

# ENERGY EXCHANGE

A publication of the National Energy Education Development Project

November 2007

## *Toyota Donates Hybrid to KY NEED*



Twenhofel Middle School students and KY NEED's hybrid Camry donated by Toyota.

To celebrate its twentieth year of operation in Georgetown, Toyota Motor Manufacturing Kentucky (TMMK) gave vehicles to two community programs in KY.

One, a minivan, went to the Bluegrass Domestic Violence Program and the other, a hybrid Camry, went to Kentucky NEED. Karen Reagor, Kentucky NEED Director, said, "We are honored to accept this gift from Toyota. Kentucky NEED reaches thousands of students, parents and teachers each year. We thank Toyota and appreciate the opportunity to work with such a visionary corporation as we continue to promote energy education in the Commonwealth."

## *Change a Light, Change the World*

NEED has already reached 100 percent of our goal of 1,000 pledges for the 2007-2008 campaign. ENERGY STAR® tracks the top five Pledge collectors every week and NEED is currently ranked number one in the non-profit organization category and number two in the education category. Congratulations to the St. Isidore NEED Group for earning a number five ranking in the education category. **Thanks to all of the groups who helped NEED meet this year's goal by collecting Pledges for 6,066 bulbs that will save 1,710,612 kWh of electricity and prevent the emission of 2,480,994 pounds of greenhouse gases.**

It's not too late to register your school group and participate in the Change a Light Campaign. To learn more, visit [www.need.org](http://www.need.org). Did you take part in a successful event to celebrate the day? Send pictures and information about your event to [info@need.org](mailto:info@need.org).

## *2008 Summer Conferences Planned*

Join us in *Galveston, Texas (July 13-17, 2008)* or in *Las Vegas, Nevada (July 20-24, 2008)* for these popular five-day energy conferences for educators who want to learn how to implement amazing energy units in their classrooms.

The registration fee of \$1,100 includes double occupancy lodging, most meals, and a variety of classroom materials. Registration materials will be available in December on [www.need.org](http://www.need.org).

## *New at www.NEED.org*

NEED's new *Question Bank* gives teachers the ability to customize evaluation tools for their energy units. There are questions at four grade levels: Primary, Elementary, Intermediate and Secondary. At each grade level, questions are provided for these topics: Sources of Energy, Science of Energy, Electricity, Transportation, and Conservation and Efficiency.

A wide selection of Knowledge, Comprehension and Application questions are included under each topic. To access the online Question Bank, go to [www.need.org/QBank.php](http://www.need.org/QBank.php).

## *NEED at NSTA National Conference*

NEED will host an exhibit and a series of workshops at the NSTA National Conference in Boston (March 27-30, 2008). In addition, the traditional NEED teacher dinner will be hosted for teachers who actively use NEED to provide an opportunity for networking and sharing experiences.

If you're planning to attend the National Conference in Boston, email Mary Spruill at [mspruill@need.org](mailto:mspruill@need.org)

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## The NEED Project

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The NEED Project is a 501(c)(3)  
nonprofit education association  
providing professional development,  
innovative materials correlated to the  
National Science Education Content  
Standards, ongoing support and  
recognition to educators nationwide.

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A list of NEED sponsors is available at  
[www.need.org](http://www.need.org) and in our Annual Report.

*Energy Exchange* is published five times a  
year by NEED for educators and students,  
and is available at [www.need.org](http://www.need.org).

NEED welcomes questions, comments, and  
suggestions. Please contact [info@need.org](mailto:info@need.org).

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## Calendar of Events

For more information, email [info@need.org](mailto:info@need.org) or call 800-875-5029.

