Carbon Cycle 2.0 at Berkeley Lab: Team Science for Clean Energy

- Artificial Photosynthesis
- Energy Storage
- Combustion
- Carbon Capture & Storage
- Biofuels
- Energy Analysis
- Climate Modeling
- Energy Efficiency
- Developing World
- Photovoltaics
- Energy Storage
- Artificial Photosynthesis
Opportunity for buildings energy efficiency research

A 2000 National Academy of Sciences estimate of economic benefits of energy efficiency R&D assigns $23 billion in savings to LBNL-derived technologies, and an additional $48 billion in savings from energy efficiency standards.
FLEXLAB

A new user facility for building efficiency!
series of configurable test-bed facilities to develop and evaluate low-energy, integrated building systems under realistic operating conditions
Energy Storage Research Opportunity

Goal: Batteries with five times the energy density at one-fifth the cost in five years

2013 Technology
- 70 miles
- $150/mile of range

battery densities improving at only 5% per year

2018 Goals
- 350 miles
- $30/mile of range

5 times energy density
1/5th battery cost

Argonne National Lab and Berkeley Lab created this unique partnership with other labs, universities and companies.
On May 25, 2012 Germany produced 22.4 GWp from Solar Energy

- 40% of electricity production from Solar at peak
- Total of 190 GWh production that day
- 14% of electricity produced over the 24 hr period

• The Solar Energy Storage Problem
• JCAP Mission is to demonstrate an artificial photosynthetic system that generates fuel from carbon dioxide (CO$_2$) and water (H$_2$O) using the sun’s energy

• Robust light absorbers and catalysts made of Earth abundant elements are developed and assembled into scalable prototypes for solar fuel generation

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Natural Photosynthesis

Artificial Photosynthesis

Macroscale Prototypes

inspires

Functional system using engineered materials

scale up

Goal is solar fuels tech for large scale deployment on non-arable land

suitable for km$^2$

m$^2$
Opportunity to impact global carbon cycle through technologies for developing world

source: gapminder.org
Lab Institute for Globally Transformative Technologies builds on history of success

Darfur Stove reducing CO₂ and saving lives

Safe drinking water for more than 1 million people daily

Biology to create lowest-cost malaria treatment available
Carbon Cycle 2.0 Major Programs

- **FLEXLAB**: New User Testbed Facility
- **Bay Area PV Consortium**
- **Photovoltaics**
- **Energy Storage**
- **JCESR & CalCharge**
- **Energy Efficiency**
- **Developing World**
- **New Institute: LIGTT**
- **Artificial Photosynthesis**
- **Combustion**
- **Carbon Capture & Storage**
- **Biofuels**
- **Advanced Biofuel Production Development Unit & JBEI Renewal**
- **DOE Energy Innovation Hub: JCAP**
- **Climate Modeling**
- **Energy Analysis**
- **Co-design center w/ SNL**
- **2 EFRCs; Potential Institute**

Major Programs:

- **Carbon Cycle 2.0**