

ARRA Energy Storage Demonstrations

AWARDEE (TECHNOLOGY)	SIZE- POWER (ENERGY)	APPLICATION	TITLE-DESCRIPTION	LOCATION	UTILITY	FUNDING: ARRA (TOTAL)	ESTIMATED COMMISSION- ING DATE
1. BATTERY STORAGE FOR UTILITY LOAD SHIFTING OR FOR WIND FARM DIURNAL OPERATIONS AND RAMPING CONTROL							
DUKE ENERGY BUSINESS SVCS. (XTREME)	24MW (15MW slow)	Renewables and Demand	Notrees Wind Storage - Deploy a wind energy storage demonstration project at the Notrees Wind power Project in western Texas. The project will demonstrate how energy storage and power storage technologies can help wind power systems address intermittency issues by building a 24 megawatt (MW) hybrid-energy storage system capable of optimizing the flow of energy.	Goldsmith, TX	Duke	\$21,806,219 (\$43,612,445)	5/12
PRIMUS POWER (ZINC-CHLORIDE FLOW BATT.)	25MW (75MWhr)	Renewables	Wind Firming EnergyFarm™ - Deploy a 25 MW - 75 MWh EnergyFarm for the Modesto Irrigation District in California's Central Valley, replacing a planned \$78M / 50 MW fossil fuel plant to compensate for the variable nature of wind energy providing the District with the ability to shift on-peak energy use to off-peak periods.	Alameda, San Ramon, Modesto, CA	Modesto Irrig. Dist.	\$14,000,000 (\$46,700,000)	2/13
SOUTHERN CALIF. EDISON CO. (LITHIUM-ION BATT.)	8MW (4 hrs)	Renewables	Tehachapi Wind Energy Storage Project – Deploy and evaluate an 8 MW utility-scale lithium-ion battery technology to improve grid performance and aid in the	Tehachapi, CA	So. Calif. Edison	\$24,978,264 (\$54,856,495)	Q1/12

			integration of wind generation into the electric supply. The project will evaluate wider range of applications for li-ion batteries that will spur broader demand for the technology, bringing production to a scale that will make this form of large energy storage more affordable.				
ARRA Sub-Total: \$60,784,483 (Project Value Sub-Total): \$145,168,940							

2. FREQUENCY REGULATION ANCILLARY SERVICES							
BEACON POWER (FLYWHEELS)	20MW (5MWhr)	Frequency	Beacon Power 20MW Flywheel Frequency Regulation Plant – Design, build, test, commission, and operate a utility-scale 20 MW flywheel energy storage frequency regulation plant in either Hazle Township, PA or Chicago Heights, Illinois, and provide frequency regulation services to the grid operator, the PJM Interconnection. The project will also demonstrate the technical, cost and environmental advantages of fast response flywheel-based frequency regulation management.	Stephen- town, NY	PPL Corp. (PA site); Midwest Energy (IL site)	24,063,978 (<i>\$48,127,957</i>)	11/13
ARRA Sub-Total: \$24,063,978 (Project Value Sub-Total): \$48,127,957							

3. DISTRIBUTED ENERGY STORAGE FOR GRID SUPPORT

<p>CITY OF PAINESVILLE (VANADIUM-REDOX BATT.)</p>	<p>1MW (6-8MWhr)</p>	<p>Coal Efficiency</p>	<p>Painesville Municipal Power Vanadium Redox Battery Demonstration Program - Demonstrate 1 MW vanadium redox battery (VRB) storage system at the 32 MW municipal coal fired power plant in Painesville. The project will provide operating data and experience to help the plant maintain its daily power output requirement more efficiently while reducing its carbon footprint.</p>	<p>Painesville, Parma, OH; Johnstown, PA; Alexandria, VA; Evansville, IN; Devens, MA</p>	<p>Painesville Municipal Power</p>	<p>\$4,242,570 (\$9,666,324)</p>	<p>12/12</p>
<p>DETROIT EDISON CO. (LITHIUM-ION BATT.)</p>	<p>25kW (20 units of 50 kWhr each)</p>	<p>Frequency, Demand and Renewables</p>	<p>Detroit Edison's Advanced Implementation of Community Energy Storage Systems for Grid Support – Demonstrated proof of concept for aggregated Community Energy Storage Devices in a utility territory. The project is comprised of the following major research objectives: 1) The 20 Community Energy Storage (CES) devices across a utility territory; 2) The installation and use of a centralized communication across the service territory; 3) The integration of a renewable resource with energy storage; 4) The creation of algorithms for dispatching CES devices for peak shaving and demand response; 5) The integration and testing of secondary-use electric vehicle batteries; and 6) The use of Energy storage devices to provide</p>	<p>West Lebanon, Hanover, NH; Saxonville, MA</p>	<p>Detroit Edison</p>	<p>\$4,995,271 (\$10,887,258)</p>	<p>7/11</p>

