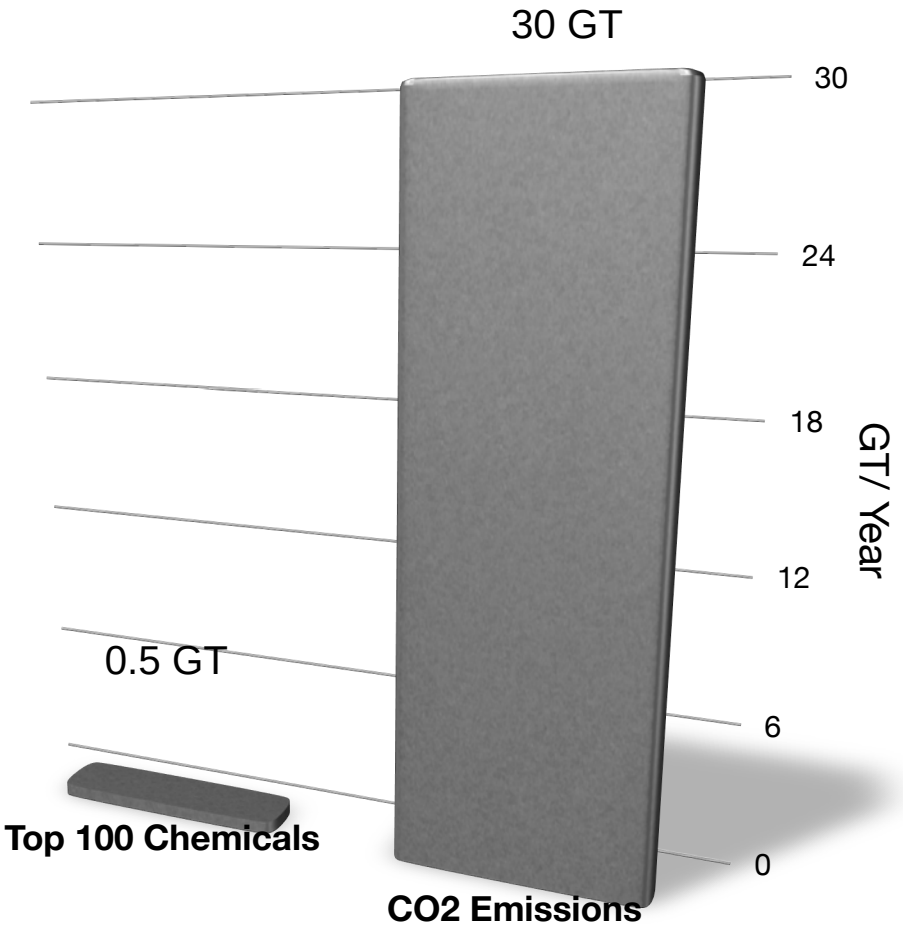
Building Operating Platform
Real-Time Sensors and Controls



Carbon Capture & Sequestration

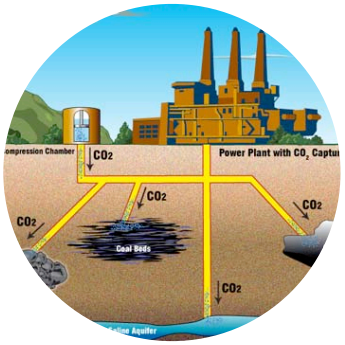
Carbon Capture and Sequestration - scale of the problem