### November 2007

- 1 Michigan Energy Smart Schools Workshop – MI
- 1 NEED Workshop – ComEd – Rockford, IL
- 1-2 NEED participation in Wind Energy Symposium – Carlsbad, CA
- 1-3 NEED sessions at Kentucky Science Teachers Association Conference – Lexington, KY
- 3 PG&E Solar Schools Workshop – Chico, CA
- 5 NEED Workshop – Millstone Power Station – Niantic, CT
- 6 NEED Workshop – ComEd – Oak Brook, IL
- 7 NEED/BLM Energy on Public Lands Workshop – Lakewood, CO
- 8-10 NEED sessions at Regional NSTA Conference – Denver, CO
- 8-10 NEED sessions at Virginia Association of Science Teachers Conference –  
Williamsburg, VA
- 9 Kentucky NEED Workshop – Knott County, KY
- 9 NEED/BLM Energy on Public Lands Workshop – Albuquerque, NM
- 9-10 NEED sessions at Illinois Science Teachers Conference – Peoria, IL
- 10 PG&E Solar Schools Workshop – Modesto/Tracy, CA
- 10 PG&E Solar Schools Workshop – Redding, CA
- 10-11 BP A+ for Energy Ambassador Training
- 12 Kentucky NEED Workshop – Perry County, KY
- 13 PG&E Solar Schools Workshop – San Jose, CA
- 14 Society of Petroleum Engineers/NEED Teacher Workshop – Anaheim, CA
- 14-17 North American Association for Environmental Education Conference –  
Virginia Beach, VA
- 15-17 NEED sessions at West Virginia Association of Science Teachers Conference –  
Roanoke, WV
- 16 NEED/BLM Energy on Public Lands Workshop – Auberry, CA
- 19 Kentucky NEED Workshop – Paducah, KY
- 27 SMUD Energize Minds for Solar Designs Awards Banquet – Sacramento, CA
- 27 Kentucky NEED Workshop – Bowling Green, KY
- 28 Kentucky NEED Workshop – Owensboro, KY
- 29 NEED Workshop – ComEd – Waukegan, IL
- 29 NEED Workshop – Richmond, VA
- 30 PG&E Solar Schools Workshop – Rocklin, CA

### December 2007

- 1 PG&E Solar Schools Workshop – Fresno/Clovis, CA
- 1 NEED participation in Kentucky School Board Association Conference – Lexington, KY
- 4 Kentucky NEED Workshop – Somerset, KY
- 6-8 NEED sessions at Regional NSTA Conference – Birmingham, AL
- 8 PG&E Solar Schools Workshop – Woodland/Colusa, CA
- 11 Kentucky NEED Workshop – Morehead, KY
- 12 Kentucky NEED Workshop – Prestonsburg, KY
- 12 Southwest Michigan NEED Workshop – Lake Michigan College, MI
- 13 Kentucky NEED Workshop – Lexington, KY
- 15 PG&E Solar Schools Workshop – Santa Rosa, CA
- TBA NEED Workshop – Fall River, MA

### January 2008

- 9-11 NASULGC/4H Training – Washington, DC

### February 2008

- 6-8 NEED sessions at Hoosier Association of Science Teachers Conference – Indianapolis, IN
- 24-26 Tennessee-Kentucky Energy Efficiency Conference – Nashville, TN

### March 2008

- 6 Cape Light Compact Educator Conference – Hyannis, MA

For details on Kentucky NEED workshops, visit [www.need.org](http://www.need.org) or contact Karen Reagor at  
[kreagor@need.org](mailto:kreagor@need.org).

Correction: Congratulations to the *Wake County Public School System, Special Category Winners* for the 2007 Youth Awards for Energy Achievement. Visit [www.need.org/YAwards/district-year.php](http://www.need.org/YAwards/district-year.php) to read about their award-winning project.

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# NEED News

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## *California*

The 2007-2008 school year is off to a great start in California! The PG&E Solar Schools Program will reach over 1,000 teachers this year with classroom materials and training designed to teach the science of energy and the science of solar energy. As 2007 draws to a close, plans for the 2008 solar installations and Bright Ideas Grants are underway. To register for a workshop or for more information about the program, visit [www.pge.com/solarschools](http://www.pge.com/solarschools).

## *Illinois*

ComEd and NEED are working together to provide Illinois teachers with an opportunity for teacher training and classroom materials starting this fall! ComEd's support provides Science of Energy Kits, Energy Management for Schools Kits, and Home Energy Efficiency Kits to participating schools. Workshops and curriculum materials also include lessons about real-time electricity pricing and the consumer's role in increasing energy efficiency. Workshops began in October and continue through November and are available to K-12 teachers in the ComEd service area. To register, visit [www.need.org](http://www.need.org).

