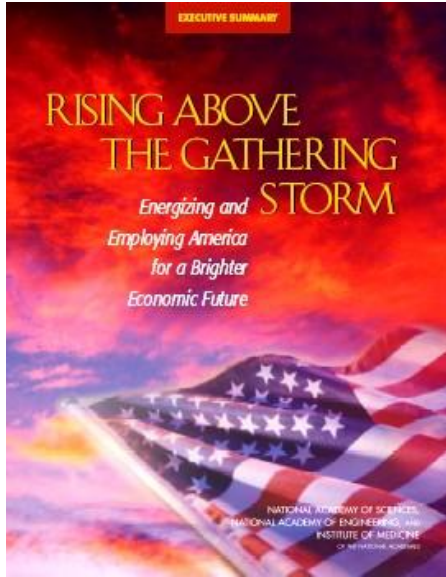




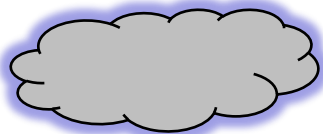
**Department of Energy  
Advanced Research Projects  
Agency - Energy**

# Advanced Research Projects Agency – Energy (ARPA-E) is a new Dept. of Energy agency for high-risk, high-impact energy R&D



**2007  
America COMPETES Act**

**2006  
*Rising Above the Gathering Storm*  
(National Academies)**



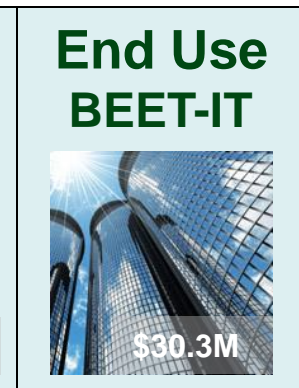
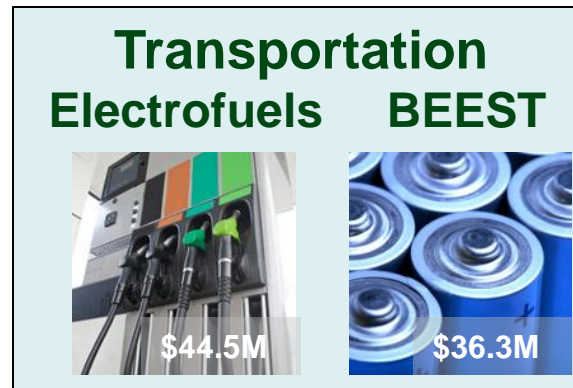
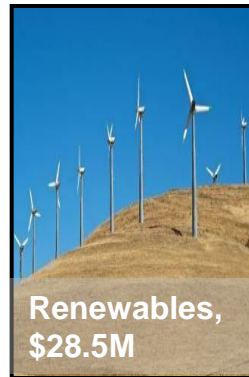
*Innovation based on science and  
engineering will be the primary driver  
of our future prosperity & security*

**2009  
American Recovery and  
Reinvestment Act**  
(\$400M appropriated for  
ARPA-E)



**President Obama  
launches ARPA-E  
at National  
Academies on April  
27, 2009**

# In year one, ARPA-E identified and invested \$366 million in 121 projects across the energy technology spectrum











**Electrofuels:** Non-photosynthetic, autotrophic biofuels  
**BEEST:** Batteries for Electrical Energy Storage in Transportation  
**BEET-IT:** Building Energy Efficiency through Innovative Thermodevices  
**ADEPT:** Agile Delivery of Electrical Power Technology  
**IMPACCT:** Innovative Materials and Processes for Advanced Carbon Capture Technologies  
**GRIDS:** Grid Scale Rampable Intermittent Dispatchable Storage