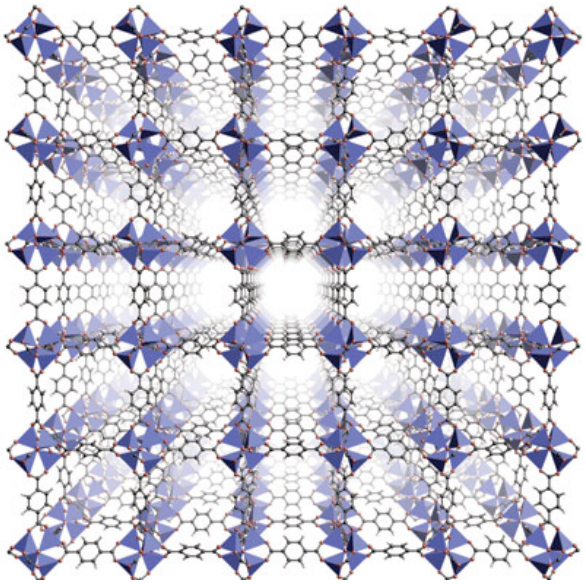




WESTCARB Pilot Sites

Carbon Capture - New materials



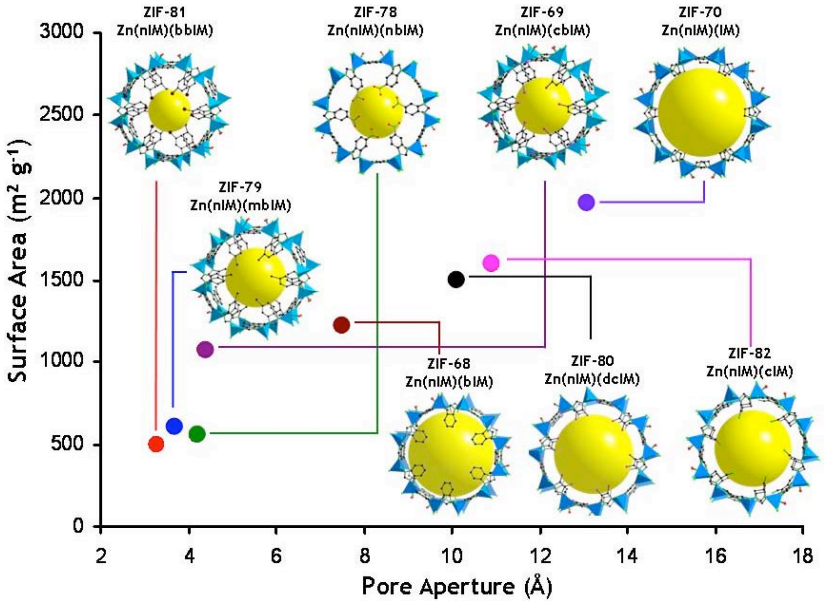


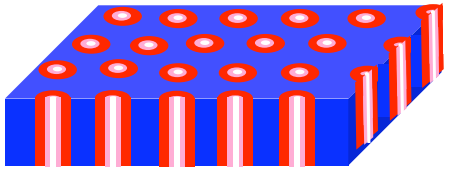
Metal Organic Frameworks

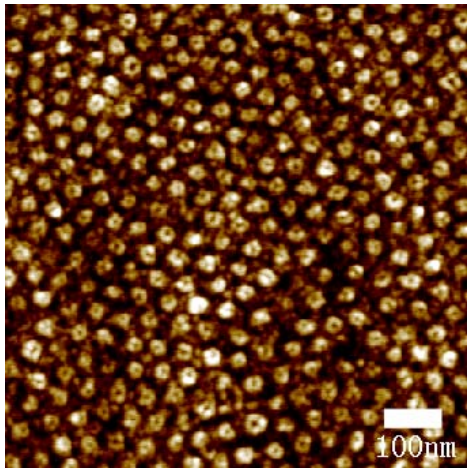
Zeolitic Imidizolate Frameworks

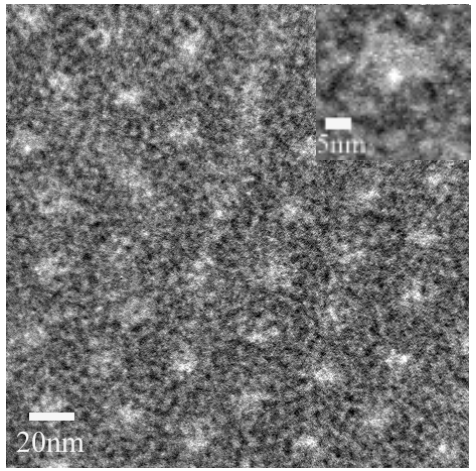
Engineered Polymer Membranes

Advanced Computation









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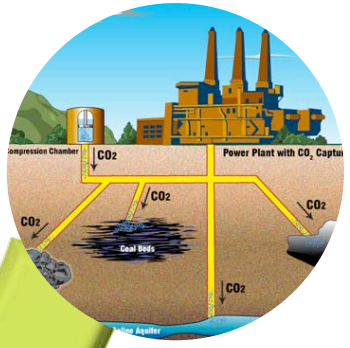

