



Low Cost High Concentration PV Systems for Utility Power Generation

Amonix, Inc.



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$3,200,000	\$29,600,000	\$14,800,000	\$14,800,000

- Project Description:**

The principal objective of the project is to transition Amonix’s concentrating photovoltaic (PV) systems from low-volume to high-volume production.

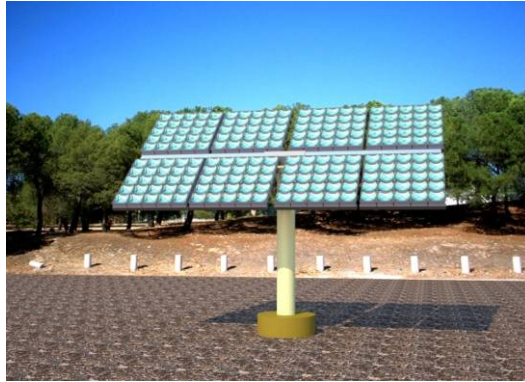
- Significance:** Utility scale mainstream power generation will be achieved using concentrating MegaModules. Amonix will take advantage of high-volume production (previously non-existent in the concentrating PV sector) to significantly reduce costs associated with the current low-volume concentrating PV market.
- Location:** Leadership of the project will be based out of Torrance California. The following Amonix team members will perform additional work in the following states: *New Jersey* - CYRO Industries; *Arizona* - ASU, JOL Enterprises; *Nevada* - UNLV; *California* - Imperial Irrigation District, Hernandez Electric, Northstar, Spectrolab, Micrel; *Colorado* - NREL.

Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	\$0.3300	1
2009-2010	\$0.1400	60
2014-2015	\$0.0600	1000



High Efficiency Concentrating Photovoltaic Power System

The Boeing Company



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$5,900,000	\$29,800,000	\$13,300,000	\$16,500,000

- Project Description:**

The work described in this proposal will develop a new concentrating photovoltaic (PV) system, incorporating high-efficiency multi-junction cells, for the utility-scale PV power market. The efficiency of the production cells will be increased along with a >2x reduction in cost and an increase in cell production capacity; a novel optical design will be developed to take best advantage of the cells; and reliability and cost of the tracker and balance of systems will be improved as well. This approach aims to achieve a \$0.15/kWh levelized cost of energy (LCOE) by 2010 and \$0.07/\$kWh by 2015.

- Significance:** Record breaking cell efficiencies packaged in a novel mirror + lens concentrator design leading to modules with very high power densities.
- Location:** Leadership of the project will be based out of Huntington Beach and Sylmar, California. The following Boeing team members will perform additional work in the following states: *California* - Light Prescription Innovators, UC Merced, Southern California Edison, Caltech; *Oregon* - PV Powered; *New Mexico* - Array Technologies; *Ohio* - James Gregory Associates/Sylarus; *Colorado* - NREL.

Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	\$0.3181	1
2009-2010	\$0.1494	20
2014-2015	\$0.069	150



Reaching Grid Parity Using BP Solar Crystalline Silicon Technology

BP Solar International Inc.



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$7,500,000	\$39,100,000	\$19,100,000	\$20,000,000

- Project Description:**

BP Solar will focus on accelerating the development of multi-crystalline silicon technology for use in the residential and commercial markets, using products specifically designed for these applications. The goals of this program are to achieve grid parity and increase production volume.

- Significance:** BP partnership including feedstock suppliers, automated equipment developers, inverters and balance of systems (BOS) manufactures, a utility company and several universities, is positioned to analyze and improve all aspects of the crystalline silicon PV business from raw materials through installation of the system on the customer’s site.
- Project Location:** Leadership of the project will be based out of Frederick Maryland. The following BP team members will perform additional work in the following states: *Michigan* - Dow Corning, Recticel; *California* - Ceradyne, Palo Alto Research Center, Fat Spaniel, SMUD; *Georgia* - Bekaert, Georgia Tech; *Ohio* - Ferro, ATS-Ohio; *Connecticut* - Specialized Technology Resources; *Pennsylvania* – Komax; *Tennessee* - AFG Industries; *Florida* - University of Central Florida; *Arizona* - ASU.

