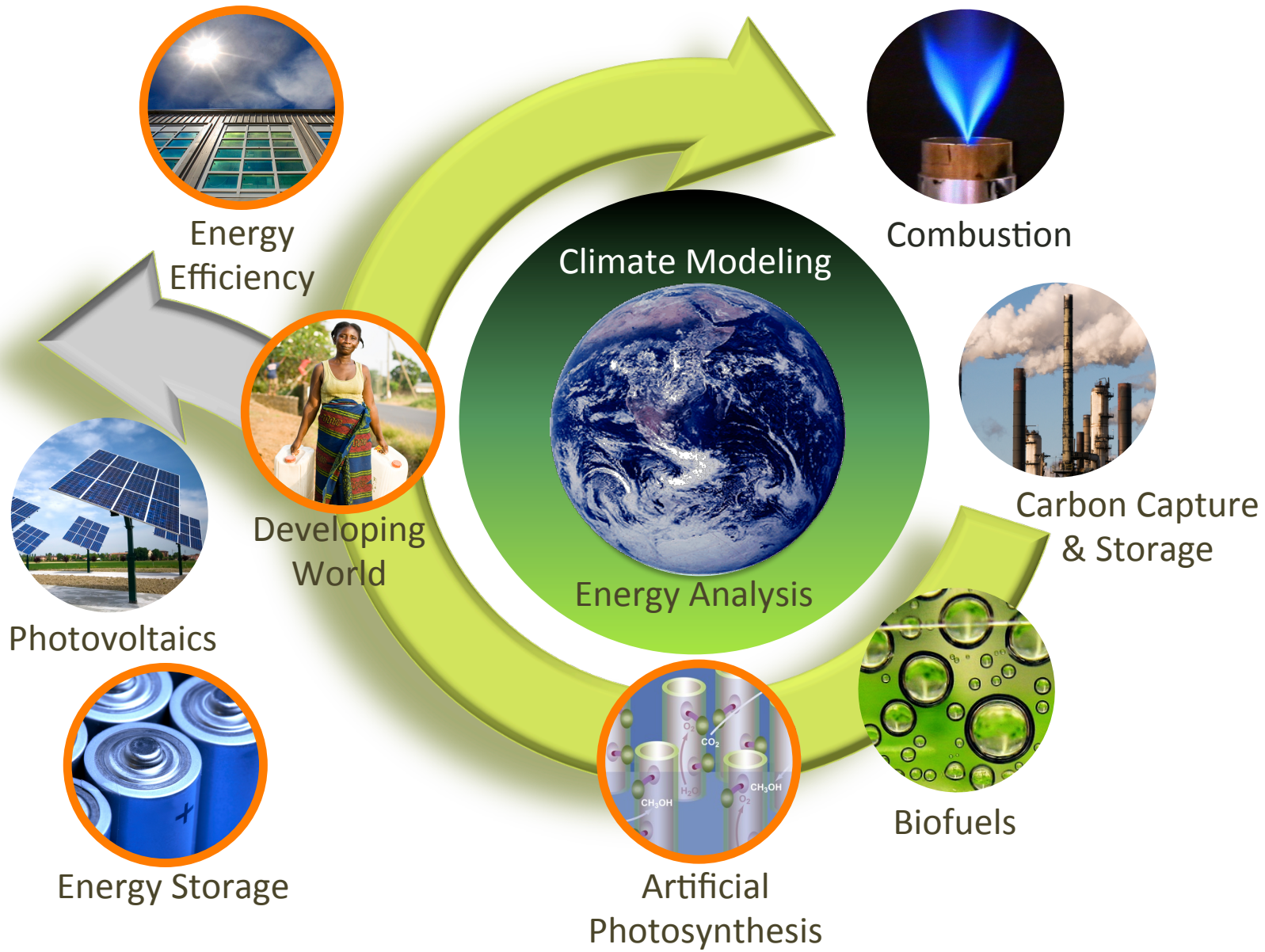
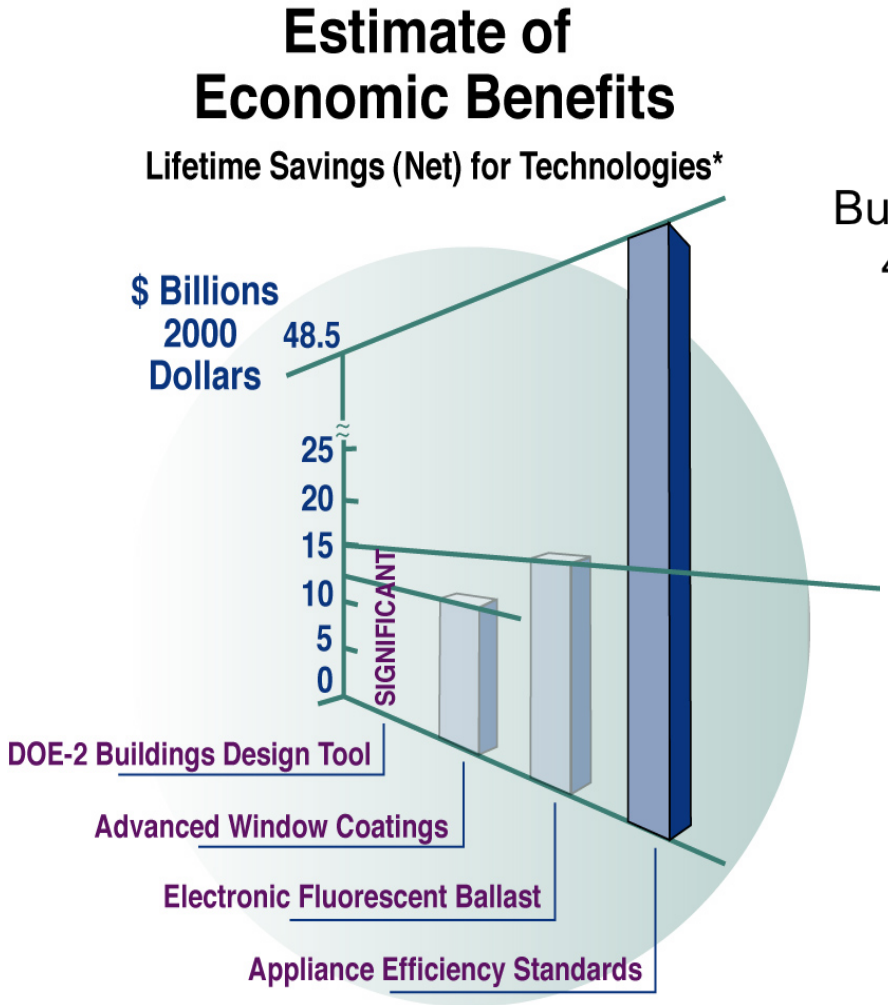
