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Attachments:	ARPA-E_Project_Selections.pdf

Attached are the ARPA-E awards. Ceres got $5 million for "genes that enable energy crops to produce more biomass"! There are several other interesting awards is enzyme conversion and pyrolysis. After looking at this, I would like to know why our WH white paper wasn't competitive?

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ARPA-E Project Selections
Announced October 26, 2009

Lead Research Organization (Partner Organizations)	**DOE Grant Amount**	**Lead Organization Location**	**Project Description**
1366 Technologies Inc. (Massachusetts Institute of Technology – Lab for PV Research)	$4,000,000	Lexington, MA	***Renewable Power*** *(solar)* "Direct Wafer" technology to form high efficiency "monocrystalline-equivalent" silicon wafers directly from molten silicon, with potential to halve the installed cost of solar photovoltaics.
Agrivida, Inc.	$4,565,800	Medford, MA	***Biomass Energy*** Cell wall-degrading enzymes grown within the plant itself that are activated after harvest, dramatically reducing the cost of cellulosic biofuels and chemicals
Arizona State University (Fluidic Energy, Inc.)	$5,133,150	Tempe, AZ	***Energy Storage*** *A* new class of metal-air batteries using ionic liquids, with many times the energy density of today's lithium-ion batteries. Could enable long range, low cost plug-in hybrid and all-electric vehicles.
Arizona State University (Diversified Energy, North Carolina State University)	$5,205,706	Tempe, AZ	***Direct Solar Fuels*** Cyanobacteria that produce and secrete fatty acids for biofuel feedstock using just sunlight, water, and carbon dioxide as inputs.
Ceres, Inc.	$4,989,144	Thousand Oaks, CA	***Biomass Energy*** Genes that enable energy crops to produce more biomass using less land (and lower quality land), less water, and less fertilizer than standard energy crops. This approach would provide sustainable biofeedstocks to displace oil and coal for fuels and power production.
Delphi Automotive	$6,733,386	Kokomo, IN	***Vehicle Technologies***

Systems LLC (International Rectifier, Oak Ridge National Laboratory)			New power electronics technology based on a Gallium Nitride on Silicon process with innovative thermal management that can enable up to 50% more efficient power delivery from batteries to electric motors.
E.I. du Pont de Nemours and Company (Bio Architecture Lab)	$9,000,000	Wilmington, DE	***Biomass Energy*** Production of bio-butanol, an advanced biofuel, from macroalgae (seaweed). Seaweed is a potentially sustainable and scalable new source of biomass that doesn't require arable land or potable water.
EaglePicher Technologies LLC (Pacific Northwest National Laboratory)	$7,200,000	Joplin, MO	***Energy Storage*** High energy, low cost planar liquid sodium beta batteries for grid scale electrical power storage. Could enable continuous power from renewable resources, like wind and solar, and could support a highly stable and reliable grid.
Envia Systems (Argonne National Laboratory)	$4,000,000	Hayward, CA	***Energy Storage*** High energy density Lithium-ion batteries with 3x better energy density than current batteries. Based on novel nano silicon-carbon composite anodes and manganese composite cathodes discovered at Argonne National Laboratory. Could lower the cost and speed the adoption of plug-in hybrids and electric vehicles.
Exelus, Inc. (Zeolyst International, Linde Process Plants)	$1,000,000	Livingston, NJ	***Oil & Gas*** A novel catalyst to convert the olefins in refinery off-gas, which is currently flared and lost, into high-octane alkylate fuel. Could enable recovery up to 45 million barrels per year of gasoline.
FastCAP Systems Corporation (MIT)	$5,349,932	Cambridge, MA	***Energy Storage*** A nanotube enhanced ultracapacitor with energy density approaching that of standard batteries, but with many times greater power density and thousands of times the cycle