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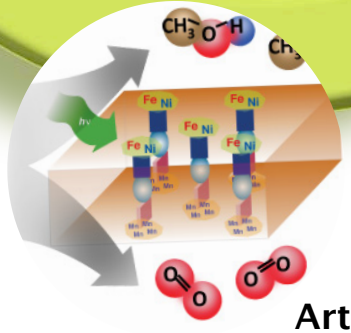
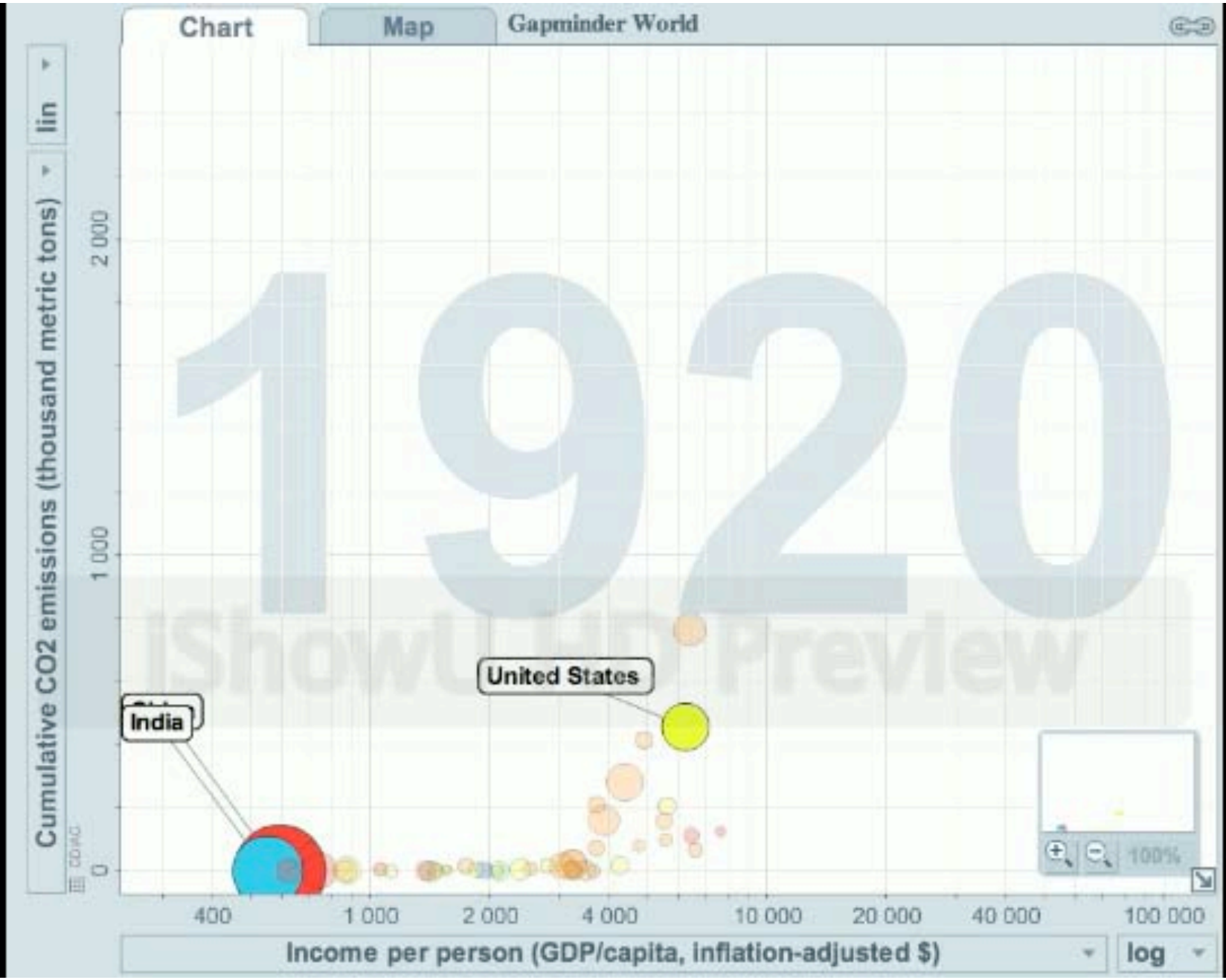