## *Indiana*

The Indiana NEED Project is pleased to announce that the 2007-2008 school year will be filled with workshops, the ever-popular NEED hands-on kits, curriculum materials and the Indiana Saving Energy Program—with classroom lessons and home energy efficiency kits for students and their families. The program is sponsored by Duke Energy Indiana, the Indiana Office of Energy and Defense Development and the American Electric Power Foundation.

## *New York*

NEED workshops continue to be a hit in New York with the middle school hydrogen workshops, sponsored by NYSERDA, being presented across the state this fall. Earlier this year, NEED participated in the Saratoga Sustainability Fair with NEED Lead Teacher Joanne Coons facilitating sessions and hosting a NEED exhibit. Stay tuned for more opportunities coming soon in New York.

## *American Electric Power*

Calling all 4<sup>th</sup> grade teachers in AEP's service area! If your school receives electricity from American Electric Power, we have good news for you! The AEP Foundation has approved a grant to NEED to provide compact fluorescent light bulbs to 4<sup>th</sup> grade students throughout the AEP service area—Virginia, West Virginia, Kentucky, Ohio, Indiana, Michigan, Oklahoma, Texas, Louisiana, and Arkansas. To be added to the list of classrooms to receive the CFLs and associated classroom activities, please email Mary Spruill at [mspruill@need.org](mailto:mspruill@need.org).

## *BP A+ for Energy Program*

BP will launch the 2008 A+ for Energy Program in November. The program provides \$5,000 and \$10,000 grants to classroom teachers in several states. Grant winners receive NEED curriculum materials and sponsorship to attend the A+ for Energy Educator Conference co-hosted by NEED. For eligibility rules and to apply, visit [www.aplusforenergy.com](http://www.aplusforenergy.com).

## *H<sub>2</sub> Educate*

Fifty educators from across Virginia joined hydrogen experts and the GM Fuel Cell Vehicle team at the Virginia Hydrogen Workshop on October 4th in Norfolk, Virginia. Participating teachers received NEED's H<sub>2</sub> Educate Kits and curriculum materials. The workshop was sponsored by the Virginia General Assembly and the Virginia Department of Mines, Minerals and Energy.

## *NEED at NSTA Regional Conferences*

NEED will be facilitating sessions at the NSTA regional conferences in Detroit, MI (October 18-20), Denver, CO (November 8-10), and Birmingham, AL (December 6-8) this fall. Stop in and see one of the NEED staff at the workshops.

## *Sacramento Municipal Utilities District*

The Sacramento Municipal Utility District will recognize the winners of the Energize Minds for Solar Designs grant program on November 27 in Sacramento. The 2006 winners will highlight their successes at the awards dinner; 2006 winners include: Kristen Couchot – Sheldon High School (Sacramento), Fred Evangelisti – American River College (Sacramento), and Naomi Harper – Will Rogers Middle School (Fair Oaks).

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## NEED News

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Large crowds toured the solar village during the 2007 Solar Decathlon.

Credit: Kaye Evans-Lutterodt/Solar Decathlon

### *Solar Decathlon 2007*

The Solar Decathlon is a ten-part competition between college teams that challenges each team to design and build a house that must power all the home energy needs of a typical household using only the sun. The “solar village,” located on the National Mall, was open to the public October 12-20, 2007. The Solar Decathlon was developed by the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy to encourage the pursuit of careers in science and engineering, to raise awareness within the general public about renewable energy and energy efficiency, and to help move solar technologies into the market place at a faster rate. This year, 20 teams from the U.S. (including Puerto Rico), Canada, Spain, and Germany competed. The next Solar Decathlon will be in 2009. For more information, visit [www.solardecathlon.org/](http://www.solardecathlon.org/).

### *Solar Schools in Illinois*

With the support of the Illinois Clean Energy Community Foundation and ComEd, NEED conducted two solar workshops for schools in ComEd’s service area, in Rockford and Oak Brook. Many participating schools have photovoltaic installations and others attended to learn more about installing solar on their schools. Schools in attendance received NEED Solar Energy Kits and curriculum materials.