			life. Could greatly reduce the cost of hybrid and electric vehicles and of grid-scale storage.
FloDesign Wind Turbine Corp.	$8,325,400	Wibraham, MA	***Renewable Power*** *(wind)* A new high efficiency shrouded wind turbine able to deliver significantly more energy per unit of swept area. Could also reduce noise and safety concerns, enabling distributed wind applications.
Foro Energy, Inc.	$9,151,300	Littleton, CO	***Renewable Power*** *(geothermal)* A new hybrid thermal/mechanical drilling technology for much faster drilling with less wear and tear on the drill bit. Could open up cost effective access to the geothermal energy in deep, hard basement rock, a potentially huge new source of domestically available, carbon-free baseload power.
General Motors Company (University of Michigan, HRL Laboratories, LLC, Dynalloy, Inc.)	$2,655,174	Warren, MI	***Vehicle Technologies*** A shape memory alloy (SMA) energy recovery device to convert waste heat from car engines into electricity. Could significantly increase fuel efficiency in cars (most energy is lost as heat) and could be used in many other heat recovery applications.
Inorganic Specialists, Inc. (Ultramet, Inc., EaglePicher, Southeast Nonwovens, EMTEC)	$1,999,447	Miamisburg, OH	***Energy Storage*** A silicon-coated carbon nanofiber paper for the anode of next generation Lithium-ion batteries. These low cost, manufacturable batteries could accelerate the deployment of plug-in hybrids and electric vehicles, shifting U.S. transportation energy from imported oil to the grid.
Iowa State University (Purdue University)	$4,373,488	Armes, IA	***Direct Solar Fuels*** Metabolic engineering and synthetic biology approaches to increase lipid production, carbon dioxide uptake, and thermal tolerance of algae for the production of biofuels directly from

			sunlight and CO_2. Could make algae-based biofuels production economically viable.
ITN Energy Systems, Inc. (MAG Industrial Automation Systems, EPRI, Colorado School of Mines)	$4,986,249	Littleton, CO	***Building Efficiency*** Solid-state electrochromic film on plastic substrates with roll-to-roll production process to substantially reduce the cost of electrically controlled smart windows for net-zero energy buildings. These windows reduce heating and cooling loads and minimize overhead lighting use.
Lehigh University	$566,641	Bethlehem, PA	***Carbon Capture*** Electric field swing adsorption for carbon capture using high surface area conductive solid carbon sorbents. Uses electric fields to change the interaction of molecules on a surface, capturing and then releasing the CO_2 using far less energy than current approaches.
Massachusetts Institute of Technology	$6,949,624	Cambridge, MA	***Energy Storage*** An all liquid metal grid-scale battery for low cost, large scale storage of electrical energy. This new class of batteries could enable continuous power supply from renewable energy sources, such as wind and solar and a more stable, reliable grid.
Michigan State University	$2,540,631	East Lansing, MI	***Vehicle Technologies*** The wave disc engine, a gas-fueled electric generator that is five times more efficient than traditional engines for electricity production, as well as lighter and cheaper to manufacture. Could replace current generators for plug-in hybrid electric vehicles.
Momentive Performance Materials (Soraa, Advanced Photonic Crystals)	$4,519,259	Strongsville, OH	***Building Efficiency*** A high-pressure ammonothermal process for the inexpensive production of high quality, single crystal GaN substrates at high crystal growth rates. Could allow

			production of light emitting diodes (LEDs) at costs equal to current low-cost fluorescent lighting. LED lighting consumes as little as one tenth of the energy of current lighting options.
Nalco Company (Argonne National Laboratory, Argonne, IL USA)	$2,250,487	Naperville, IL	***Carbon Capture*** An electrochemical process for CO_2 capture using Resin-Wafer Electrodeionization. Uses pH changes to adsorb and desorb CO_2 from flue gas without energy intensive, costly processes such as heating or a vacuum.
NanOasis Technologies, Inc.	$2,031,252	Richmond, CA	***Water*** Carbon nanotubes for reverse osmosis membranes that require less energy and have many times higher flux. Could dramatically reduce the cost and energy required for desalination to supply fresh water for our crops and communities.
Ohio State University (PSRI, CONSOL Energy, Inc., Shell/CRI, The Babcock and Wilcox Company)	$5,000,000	Columbus, OH	***Carbon Capture*** Syngas Chemical Looping (SCL) to convert coal or biomass into electricity while efficiently capturing the CO2. Hass successfully been demonstrated at laboratory scale; this project will scale it up to a pilot plant at the National Carbon Capture Center.
PAX Streamline, Inc. (Georgia Tech Research Institute)	$3,000,000	San Rafael, CA	***Renewable Power*** *(wind)* "Blown Wing" technology for wind turbines. Creates a virtual airfoil by jetting compressed air along a wing. Can be dynamically adjusted to maximize power under a wide range of wind conditions. A new design that can be manufactured at a fraction of the cost.
Pennsylvania State University (Sentech Corporation)	$1,900,067	University Park, PA	***Direct Solar Fuels*** Catalyst-coated titanium dioxide nanotube membranes to convert sunlight, carbon dioxide and water into methane and other hydrocarbon