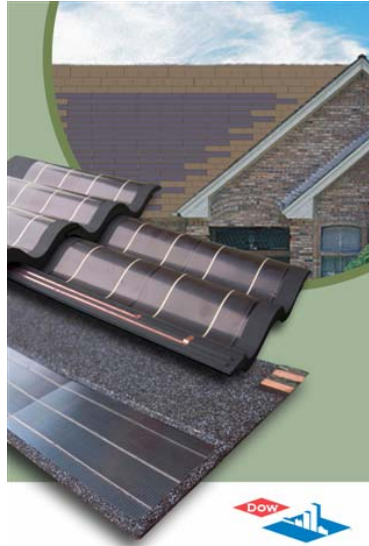
Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	\$0.1690	---
2009-2010	\$0.1076	---
2014-2015	\$0.0722	---

**BP Solar requested that Manufacturing Capacity Metrics be withheld as proprietary information.



Fully Integrated Building Science Solutions for Residential and Commercial Photovoltaic Energy Generation

The Dow Chemical Company



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$3,300,000	\$19,000,000	\$9,400,000	\$9,600,000

- Project Description:**

The Dow Chemical Company (Dow) will develop low cost, building integrated, grid-connected photovoltaic (PV) systems that meet SAI levelized cost of energy (LCOE) goals for solar electricity generation installations.

- Significance:** Dow will leverage its encapsulation and roofing experience to develop new PV-power roofing products and explore creating new product lines based upon this technology.
- Project Location:** Leadership of the project will be based out of Midland Michigan. The following Dow team members will perform additional work in the following states: *California* - Miasole, SolFocus; *Michigan* – Fronius; *Delaware* University of Delaware; *Massachusetts* - IBIS Associates.

Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	\$0.1973	0
2009-2010	\$0.1122	5
2014-2015	\$0.0603	100



A Value Chain Partnership to Accelerate U.S. Photovoltaic Industry Growth

GE Energy



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$8,100,000	\$43,500,000	\$18,600,000	\$24,900,000

- Project Description:**

This project examines every aspect of the value chain and proposes development in critical areas assured to impact the levelized cost of energy (LCOE) for photovoltaic systems in the US market. To achieve these goals GE Energy will produce lower cost high purity feedstock processes, develop high efficiency bifacial cells in low concentration modules, certify flexible thin-film modules adaptable to multiple building-integrated PV and conventional markets, develop plan for thin film module manufacturing, and lower systems costs based on module developments, balance of system (BOS) component cost reductions, and innovative system installation strategies.

- Significance:** GE will initially pursue multiple PV technologies and will down select among the different approaches at 12 and 24 months using performance and market analysis.
- Location:** Leadership of the project will be based out of Delaware. The following GE team members will perform additional work in the following states: *Washington* – REC; *California* – Solaicx; *Georgia* - Georgia Tech Research Corporation; *North Carolina* - North Carolina State University; *Delaware* - University of Delaware.

Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	\$0.1900	20
2009-2010	\$0.0890	300
2014-2015	\$0.0580	1500



AC Module PV System

GreenRay, Inc.



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$400,000	\$4,800,000	\$2,300,000	\$2,500,000

- Project Description:**

The objective of the GreenRay Inc. program is to develop an AC module system that integrates the photovoltaic (PV) module and the inverter. The AC module system is simpler to design, is safer for installer/users, costs less, and is more reliable. These attributes contribute to realizing the levelized cost of energy (LCOE) targets by 2015.

- Significance:** The simplifications resulting from the AC module allows systems to be modularly expandable, resistant to failure, and provide optimal support for multiple module orientations.
- Location:** Leadership of the project will be based out of Lincoln Massachusetts. The following GreenRay team members will perform additional work in the following states: *Texas* - Sanyo Energy; *Pennsylvania* - Tyco Electronics; *Colorado* - Coal Creek Design; *California* - BluePoint Associates; *Massachusetts* - National Grid.

Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	\$0.34	1
2009-2010	\$0.18	4
2014-2015	\$0.09	180.25



Flexible Organic Polymer-Based PV For Building Integrated Commercial Applications

Konarka



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$1,200,000	\$8,800,000	\$3,600,000	\$5,200,000

- Project Description:**

The Konarka program objective is to address technical challenges that prevent the use of organic polymer-based photovoltaic (PV) modules on rooftop applications. This will be accomplished by first developing new barriers to prevent water and oxygen from entering the cells and impeding their function. Secondly, by raising module performance to a required output level (W/m²) for commercial rooftop applications. All developed processes will be compatible with high speed processing required to meet the SAI, LCOE program goals.

