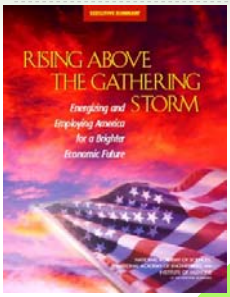
ARPA-E: Launching Energy Innovation in the 21st Century

Eric Toone, Deputy Director for Technology

Woodford Shale Summit at
the University of Oklahoma

March 29, 2011

Creation & Launching of ARPA-E



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

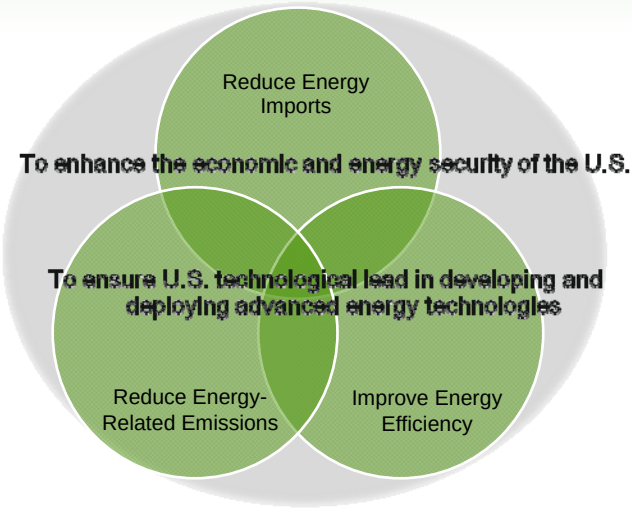
2007
America COMPETES Act

2006
Rising Above the Gathering Storm
(National Academies)

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

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

ARPA-E's Mission and Means



To overcome the long-term and high-risk technological barriers in the development of energy technologies.

(A)identifying and promoting revolutionary advances in fundamental sciences; **AND**

(B)translating scientific discoveries and cutting-edge inventions into technological innovations; **AND**

(C)accelerating transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty.

An ARPA-E Project has four main attributes

IMPACT

If successful, project could have:
- High impact on ARPA-E mission areas
- Large commercial application

BREAKTHROUGH TECHNOLOGY

Technologies that:
- Do not exist in today's energy market
- Are not just incremental improvements; could make today's technologies obsolete

ADDITIONALITY

- Difficult to move forward without ARPA-E funding
- But able to attract cost share and follow-on funding
- Not already being researched or funded by others

PEOPLE

- Best-in-class people
- Teams with both scientists and engineers
- Brings new people, talent and skill sets to energy R&D

ARPA-E Currently has six focused programs plus a broad portfolio of projects from its first solicitation

Broad Solicitation

Transportation

Electrofuels

BEEST

End-Use Efficiency

BEETIT

Stationary Power

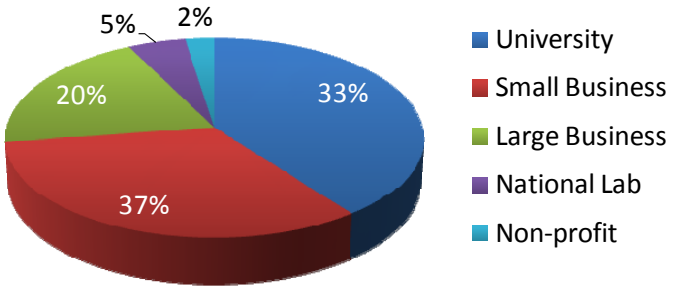
ADEPT

IMPACCT

GRIDS

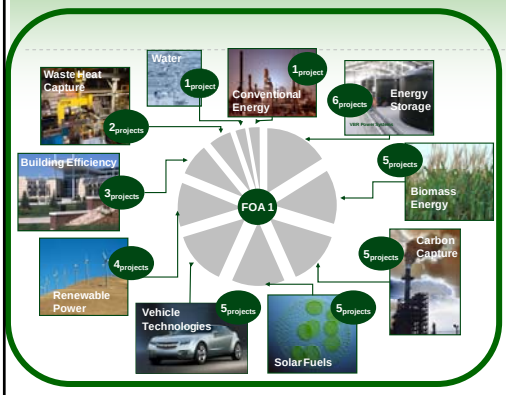
To date ARPA-E has made 121 awards from seven FOAs to a wide variety of organizations