### *Student Installed Photovoltaic Systems*

Students at William M. Davies Career and Technical High School in Lincoln, RI recently completed the installation of two photovoltaic systems. The power generated (about 3 kW) is more than enough to run the lighting in the electricity shop; the rest is used in the school. Along with their instructor, Rick Lowell, the class dug trenches for conduit, installed all the wiring, and cemented the sonotubes for the ground mounted systems. The grant came from the RI State Energy Office. With the support from school administration, Entech Engineering, and Solar Wrights, the three year project was completed in June 2007. The next step for the project, according to Lowell, is to “design and install a sun tracker system in order to generate more power. Why not kick it up a notch?”



Davies Career and Technical High School students with their newly installed photovoltaic system.

### *U.S. Bureau of Land Management*

The Alaska Get Energized Conference welcomed over 40 educators from across Alaska to discuss Alaska energy issues and learn more about energy to integrate into the classroom. BLM’s Campbell Creek Science Center and BP sponsored the two-day event. Teachers received the BLM-NEED Energy on Public Lands curriculum materials and other NEED materials. BLM-NEED workshops will be hosted in New Mexico (October 29 and November 9), Colorado (November 7), and California (November 16). Want more info? Visit [www.need.org](http://www.need.org) or email [info@need.org](mailto:info@need.org).

### *WeatherBug Schools*

Interested in extending your classroom energy lessons? Schools are learning more about the connection between weather and their energy efficiency and conservation activities, as well as the production of electricity from the solar and wind systems installed on their schools. This past summer, NEED teachers attending the NEED Facilitator Training and the NEED Energy Conferences for Educators had the opportunity to learn more about WeatherBug. NEED and WeatherBug are currently investigating ways to tie the WeatherBug curriculum in more closely to NEED’s energy curriculum. For more information about WeatherBug, visit [www.weatherbug.com](http://www.weatherbug.com).

### *National Solar Tour*

The American Solar Energy Society National Solar Tour took place on October 6, 2007. The focus of the tour is to highlight energy efficiency and renewable energy technologies that are working and available to the average person right now. NEED Lead Teacher Joanne Coons’ home in New York, built in 1852, was on the tour. Highlights of her home include ENERGY STAR® qualified appliances, a 2.4 kW photovoltaic system with a passive tracking system, a 115 gallon biodiesel processor to fuel the car, a solar hot water heating system, a battery operated lawn mower, and interior radiance paint that keeps rooms cooler in summer and warmer in winter. Thanks for sharing your home, Joanne!

# Primary Activity: Transport Sort

Below are pictures of ways students travel to and from school. Cut out each picture and place it into the correct category under each sort. For the final sort, make up your own categories. Be sure to place the pictures into one stack before starting a new sort.

First Sort

- Group A: Things with wheels.
- Group B: Things without wheels.

Fourth Sort

- Group A: Things that use human energy to move.
- Group B: Things that use fuel to move.

Second Sort

- Group A: Ways I have traveled to or from school.
- Group B: Ways I have not traveled to or from school.

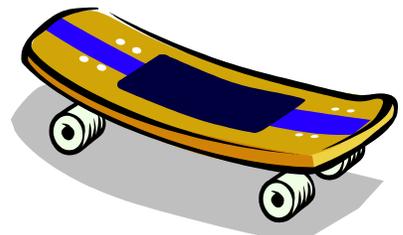
Fifth Sort

Group A: \_\_\_\_\_

Third Sort

- Group A: Energy smart ways to travel.
- Group B: Energy wasteful ways to travel.

Group B: \_\_\_\_\_



## Intermediate Article: Plug-In Hybrid Electric Vehicles



Advantages and disadvantages of PHEVs are being studied, as well as the challenges to introducing them into commercial markets.

*Credit: DOE*

Electric vehicles were once seen as a way to reduce air pollution and our dependence on foreign oil, but their limited driving range kept them from being accepted nationwide. New advances in batteries and hybrid technologies are helping to spur new interest in the electric car.

*Plug-in hybrid electric vehicles (PHEVs)* use batteries for propulsion until the charge gets depleted, then switch over to engines powered by traditional or alternative fuels for additional driving distance. When parked, PHEVs can recharge from standard electric outlets. Interest is growing in hybrid vehicles that can recharge from the electric grid because of their high fuel economy, longer driving distance and the potential to reduce petroleum use.