- Significance:** Konarka is the only team selected who is working with organic based PV materials which can be produced at very low costs.
- Congressional District:** Leadership of the project will be based out of Lowell Massachusetts. The following Konarka team members will perform additional work in the following states: *Delaware* - University of Delaware; *Colorado* - NREL.

Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	---	---
2009-2010	---	---
2014-2015	<\$0.10	1,000-3,000

**Konarka requested that Key Metrics for 2006 and 2009-2010 be withheld as proprietary information.



Flexible Integrated PV System

Miasolé



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$5,800,000	\$47,000,000	\$20,000,000	\$27,000,000

- Project Description:**

Miasolé will significantly reduce the cost of PV by bringing high-volume manufacturing technology to the production of thin-film solar cells and the introduction of flexible PV modules with integrated electronics. Miasolé already has an operational solar cell production system line and an expansion line is near completion.

- Significance:** Miasolé’s roll-to-roll sputter deposition of copper indium gallium selenium (CIGS) materials allows for rapid expansion of production capacity. A diverse set of design proposals including integrated inverters, alternative substrate materials, phase shifting dyes, and improved interconnections and junctions allow for increased module efficiencies with decreasing costs.
- Location:** Leadership of the project will be based out of Santa Clara California. The following Miasolé team members will perform additional work in the following states: *Texas* - Exeltech; *Pennsylvania* - Carlisle-Syntec; *Colorado* - University of Colorado, NREL; *Delaware* - University of Delaware; *New Mexico* - Sandia National Laboratory.

Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	\$0.1900	85
2009-2010	\$0.0670	1200
2014-2015	\$0.0530	5000



Delivering Grid-Parity Solar Electricity On Flat Commercial Rooftops

Nanosolar



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$1,100,000	\$40,000,000	\$20,000,000	\$20,000,000

- Project Description:**

Nanosolar will deliver a uniquely scalable photovoltaic (PV) cell technology with industry-best \$/watt performance to grid-parity PV systems for large-scale commercial building installations. This will be accomplished through the development of an integrated suite of system components and designs based on innovations in module, inverter, and mounting technology and informed by a framework of real-world performance feedback.

- Significance:** Nanosolar’s innovative printed Copper Indium Gallium Selenium (CIGS) thin film cells will be integrated into a minimal module frame to optimized shipping and installation requirements.
- Location:** Leadership of the project will be based out of Palo Alto, California. The following Nanosolar team members will perform additional work in the following states: *California* - SunTechnics, Inc. and SunLink, LLC.

Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	\$0.0730	---
2009-2010	\$0.0600	---
2014-2015	\$0.0520	---

**Nanosolar requested that Manufacturing Capacity Metrics be withheld as proprietary information.



Fully Automated Systems Technology

PowerLight



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$2,800,000	\$12,300,000	\$6,000,000	\$6,300,000

- Project Description:**

PowerLight will focus on reducing non-cell costs by simplifying installation, integrating various system products (i.e. module and mounting), automating project design and eliminating non-value added steps by using a systems design approach. PowerLight’s approach offers the technical advantage of reducing costs independent of the cell supplier and allows the use of multiple photovoltaic (PV) cell suppliers.

- Significance:** PowerLight’s generic cells-to-systems factory approach is largely technology neutral and will produce cost reductions regardless of which PV technologies dominate.
- Location:** Leadership of the project will be based out of Berkeley California. The following PowerLight team members will perform additional work in the following states: *Connecticut* - Specialized Technology Resources, Inc.; *California* - Autodesk.