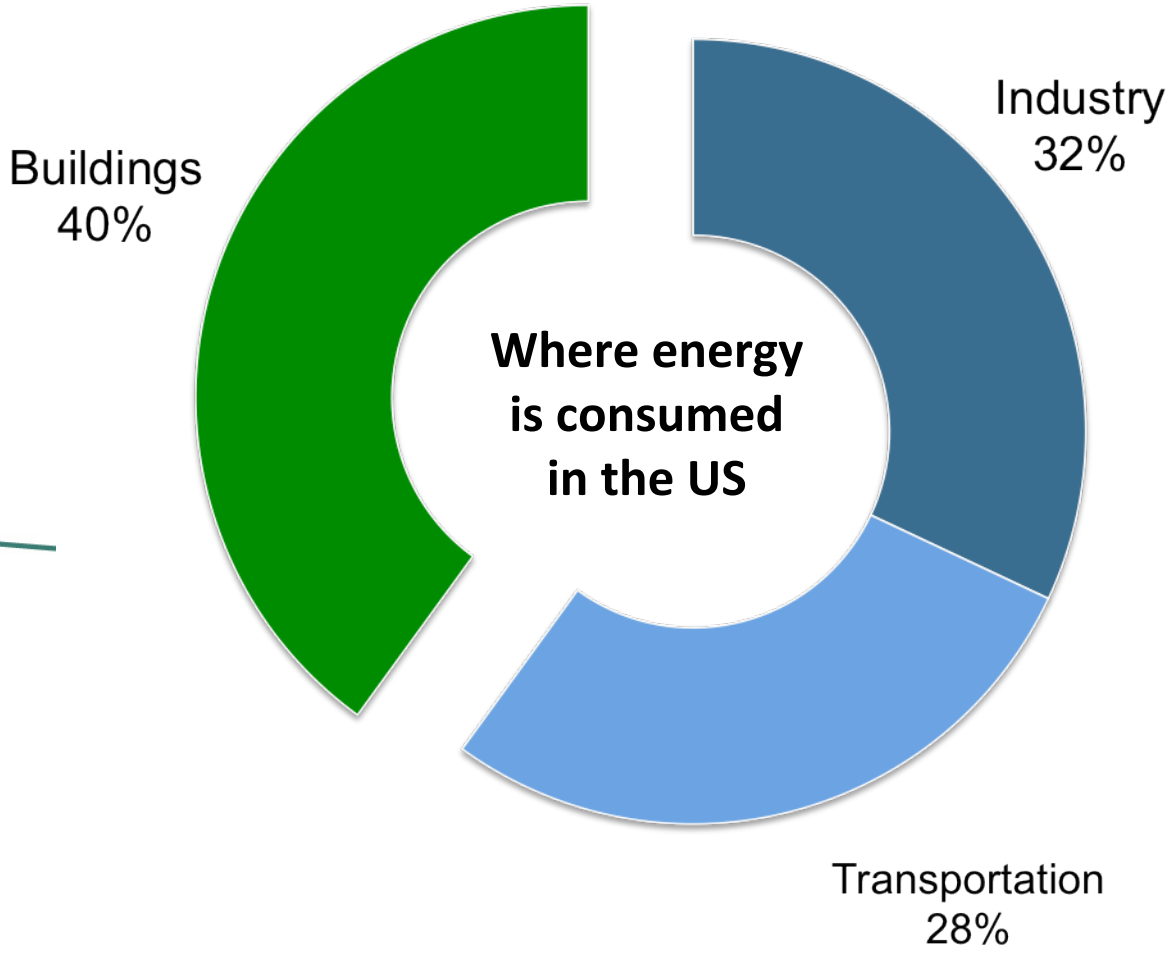
Carbon Cycle 2.0 at Berkeley Lab: Team Science for Clean Energy