Broad Funding Opportunity \$158.4 M

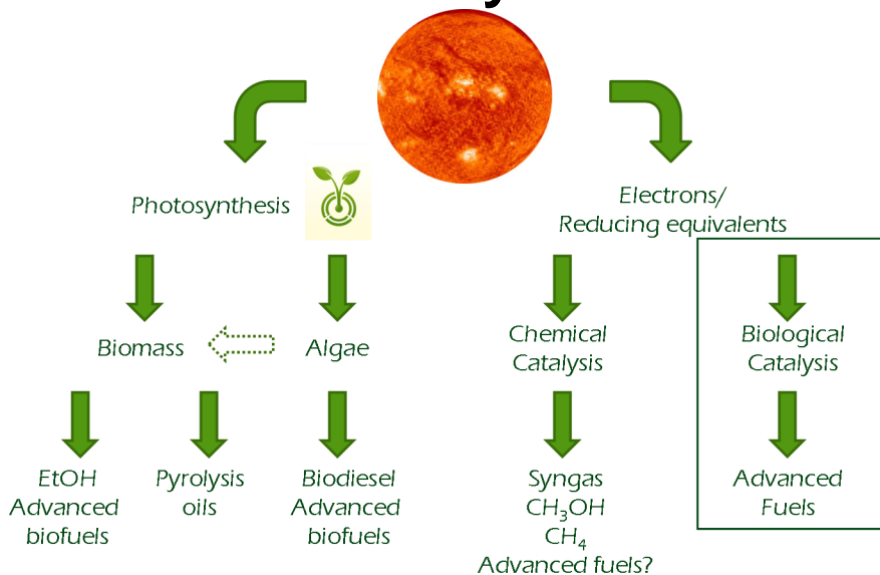
Focused Program Areas \$207.1 M

# ARPA-E's current bioenergy portfolio places investments in transformative near-to-mid term bioenergy technologies...

Near Term Technologies		
Biomass Technologies		<u>High Yielding, Low Input Energy Crops</u> Trait development to increase biomass yields while decreasing use of nitrogen fertilizers
		<u>MacroAlgae Butanol</u> Produce isobutanol from macroalgae, an advantaged, environmentally sustainable feedstock
		<u>Scaling and Commercialization of Algae Harvesting Technology</u> Transform economics of algae-based fuels by dramatic energy cost reductions
Pretreatment & Conversion		<u>Catalytic Biocrude Production in a Novel Short-Contact Time Reactor</u> Novel single step catalytic biomass pyrolysis process to maximize carbon conversion efficiency and yield a low oxygen-content biocrude
		<u>Conditionally Activated Enzymes Expressed in Cellulosic Energy Crops</u> Produce inactive enzymes within plant biomass for conditional activation, and pretreatment cost/impact reduction
Innovative Algae Technologies		<u>Cyanobacteria Designed for Solar-Powered Highly Efficient Production of Biofuels</u> Engineer photosynthetic Synechocystis cyanobacteria to enable highly efficient production and secretion of fatty acids in a continuous culture maintained in stationary phase
		<u>A Genetically Tractable Microalgae Platform for Advanced Biofuel Production</u> Empower the economic viability, versatility, and sustainability of the algae-based fuels industry via development of a genetically tractable Chlamydomonas microalgal platform
		<u>Shewanella as an Ideal Platform for Producing Hydrocarbon Biofuels</u> Develop a co-culture with photosynthetic cyanobacteria and Shewanella bacteria to produce and continuously harvest hydrocarbons for fuel production



# ...as well as “Electrofuels”, a program area for mid-to-long term solutions to many current biofuel production inefficiencies



“Electrofuels” targets the use of non-photosynthetic, autotrophic microorganisms for the production of infrastructure compatible biofuels. 13 projects, \$45M ARPA-E, \$56M Total

**The Electrofuels program is opening up a new area of research and path to biofuels**

Assimilate Reducing Equivalents: *other than reduced carbon or products from Photosystems I & II (ex. direct current, H<sub>2</sub>, H<sub>2</sub>S, etc.)*

Pathways for Carbon Fixation: *reverse TCA, Calvin- Benson, Wood-Ljungdahl, Hydroxpropionate-hydroxybutyrate, or newly designed biochemical pathways*

Fuel synthesis: *metabolic engineering to direct carbon flux to fuel products*