			fuels.
Phononic Devices, Inc (University of Oklahoma, California Institute of Technology, University of California at Santa Cruz)	$3,000,000	Norman, OK	***Waste Heat Capture*** A new class of high efficiency thermoelectric devices and materials that use thermally insulating semiconductors with high thermal-to-electric conversion efficiencies. An astounding [60%] of U.S. energy is lost in the form of waste heat – from power plants, industrial processes, and vehicles. High efficiency thermoelectrics hold great promise to tap into this vast hidden energy resource while reducing U.S. greenhouse gas emissions.
Porifera Inc. (University of California Berkeley, Lawrence Livermore National Laboratory)	$1,077,992	Hayward, CA	***Carbon Capture*** Carbon nanotubes integrated into polymer membranes to increase the flux of CO_2 capture membranes by two orders of magnitude. Could enable much less expensive carbon.
RTI International (Archer Daniels Midland Company, ConocoPhillips, Albemarle Corporation)	$3,111,693	Research Triangle Park, NC	***Biomass Energy*** A single-step catalytic biomass pyrolysis process with high carbon conversion efficiency to produce a stable bio-crude "oil" with low oxygen content. The approach combines pyrolysis oil production, stabilization, and upgrading into one process.
Stanford University	$4,992,651	Stanford, CA	***Building Efficiency*** Sensors, software, and controls to track and improve energy use patterns. Could lead to substantial reductions in building energy use by changing human behavior through timely information and usable controls.
Sun Catalytix Corporation	$4,085,350	Cambridge, MA	***Direct Solar Fuels / Energy Storage*** A novel catalyst to greatly enhance

			the efficiency of splitting water into hydrogen and oxygen. An important platform technology for the production of solar fuels and for distributed energy storage systems.
United Technologies Research Center (Hamilton Sundstrand, CM-Tech, Inc., Worley-Parsons, Columbia University)	$2,251,183	East Hartford, CT	***Carbon Capture*** Synthetic enzymes for capturing CO_2 from coal plant flue gas streams. Uses a synthetic form of the enzyme carbonic anhydrase, which our bodies use to remove CO_2. Could dramatically reduce the cost of carbon capture.
Univenture, Inc. (Rockwell Automation, Ohio University, Case Western Reserve University)	$5,992,697	Marysville, OH	***Biomass Energy / Direct Solar Fuels*** A novel algae harvesting system that could dramatically reduce the energy cost necessary to harvest, dewater, and dry algae by using a novel absorbent moving belt harvester. This technology offers the potential to transform the economics of algae-based biofuel production by removing a major barrier to large scale commercialization.
University of California, Riverside	$760,705	Riverside, CA	***Vehicle Technologies*** Alkaline polymer electrolyte fuel cell membranes that eliminate the use of expensive catalyst materials. Potential to drastically reduce fuel cell costs and enable their widespread application in building and automotive applications.
University of Delaware (University of Nebraska-Lincoln, Northeastern University, Virginia Commonwealth University, Ames	$4,462,162	Newark, DE	***Vehicle Technologies*** Novel high energy density, low rare-earth content magnetic materials with double the energy density of current materials. Would decrease the weight and increase the efficiency of motors for hybrid, plug-in hybrid, and electric vehicles and generators for advanced wind turbines. Also could greatly reduce

Laboratory, Electron Energy Corporation)			U.S. imports of key rare-earth elements that are not domestically available.
University of Illinois (MC10, Inc.)	$1,715,752	Urbana, IL	***Waste Heat Capture*** A novel thermoelectric waste heat harvesting device based on large area arrays of 1-D concentric silicon nanotubes. Can be inexpensively printed as stacked thermoelectric junctions. This low cost thermoelectric technology holds great promise to allow the U.S. to begin to harvest the more than 60% of its energy that it loses in the form of waste heat.
University of Minnesota (BioCee, Inc.)	$2,200,000	St. Paul, MN	***Direct Solar Fuels*** Production of liquid hydrocarbon transportation fuels directly from sunlight, water and CO2 using an artificial symbiotic colony of photosynthetic cyanobacteria and *Shewanella*, a hydrocarbon producing bacteria.