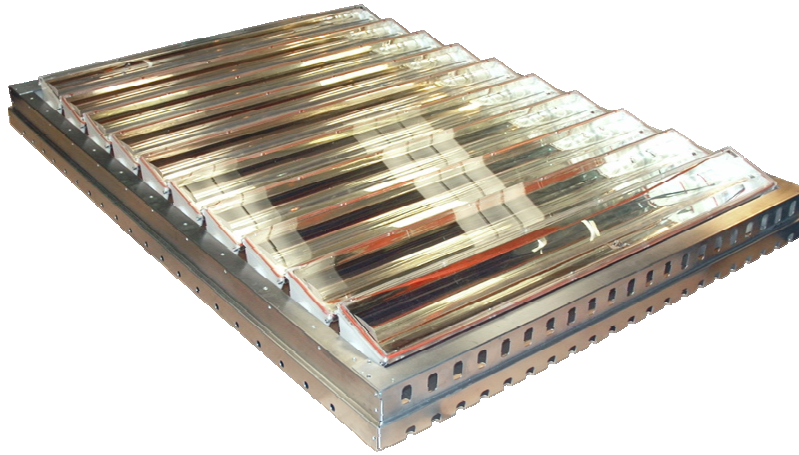
Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	---	---
2009-2010	---	---
2014-2015	---	---

**Powerlight requested that Key Metrics be withheld as proprietary information.



Concentrating Solar Panels: Bringing the Highest Power and Lowest Cost to the Rooftop

Practical Instruments



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$2,200,000	\$8,100,000	\$4,000,000	\$4,100,000

- Project Description:**

Practical Instruments will develop a tracking/concentrating solar module that will have the same geometric form factor as a conventional flat, roof mounted photovoltaic (PV) panel. The module will produce more power and cost less than conventional panels of the same size.

- Significance:** The unique design of Practical Instruments’ concentrating module allows for high efficiencies in a conventional flat module design. This enables larger power installations on commercial and residential rooftops – the largest and fastest growing markets in the solar industry.

- Location:** Leadership of the project will be based out of Pasadena California. The following Practical Instrument team members will perform additional work in the following states: *California* – SpectroLab; *New Mexico* - Sandia National Laboratory; *Massachusetts* – MIT; *Maryland* - SunEdison.

Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	\$0.1470	1
2009-2010	\$0.0790	40
2014-2015	\$0.0560	600



Grid-Competitive Residential and Utility Solar Power Generating Systems

SunPower



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$7,700,000	\$36,100,000	\$17,900,000	\$18,200,000

- Project Description:**

SunPower will develop turn-key, high-efficiency residential, commercial, and large ground-mounted systems that are cost effective in delivering electricity at grid parity. Key program objectives are to decrease Levelized Cost of Energy (LCOE) for the commercial ground, commercial roof and production homebuilder markets. These reduced costs will be accomplished through the development of high efficiency modules and reduced system development and installation time.

- Significance:** SunPower will reduce costs associated with high-efficiency back contact silicon cells via automated production and improved silicon processing techniques. Improved grain boundary passivation, light trapping, and cell thinning will result in efficiency gains as well as cost reductions
- Location:** Leadership of the project will be based out of San Jose, California. The following Sunpower team members will perform additional work in the following states: *California* – Solaicx; *Massachusetts* – MIT, *Colorado* – NREL.

Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	---	---
2009-2010	---	---
2014-2015	---	---

**SunPower requested that Key Metrics be withheld as proprietary information.



Low Cost Thin Film Building-Integrated PV Systems

United Solar Ovonic LLC



- Funding:**

DOE Year 1	Total Cost	DOE Cost	Recipient Cost
\$2,400,000	\$38,900,000	\$19,300,000	\$19,600,000

- Project Description:**

United Solar Ovonic aims to develop the lowest cost solution for the commercial building-integrated PV market. Depending on the complexity of the building, the current installed cost of PV on commercial buildings range between \$6 to \$8/watt. The goal is to reduce the Levelized Cost of Energy (LCOE) from 15.83 ¢/kWh in 2006 to 12.8 ¢/kWh in 2010.

- Significance:** This project will focus on increasing the efficiency and deposition rate of silicon-based, multi-bandgap, flexible, thin-film photovoltaic cells and reducing the cost of inverters and balance-of-system components.
- Location:** Leadership of the project will be based out of Auburn Hills Michigan. The following United Solar team members will perform additional work in the following states: *California* - SMA America, Developing Energy Efficient Roof Systems; *Massachusetts* - Sat Con Technology Corporation, Solectria Renewables; *Oregon* - PV Powered, University of Oregon; *New Jersey* - Turtle Energy; *Maryland* - SunEdison; *New York* - Syracuse University.

Key Metrics		
	LCOE (\$/kWh)	Manufacturing Capacity (MW)
Baseline (2006)	\$0.1580	60
2009-2010	\$0.1280	300
2014-2015	\$0.0760	1000