Project Breakdown by Lead Organization Type (% based on award value)*

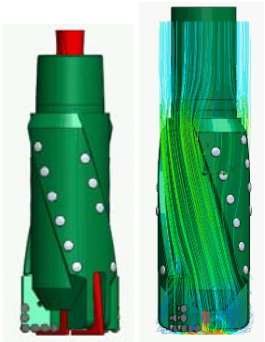


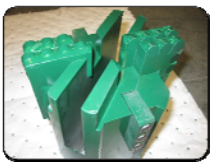
*Total Value of Awards = $366 million

FOA1



Low-contact drilling technology to enable economical geothermal wells





FORO ENERGY

Dr. Dave Danielson

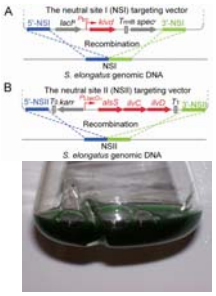
Electrofuels

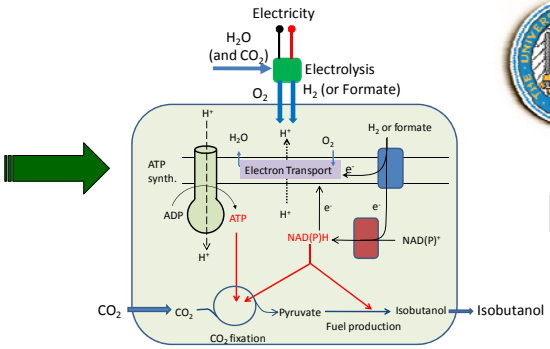
1. Assimilate Reducing Equivalents

2. Fix CO_2 for Biosynthesis

3. Generate Energy Dense Liquid Fuel

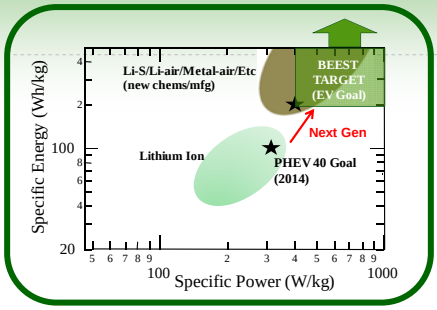
Electro-Autotrophic Synthesis of Higher Alcohols



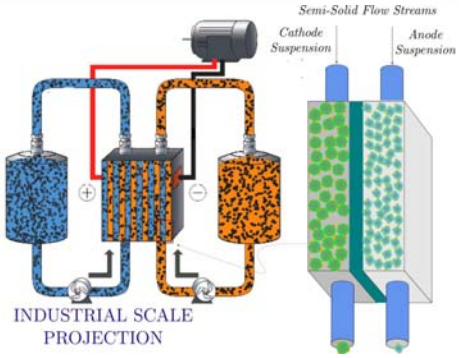


Dr. Eric Toone

BEEST



The Semi Solid Flow Cell (SSFC): Flow Batteries meet Solid Batteries

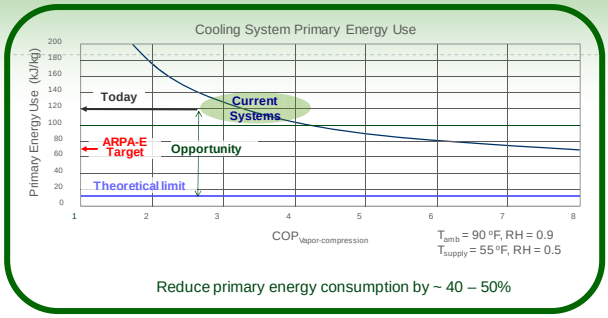


Dr. Dave Danielson

	Redox Density (M)	Voltage (V)
Aqueous Flow Battery	~ 2	~1
50% Solids SSFC	10-25	~3.5

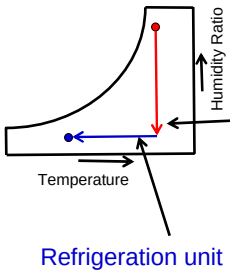
BEETIT

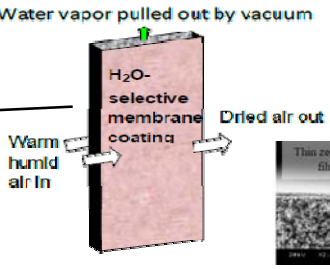
Dr. Ravi Prasher

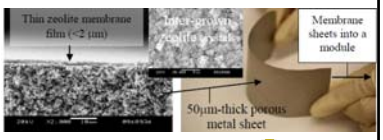


Reduce primary energy consumption by ~ 40 – 50%

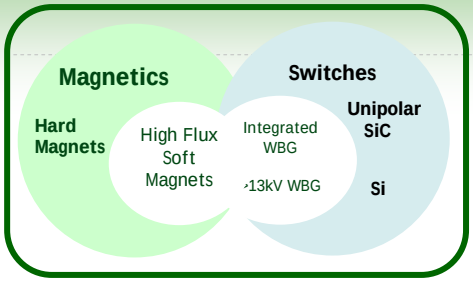
High-Efficiency, on-Line Membrane Air Dehumidifier Enabling Sensible Cooling for Warm and Humid Climates