Opportunity for buildings energy efficiency research



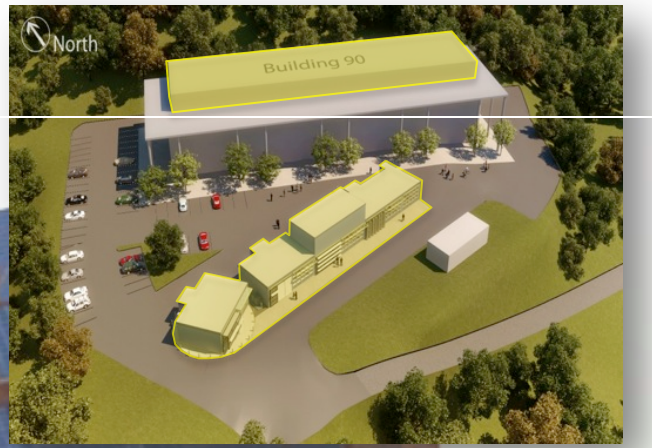


A 2000 National Academy of Sciences estimate of economic benefits of energy efficiency R&D assigns $23 billion in savings to LBNL-derived *technologies*, and an additional $48 billion in savings from energy efficiency *standards*

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

JCESR | JOINT CENTER FOR ENERGY STORAGE RESEARCH

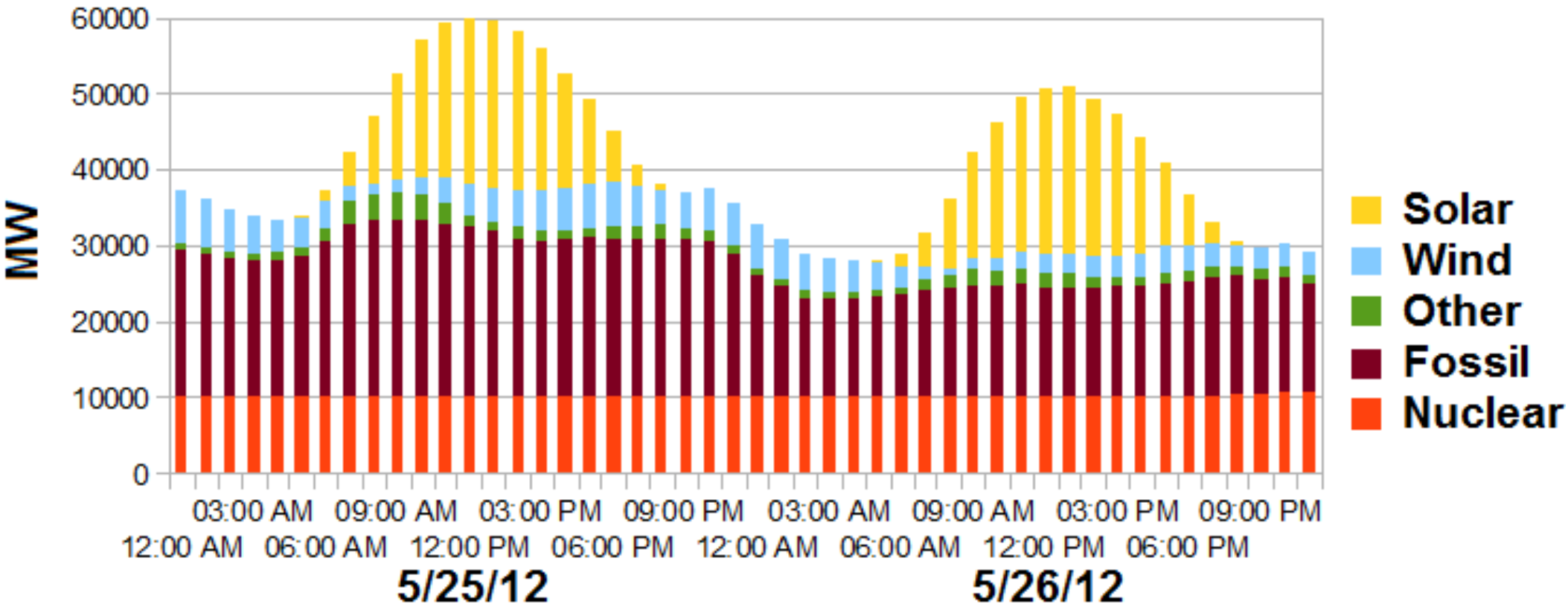
2018 Goals

5 times energy density → 350 miles

1/5th battery cost → $30/mile of range

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

Electricity production from solar and wind in Germany in 2012, Compiled by Prof. Bruno Burger, Fraunhofer ISE, October 22, 2012

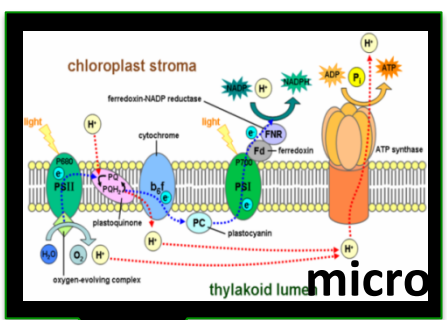
Joint Center for Artificial Photosynthesis