			ancillary services to the power grid.				
EAST PENN MFG. CO. (ULTRACAPACITOR/ LEAD-ACID BATT.)	3MW (1-4MWhr)	Frequency/ Demand	Grid-Scale Energy Storage Demonstration for Ancillary Services Using the UltraBattery Technology - Demonstrate the economic and technical viability of a 3MW grid-scale, advanced energy storage system using the lead-carbon UltraBattery technology to regulate frequency and manage energy demand.	Lyons Station, PA	Met-Ed	\$2,543,746 (\$5,087,269)	4/12
PREMIUM POWER CORP. (ZINC-BROMINE BATT.)	5-500 kW (6 hrs)	Renewables & Micro-grid	Premium Power Distributed Energy Storage System Demonstration for National Grid and Sacramento Municipal Utility District - Demonstrate competitively-priced, multi-megawatt, long-duration advanced flow batteries for utility grid applications. This three-year project incorporates engineering of fleet control, manufacturing and installation of five 500-kW/6-hour TransFlow 2000 energy storage systems in California and New York to lower peak energy demand and reduce the costs of power interruptions.	North Reading, MA; Syracuse, NY; Sacramento, Rancho Cordova, CA	National Grid & Sacramento Municipal Utility Dist.	\$6,062,552 (\$12,514,660)	4/12
PUBLIC SVC. CO. OF NM (PNM) (ADVANCED LEAD ACID BATT.)	500kW (2.5MWhr)	Renewables and Modeling	PV Plus Storage for Simultaneous Voltage Smoothing and Peak Shifting - Demonstrate how a 2.5MWh Advanced Lead Acid flow battery along with a sophisticated control system turns a 500kW solar PV installation into a reliable, dispatchable distributed generation resource. This hybrid resource will mitigate	Albuquerque NM	PNM	\$2,505,931 (\$6,313,433)	8/11

			fluctuations in voltage normally caused by intermittent sources such as PV and wind and simultaneously store more energy for later use when customer demand peaks.				
ARRA Sub-Total: \$20,350,070							
(Project Value Sub-Total): \$44,468,944							

4. COMPRESSED AIR ENERGY STORAGE (CAES)

PACIFIC GAS & ELECTRIC CO. (CAES)	300MW (10 hrs)	Renewables, Spinning Reserve, VARS	Advanced Underground CAES Demonstration Project Using a Saline Porous Rock Formation as the Storage Reservoir - Build and validate the design, performance, and reliability of an advanced, underground 300 MW Compressed Air Energy Storage (CAES) plant using a saline porous rock formation located near Bakersfield, CA as the storage reservoir.	Kern County, CA	Pacific Gas & Electric	\$25,000,000 (\$355,956,300)	12/16
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ARRA Sub-Total: \$25,000,000							
(Project Value Sub-Total): \$355,956,300							

5. DEMONSTRATIONS OF PROMISING ENERGY STORAGE TECHNOLOGIES

AQUION ENERGY, INC. (SODIUM-ION BATT.)	10-100 kWhr	Renewables	Demonstration of Sodium Ion Battery for Grid Level Applications - Partner with Carnegie Mellon University to demonstrate a new, low cost, long-life, highly efficient, environmentally friendly, stationary energy storage battery that uses a proven and fully novel cell chemistry. Specifically, an aqueous sodium-ion based electrolyte is used in conjunction	Pittsburgh, PA	AES Duke Energy	\$5,179,000 (\$10,359,827)	
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			with simple highly scalable electrode materials housed in low cost packaging.				
AMBER KINETICS, INC. (FLYWHEELS)	50 kW (50kWhr)	Frequency	Amber Kinetics Flywheel Energy Storage Demonstration - Develop and demonstrate an innovative flywheel technology for use in grid-connected, low-cost bulk energy storage applications. This demonstration effort, which partners with AFS Trinity, will improve on traditional flywheel systems, resulting in higher efficiency and cost reductions that will be competitive with pumped hydro technologies.	Fremont, CA	(in-house)	\$3,694,660 (\$10,003,015)	12/13
RAYTHEON KTECH. (REDOX FLOW BATT.)	250kW (1MWhr)	Renewables	Flow Battery Solution for Smart Grid Renewable Energy Applications - Demonstrate a prototype flow battery system with an intermittent renewable energy source - a helios dual-axis tracker photovoltaic system. The project will combine a proven redox flow battery chemistry with a unique, patented design to yield an energy storage system that meets the combined safety, reliability, and cost requirements for distributed energy storage.	Albuquerque NM; Sunnyvale, Snelling, CA	(none)	\$4,764,284 (\$9,528,567)	12/12
SEEO, INC. (LITHIUM-ION BATT.)	(25kWhr)	CES	Solid State Batteries for Grid-Scale Energy Storage - Develop and deploy a 25kWh prototype battery system based on Seeo's proprietary nanostructured polymer electrolytes. This new class of advanced lithium-ion rechargeable battery will demonstrate the substantial	Berkeley, Van Nuys, CA	PG&E	\$6,196,060 (\$12,392,120)	1/13

			improvements offered by solid state lithium-ion technologies for energy density, battery life, safety, and cost. These batteries would be targeted for utility-scale operations, particularly Community Energy Storage projects.				
SUSTAINX (CAES)	1MW (4MWhr)	Renewables – both	Demonstration of Isothermal Compressed Air Energy Storage to Support Renewable Energy Production -Design, build, and deploy a utility-scale, low-cost compressed air energy storage system to support the integration of renewable energy sources onto the grid. The 1 MW/4hr system will store potential energy in the form of compressed air in above-ground industrial pressure facilities. The technology utilizes isothermal gas cycling coupled with staged hydraulic compression and expansion to deliver an efficient and cost-effective energy storage solution.	W. Lebanon, Hanover, NH; Saxonville, MA	AES Energy Storage	\$5,396,023 (\$10,792,045)	12/12

ARRA Sub-Total: \$19,653,027
(Project Value Sub-Total): \$53,075,574

ARRA TOTAL FUNDING: \$149,851,558
(PROJECT VALUE TOTAL: (\$646,797,715))