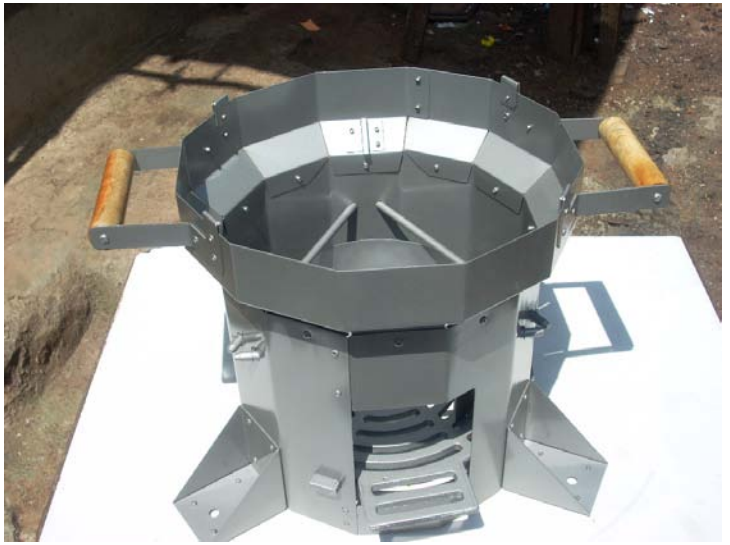
Artificial Photosynthesis

Developing World - Future in the Balance

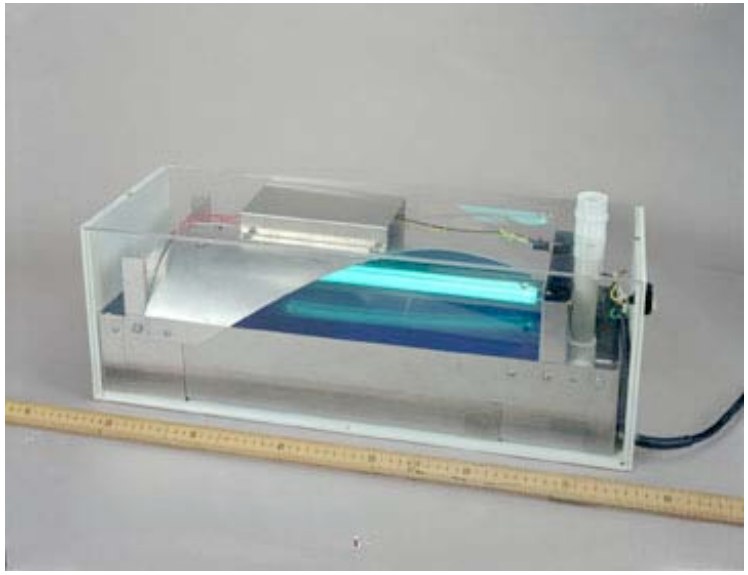


source: gapminder.org

Developing world success stories for LBNL



Berkeley Darfur Stove



UV Waterworks

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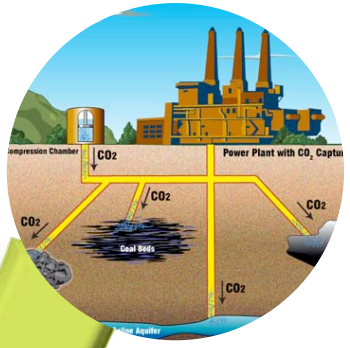