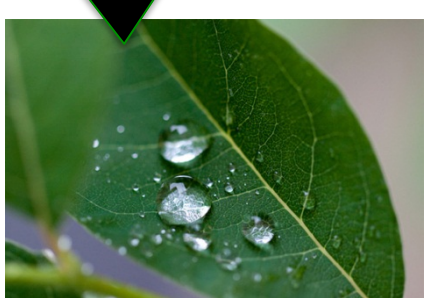
- **JCAP Mission is to demonstrate an artificial photosynthetic system that generates fuel from carbon dioxide (CO_2) and water (H_2O) using the sun's energy**

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

JCAP
JOINT CENTER FOR ARTIFICIAL PHOTOSYNTHESIS

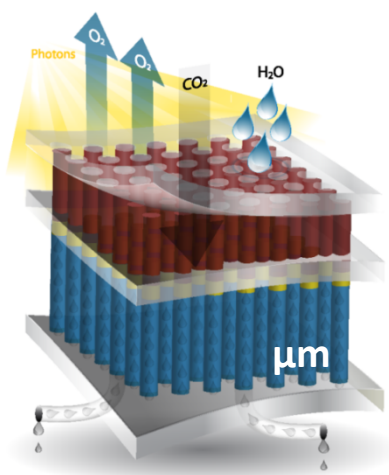
Natural Photosynthesis





inspires

Artificial Photosynthesis



fuel fuel

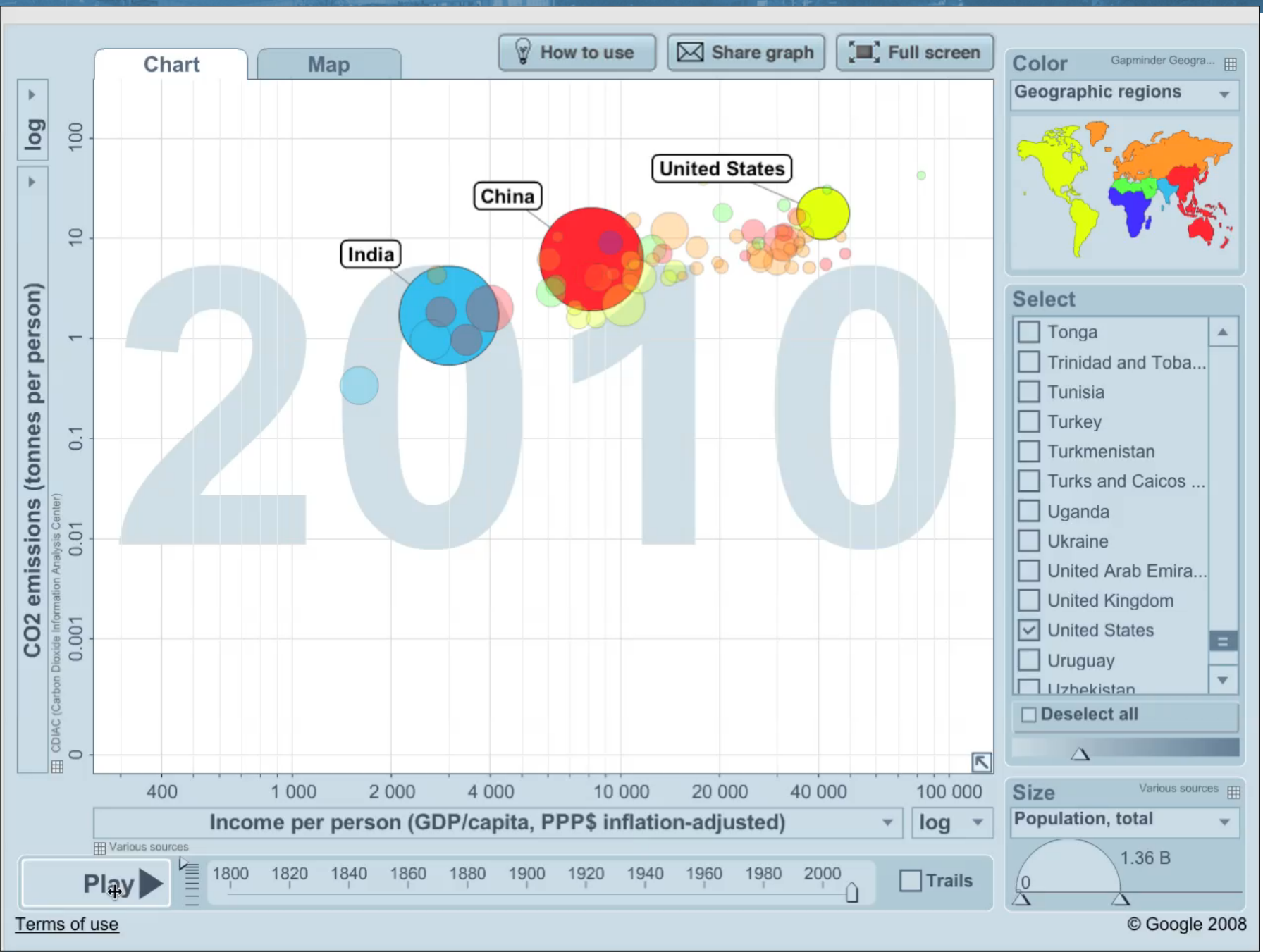
Functional system using engineered materials