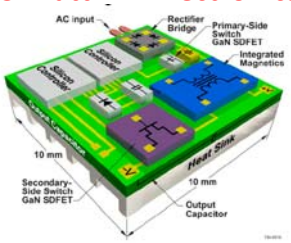


ADEPT



Chip-scale LED Driver for Commercial Lighting

25 Watt LED Electronics



300x reduction in power stage volume

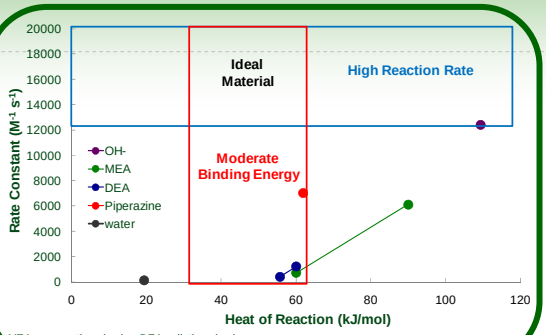
Integrated Circuits for Power Systems

- On-chip inductors and transformers
- High-voltage transistors
- High-energy capacitors

TELEDYNE SCIENTIFIC & IMAGING, LLC
A Teledyne Technologies Company

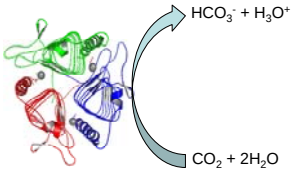
Dr. Rajeev Ram

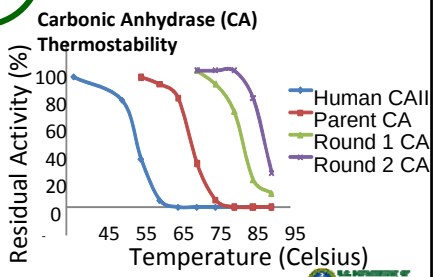
IMPACCT



MEA = monoethanolamine, DEA = diethanolamine

Low-Cost Biological Catalyst to Enable Efficient CO_2 Capture

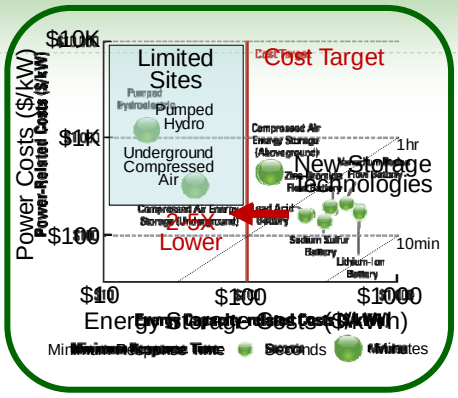




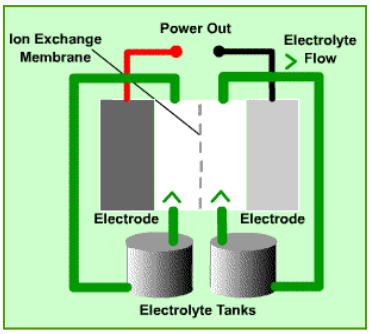
Dr. Mark Hartney

CODEXIS®

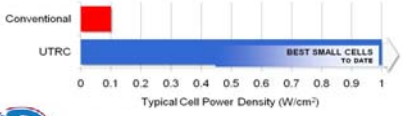
GRIDS



Transformative Electrochemical Flow Storage System



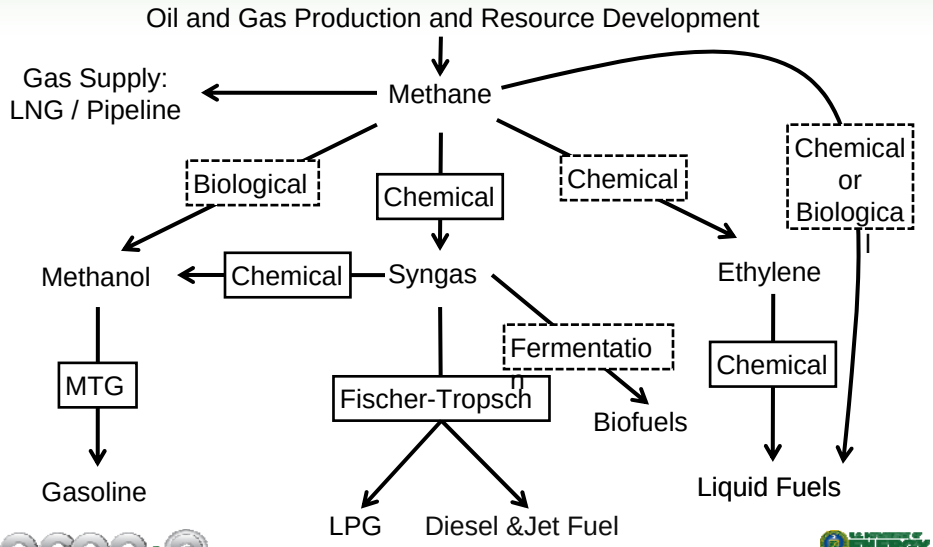
Dr. Mark Johnson



United Technologies Research Center

Clipper

Pratt & Whitney
A United Technologies Company

Pratt & Whitney Rocketdyne, Inc.

ARPA-E is interested in natural gas and had a session at our Summit called "Natural Gas Conversion to Liquid Fuels"