ARPA-E Project Selections – TECHNICAL DESCRIPTIONS

September 10, 2010

These projects have been selected for negotiation of awards; final award amounts may vary.

Lead Research Organization (Partner Organizations)	**Amount**	**Lead Organization Location** (City, State)	***Technology Focus – Application: Project Title*** **Project Description**
Dais Analytic Corporation	$680,000	Odessa, FL	*Nanotechnology Membrane-Based Dehumidifier* In warm and humid climates, the need to remove moisture out of the air significantly reduces the efficiency of air conditioning. The Dais Analytic Corporation will scale in size and field trial a novel dehumidification system. The system operates by directly manipulating water vapor using a selectively permeable membrane. The membrane, made of a nano-structured solid polymer, is permeable to moisture but not permeable to air. The system creates a vacuum behind the membrane that pulls water vapor from air without changing its temperature. The vapor is expirated to the environment through a second set of membranes external to the controlled environment. The system promises significantly reduced energy consumption for air cooling in warm and humid climates and reduced future CO2 emission growth from the HVAC sector.
GE Global Research	$2,249,980	Niskayuna, NY	*Transformational Nanostructured Permanent Magnets* In this project, General Electric Global Research (GE) will develop cost competitive next-generation permanent magnets with magnetic energy product of at least 80 MGOe and 80% less rare-earth mineral content. To increase the magnet's energy product, GE will develop bulk proprietary nanostructured consolidated and fully dense microstructures and will demonstrate for the first time a bulk exchange-spring nanocomposite permanent magnet. This transformational permanent magnet performance result will exceed the maximum theoretical energy product of the state-of-the-art Nd2Fe14B at 64 MGOe. The impact of these new magnets is to increase the efficiency and power density of electric machines while reducing raw material cost. These magnets will enable further market penetration of hybrid vehicles and wind turbine generators, while enhancing US competitiveness in rare-earth mineral based products.
Makani Power, Inc.	$3,000,000	Alameda, CA	*Airborne Wind Turbine* The Makani Airborne Wind Turbine (AWT) converts wind energy into grid-quality, utility scale electricity using tethered, high-performance wings outfitted with turbines. Power is extracted from this motion by the wing-mounted turbines and transmitted to the ground through an electrically-conductive tether. However, because the wing is not constrained to rotate

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			about a hub, it can sweep a much larger section of the sky than a conventional wind turbine and fly at a higher altitude where the wind is both stronger and more consistent. These advantages result in a system that can deliver a capacity factor of 60% and with lower overall mass. Makani will develop a prototype that will be used to validate the design of the full scale system, which will reduce the cost of electricity compared to conventional horizontal axis wind turbines.
Sustainable Energy Solutions (GE, American Air Liquide, BYU)	$750,000	Provo, UT	*Cryogenic Carbon Capture* Cryogenic carbon capture (CCC) is the process of removing carbon dioxide (CO2) from flue gas by desublimation, followed by compression and transport of CO2 in the condensed phase. With emerging process equipment and design concepts, CCC has the potential to be more efficient and less expensive than current solvent-based CO2 separation technologies. Sustainable Energy Solutions will develop and validate novel process components, and design a CCC prototype system suitable for testing at coal-fired power plants. The approach is estimated to provide a 50% energy reduction for capturing CO2, in comparison to state-of-the-art amine-based solvent processes.
Teledyne Scientific & Imaging, LLC (University of Maryland)	$500,000	Thousand Oaks, CA	*Optofluidic Solar Concentrators* Currently tracking of solar radiation in concentrated photovoltaic systems is provided by mechanical means with multiple moving parts which raises reliability concerns. These systems are also bulky. Teledyne Scientific & Imaging (TS&I) and its team member, the University of Maryland, propose to develop a solar concentrator using a novel optofluidic system. The implementation of the proposed optofluidic system is based on electrowetting. The electrowetting effect controls the contact angle of a liquid on a hydrophobic surface through the application of an electric field. With two immiscible fluids in a transparent cell, they can actively control the contact angle along the fluid-fluid-solid tri-junction line and hence the orientation of the fluid-fluid interface via electrowetting. The naturally-formed meniscus between the two liquids can function as an optical prism. Without any mechanical moving parts, this dynamic liquid prism allows the device to adaptively track both the daily and seasonal changes of the Sun's orbit, i.e., dual-axis tracking. This innovative technology reduces capital costs for concentrating photovoltaics (CPV) and increases operational efficiency by eliminating the power consumption of mechanical tracking. Most importantly, the elimination of bulky tracking hardware and quiet operation will allow extensive residential deployment of concentrated solar power.

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University of California Los Angeles (UCLA) (Jet Propulsion Laboratory)	$2,420,802	Los Angeles, CA	*Thermal Energy Storage with Supercritical Fluids* Two-tank molten salt is currently the preferred state-of-the-art thermal energy storage for solar thermal power plants. The UCLA-led team will develop a thermal energy storage system which will significantly reduce the cost and increase the volumetric and mass based energy density. This team will develop and implement a supercritical fluid based thermal energy storage system designed to operate both at moderate (100 – 200 oC) and high temperatures (300 – 550 oC) with a modular single-tank design. Supercritical storage enables high volumetric energy density due to the high density of the supercritical state and the ability to provide high temperature storage. The team will identify and develop fluids with high specific storage capacity and design tanks to enable cost-effective small footprint storage of solar thermal power. For high temperature storage the volumetric energy density will potentially increase by over a factor of 2 when compared to two-tank molten salt systems, with a cost less than 70% of the molten salt system.
TOTAL FUNDING	**$9,600,782**		