



## **E<sup>2</sup> Energy to Educate<sup>SM</sup>**

As part of our commitment to education, E<sup>2</sup>: Energy to Educate Grants support projects that are team oriented, learning focused, hands-on demonstration projects with specific results. E<sup>2</sup> Energy to Educate projects enhance student understanding of the science and technology needed to address energy issues, and reach and inspire students to think differently about energy.

### **2016 E2 Energy to Educate – Highlights**

- **17 projects awarded nearly \$400,000, reaching over 35,000 students nationwide**
- Student projects include installing and studying luminescent solar concentrators, building and racing electric vehicles, designing wind turbines, scientific testing of fuel cells, and evaluation of energy storage technologies

### **2016 E2 Energy to Educate – Awardees**

#### **Albany State University**

*Albany, GA*

At least 100-150 middle and high school students will be engaged in design and construction of a battery charging device with solar energy. The charged battery will be used to run a rechargeable battery operated vehicle. As solar energy will be used as energy source to drive the vehicle, the vehicle can be termed as "Green vehicle" which will be the part of future "Green Transportation". In this project, school students will learn about design calculations, various constraints in design and budget, and selection of proper materials or devices for construction. Initially, the project will start with a design of a charger with high power level (300 Watts). At the end of the project, to ensure sustainability, a group of students will be selected from each participating school and will be asked to design a charger with lower power level (<100 watts). Students will assemble all components and compete in science fair competitions. The expected outcome of the project will be to motivate at least 30% of the student participants towards choosing a solar energy related STEM career.

#### **Allegheny College**

*Meadville, PA*

There is an increasing emphasis on developing local food economies both nationally and internationally. This project explores the use of recoverable and otherwise waste energy sources to power and heat a small-scale demonstration greenhouse. This project will use innovative heating and photovoltaic systems to maintain a microclimate within the greenhouse for year round food production. The roof of the greenhouse will be composed of luminescent solar concentrators (LCSs), a novel photovoltaic technology that can generate electricity from "wasted" light. The panels capture and convert unusable wavelengths into electricity while allowing photosynthetically active light to reach the plants below. Additional systems will be powered by pelletized switchgrass and recovered

oil. All systems will be monitored so that energy production and consumption can be assessed by students through established educational programs. Once the greenhouse has been fitted with the technologies to generate power and heat from recoverable and waste energy sources, it will be used as a demonstration laboratory and educational tool to teach hundreds of students and serve as a model for the potential application of these technologies elsewhere on or off campus.

### **Carnegie Mellon University**

*Pittsburgh, PA*

The Carnegie Mellon Racing Team is a group of students that build 100% electric vehicles from the ground up each academic year. Carnegie Mellon Racing promotes excellence in engineering as it encompasses all aspects of industry engineering including research, design, manufacturing, testing, developing, marketing, management and finances. Our Electric Race Car project takes students out of the classroom and allows them to apply textbook theories to real work experiences. The team devotes thousands of hours to designing the vehicle using industry-level system analysis and 3D CAD software, then physically builds it once the designs have been validated. Once the vehicle is completed the team allocates time to testing and tuning the vehicle to collect data and see where improvements could be made. The team then participates in two competitions at Formula Hybrid in April and FSAE Electric in June. At these competitions the team competes in events against teams from both the United States and Europe.

### **Challenger Center for Space Science Education**

*Washington, DC*

Challenger Center will create an 8-hour program that introduces early high school students to energy science and careers. The program will include an overview of energy science, including topics relevant to the energy in Transportation, Backyard Generation, and Zero Waste focal areas. The program will also include a hands-on, team-based research challenge, an introduction to energy careers, and an opportunity to interact with energy professionals. In 2017, Challenger Center will design and pilot this program with at least 100 students in Washington, DC. Then, we will share this program with our network of 43 Challenger Learning Centers in the U.S. and internationally, who deliver high quality STEM programming to more than 250,000 students annually. We also have over 20 communities actively working to establish a Challenger Learning Center that are seeking programs like this to engage students and teachers during the multi-year process of opening a Center.