The first aspect that most people consider when looking at new technologies are the advantages. PHEVs are still being studied, but most experts agree that the advantages to PHEVs are improved fuel economy, decreased dependence on imported oil, and the possibility of balancing demand on the electric grid.

There are several factors to consider when looking at PHEVs:

**Vehicle Technology**—Since Americans drive on average 33 miles per day, the ideal PHEV battery should provide up to 40 miles of driving. Current battery technology cannot provide that distance. That is one reason why the U.S. Department of Energy recently proposed \$17 million funding five different projects focused on vehicle batteries. According to Assistant Secretary Kolevar, the goal of the funding is to “get PHEVs out of the laboratory and into the showroom.”

**Electric Distribution**—Recent studies show that the current electric grid technology can support the initial influx of PHEVs. The electric grid is designed to provide peak power demands, but the system only runs at full capacity about five percent of the time. The rest of the time the grid could be producing electricity up to full capacity to support PHEVs. One of the challenges for the electric grid is vehicles charging during peak hours, increasing peak demand. One way to avoid this problem is *smart charging*. Smart charging allows a utility to remotely control the charging rate of a vehicle to help balance the generation and load of the electric grid. Pacific Gas and Electric (PG&E) and Tesla Motors recently announced a project focused on smart charging.

Another future possibility of PHEVs is *vehicle-to-grid (V2G)* power delivery. V2G allows a two-way transfer of energy. V2G cars could provide power to the grid when plugged in, or be charged by the grid while parked. V2G technologies could help balance generation and load needs of the electric grid. Most experts agree, however, that V2G integration will not happen until some time after the introduction of PHEVs.

**Environmental Impacts**—A recent study by Pacific Northwest National Laboratory projected that for the nation as a whole, total greenhouse gases could decrease as much as 27 percent if PHEVs were used instead of light duty vehicles. Specifically, carbon monoxide emissions could decrease 98 percent and nitrogen oxide emissions could decrease 31 percent. Due to the increase in use of coal-fired power plants, however, particulate emissions would most likely increase nationally by 18 percent and sulfur oxide emissions could increase as much as 125 percent. The source of emissions will change from millions of vehicle tailpipes to a few hundred generating facilities that must already follow emission standards.

The biggest environmental impact will come when PHEVs are recharged using renewable energy sources. V2G technologies could be used to help stabilize the intermittent nature of some renewable energy sources such as wind and solar.

**Customer Expectations**—Cost is usually the biggest issue for customers. PHEVs will cost more to produce than other hybrids. Customers may be persuaded to purchase higher priced vehicles if they feel there are trade-offs. Benefits of PHEVs include fewer trips to the gas pump and a possible emergency power back-up for the home.



A Toyota Prius converted into a PHEV.

*Credit: DOE*

*Teachers: Use this article to initiate a class discussion about how students should prioritize their personal desires, as well as environmental and societal impacts when they consider the kinds of vehicles they may purchase in the future. For more information about PHEVs, visit the FreedomCAR and Vehicle Technologies Program home page at [www1.eere.energy.gov/vehiclesandfuels](http://www1.eere.energy.gov/vehiclesandfuels).*

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## Secondary Article: CAFE and MPG

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First established in 1975 by Congress, the purpose of Corporate Average Fuel Economy (CAFE) standards is to reduce energy consumption by increasing the fuel economy of cars and light trucks. For an auto manufacturer, its CAFE is the sales weighted average fuel economy of their entire fleet of either passenger cars or light trucks that are for sale within the U.S. for a given model year. With continued U.S. reliance on imported oil, updating the CAFE standards for light trucks recently became a priority for the National Highway Traffic Safety Administration (NHTSA).

The light truck standard will increase from 22.2 miles per gallon (mpg) for 2007 models to 24.0 mpg and, for the first time, CAFE standards include pickup trucks, sport utility vehicles and minivans. The new standards are expected to save 10.7 billion gallons of fuel. Manufacturers have until 2011 to meet the new standards.