scale up

Macroscale Prototypes

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

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 CO_2 and saving lives

Safe drinking water for more than 1 million people daily

Biology to create lowest-cost malaria treatment available

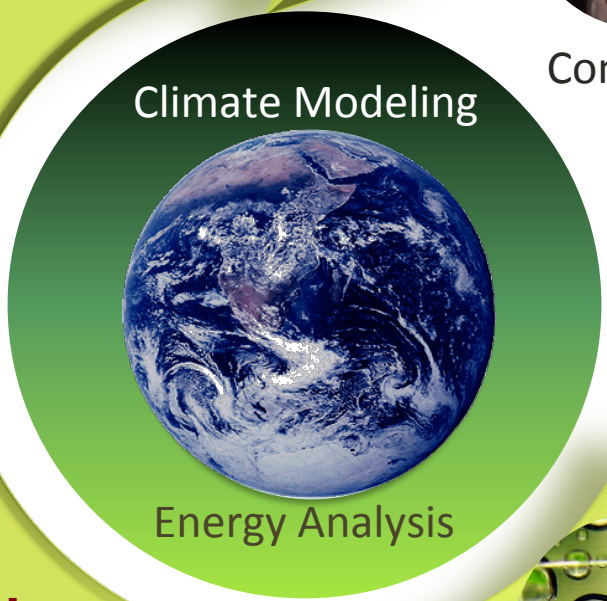
Carbon Cycle 2.0 Major Programs

FLEXLAB: New User Testbed Facility

Energy Efficiency

Combustion

Co-design center w/ SNL



Bay Area PV Consortium

Photovoltaics

Developing World

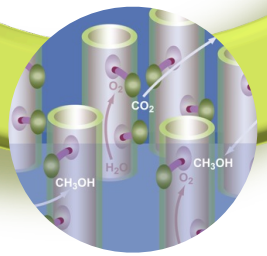
New Institute: LIGTT

Carbon Capture & Storage

2 EFRCs; Potential Institute

JCESR & CalCharge

Energy Storage



Artificial Photosynthesis

Biofuels

Advanced Biofuel Production Development Unit & JBEI Renewal

DOE Energy Innovation Hub: JCAP