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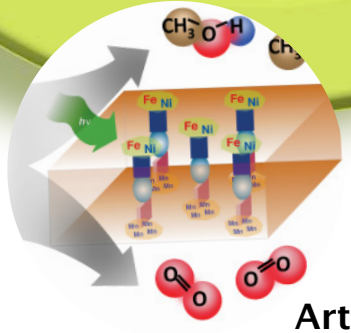
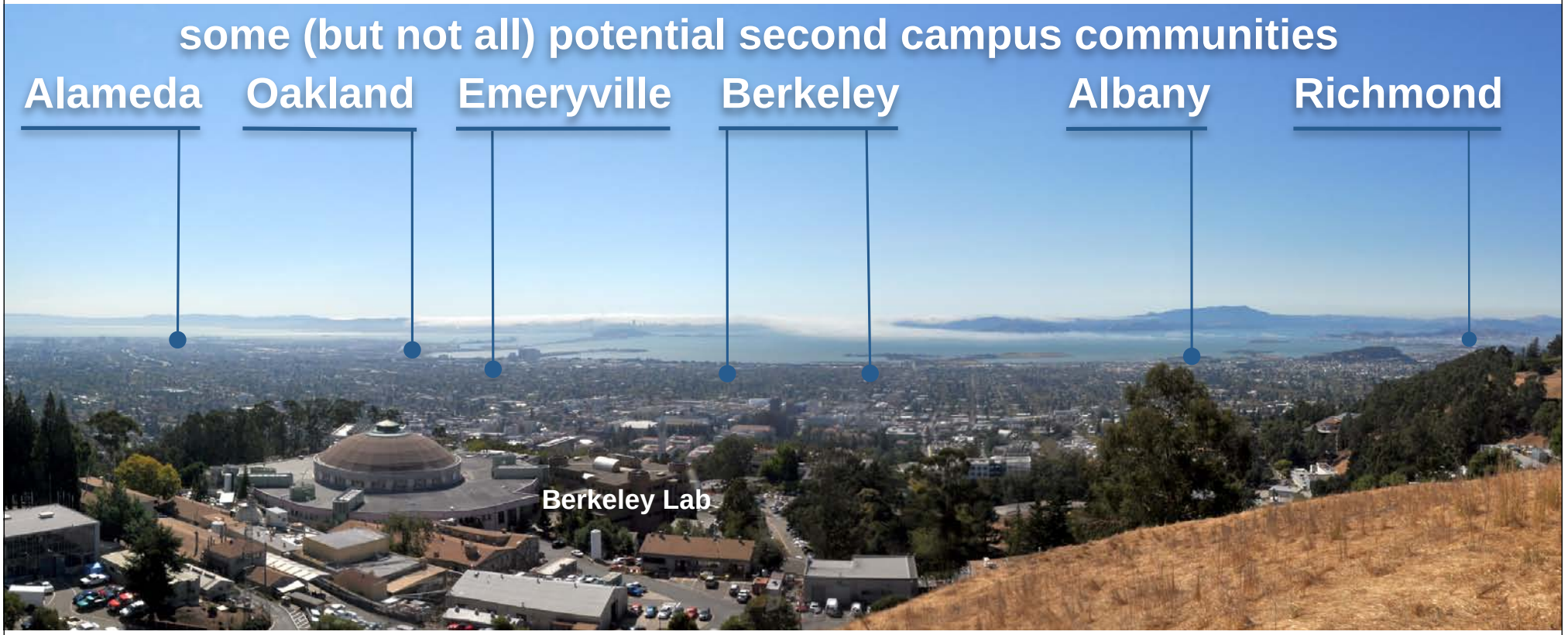


Artificial Photosynthesis

Second Campus Vision



- Consolidate programs from leased facilities at a new second campus and provide space for future growth
- Locate the campus in the San Francisco East Bay to benefit from an unmatched concentration of technology companies, world-class universities, and venture capital
- Increase cooperation with industry to speed up the innovation cycle in energy
- Accelerate the pace of innovation, technology transfer, and deployment

Community Outreach

- Science workshops and Lab visits for over 2,100 K-16 students from local communities
- Mentored research internships for 160 high school and undergraduate students
- Mentored internships for elementary and high school science teachers
- Partner Communities – Berkeley, Oakland, West Contra Costa
- Partnerships with educational, scientific, and economic development organizations

Special Campaign: early planning now underway for lab-wide volunteer effort "Cool your school" to boost science curricula in local schools