Along with the new CAFE standards, the U.S. Environmental Protection Agency (EPA), the Federal agency responsible for determining the fuel economy of vehicles, has revised its methods of testing a vehicle's miles per gallon estimates. Previously, the EPA tested vehicle models for two driving routines—*city*, which represents urban driving in stop-and-go rush hour traffic, and *highway*, which represents driving on rural and Interstate highways in free-flowing traffic—to determine its fuel economy. These routines, however, did not account for many of the habits of the typical American driver. The updated test includes a *high speed* routine with higher city and highway speeds and more aggressive acceleration and braking, an *air conditioning* routine with warmer outside conditions and air conditioner in operation, and, finally, a *cold temperature* routine that tests the effects of colder outside temperatures on driving in stop-and-go traffic. The EPA predicts that the revised test will decrease the stated fuel economy for most vehicles.

There are things that all drivers can do to increase the fuel efficiency of their vehicles:

**Drive sensibly.** Aggressive driving, such as speeding, rapidly accelerating and hard braking, wastes gas. It can lower your gas mileage by 33 percent at highway speeds and five percent around town. Driving sensibly translates to saving \$0.16 to \$1.06 per gallon.

**Observe the speed limit.** While every vehicle has a different optimal fuel economy speed, gas mileage typically decreases rapidly at speeds above 60 miles per hour (mph). As a rule of thumb, you can assume that each five miles per hour you drive over 60 mph is like paying an additional \$0.20 per gallon for gas.

**Keep your engine properly tuned.** Though results vary based on the kinds of repairs needed, keeping a car engine well tuned can save up to \$0.13 per gallon.

**Check and replace air filters regularly.** Replacing clogged air filters can improve fuel economy by as much as 10 percent. This is like saving \$0.32 per gallon.

**Keep tires properly inflated.** Improving fuel economy by over three percent is as easy as keeping tires inflated to the proper pressure. Under-inflated tires can lower gas mileage by 0.4 percent for every one pound per square inch drop in pressure of all four tires. Properly inflated tires can save \$0.10 per gallon of gasoline.

Additional ways to increase fuel economy include combining errands into one trip, commuting to work during non-peak rush hours, carpooling and using public transportation.

*Teachers: Use this article to initiate a class discussion on the pros and cons of increased CAFE standards, as well as drivers' responsibilities. For more information about CAFE standards, visit [www.nhtsa.gov](http://www.nhtsa.gov). For more information on EPA fuel economy testing or fuel saving tips, visit [www.fueleconomy.gov](http://www.fueleconomy.gov).*



Revised EPA testing gives customers more accurate fuel economy ratings.  
*Credit: EPA*

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## Short Circuits

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### *I Scream, You Scream, We all Scream for Renewable Energy*

One of Scotland's leading food companies, Mackie's, is producing Britain's first renewable energy ice cream. They produce 8,000,000 liters (2,113,376 gallons) of luxury ice cream each year with 100 percent green power generated by three wind turbines. The company may invest in a biofuel plant and solar power in the future.

*Summarized from Renewable Energy Focus July/August 2007.*

### **Google Installs Sharp Solar Electricity System**

Sharp, the world's leading provider of solar cells, provided solar modules for the largest commercial solar electricity system in the U.S. to date, which was recently installed at Google's corporate headquarters in Mountain View, California. In addition to roof-mounted arrays, the system also features a new structure that encompasses two carports under which employees can park—and if they drive a plug-in hybrid, recharge—their cars.



“Sharp shares a common goal with Google, which is to create products and technologies that benefit society and improve consumers’ lives,” said Ron Kenedi, vice president of Sharp’s Solar Energy Solutions Group. “With this system, Google is setting an example for other corporations as to the tremendous environmental and financial benefits of solar energy. But even more so, Google is demonstrating that solar electricity is just like regular electricity, and it can power anything—from computers and copiers to servers and hybrid electric cars.”

Sharp provided 9,212 208-watt modules for the project, which was designed and installed by EI Solutions of San Rafael, California. The 1.6-megawatt system is designed to feed into Google’s overall operations, reducing the amount of electricity the company purchases from its local utility. The system utilizes almost all available roof space on the Googleplex campus.

*Summarized from Sharp Solar Energy Solutions Group, Huntington Beach, CA, June 18, 2007 Press Release.*