### **Coppin State University**

*Baltimore, MD*

There has been an exponential growth in the generation of renewable energy from sources such as Wind and Sun. However, production of energy from these unconventional sources is not continuous: The wind does not blow and the sun does not shine all the time at particular place. The use of energy storage and charge devices is therefore paramount for renewable energy applications such as in transportation. Two hundred forty (240) students from Blueford Jamison STEM Academy (BDJ), Carver Vocational Technical High School, Al-Rahmah High School (ARH) and Coppin Academy High School will be coached by ten faculty, one post-doctoral researcher, one research technician and 30 students at the Coppin State University (CSU) Natural Sciences and Center for Nanotechnology on energy storage and charging system technologies and how they can be utilized in an environmentally friendly solar light rail. Students will receive hands on training and become acquainted with the energy storage,

rapid charging devices and the construction of a makeshift solar light rail. The above mentioned faculty, staff and students will mentor students as undertake projects and explore career opportunities in renewable energy technologies.

### **East Carolina University**

*Greenville, NC*

This project will educate and inspire students on the significance and societal benefits of sustainability and renewable energy in the preservation of environment and natural resources through a hands-on solar technology project. Approximately 150 East Carolina University Students from the College of Engineering and Technology (CET) will partner with Lucille W. Gorham Intergenerational Community Center (IGCC) to develop and deploy renewable energy sustainable systems with a goal to build a net zero energy facility.

### **Joliet Junior College Foundation**

*Joliet, IL*

Girls Leading the Charge will provide 250 minority and under-represented female students from low-income middle schools an opportunity to learn about energy, specifically solar powered cars, by becoming a design engineer. Joliet Junior College's (JJC) solar-powered car program is a valuable STEM hands-on learning experience. Students will learn principles of basic physics, mechanics, and solar energy while also developing critical thinking and problem-solving skills. The free course will be held afterschool in the spring and fall, and during the summer. The highpoint of the Girls Leading the Charge project will be the building of the commercially available solar-powered car instructional kits. Using the kits, students will work in teams to design solar-powered cars, learn about solar/photovoltaic (PV) cells, troubleshoot, and prepare to test their car's functionality. As part of the learning process, the students will be able to experiment with gear drive and pulley drive systems to determine which produces the fastest solar car. In addition, students will test different solar cell positions to determine which is most effective. Even though the students will be learning through the use of a kit, it will provide flexibility and creativity for them to build and test their own design. As a final project, the students will share their experience with the design process with each other and local business and technology professionals, and ultimately race their cars to determine the most successful design.

### **Kean University**

*Union, NJ*

The project will provide workshops where 310 high school students and 20 high school educators will learn about basics, application, and impacts of renewable energy through hands-on activities and software tools. Four workshops will be provided:

- Solar panel workshop
- Fuel cell workshop
- Home energy use workshop
- Life cycle

All workshops and activities will be offered during the week of Earth Day 2017, in order to celebrate the Earth Day and promote sustainability study in high schools. The project is also expected to increase the amount of students majoring in Sustainability Science at colleges and universities.

**Klein Independent School District**

*Spring, TX*

This project will provide solar energy panels and components for a mobile classroom that supports over 20,000 students throughout the district. and 12,000 additional community members each year. The panels will be placed on top of the trailer, and wired for proper energy storage and distribution. The purpose of the mobile classroom is to promote STEM careers. The trainer of the classroom will show students how solar energy can be used to support the energy needs of basic things inside a car, home, or commercial building. The second part of this project will provide learning kits that contain materials for hands on energy-based lab experiments. Students will research the advantages and disadvantages of different forms of energy. Students will discover the impact of energy sources on society and the environment. Students will discover the practical applications and value of alternative energy sources in transportation, home, and commercial use. Approximately 10,000 thousand students in Elementary, Intermediate and High Schools will benefit from these experiments each year. Twelve kits will be purchased along with twelve hydrogen fuel cell refilling stations. The kits will be shared with 44 schools in our district. The kits target specific standards in the Texas curriculum that will benefit students at all levels.

**Mid-State Technical College Foundation**

*Wisconsin Rapids, WI*

Project "Distributed Education: Power to the People" seeks to bring renewable energy training directly to the community through a shared mobile renewable energy classroom and education platform. This grant emphasizes equal access to renewable energy equipment; solar for all. This project will meet the following objectives.

- Make renewable energy education accessible.
- Provide classroom hands-on tools and curriculum to provide a greater understanding of energy production and distribution
- Inspire students to consider careers within the renewable energy industry
- Provide incentive for 10 students to enroll in the MSTC Renewable Energy program
- Reach 10% of regional high school and middle school students and inspire their intellectual scientific curiosity in energy technology

**Nueva Esperanza Academy Charter School**

*Philadelphia, PA*

Esperanza Academy Charter School, which serves 1,400 predominately low-income Latino students in North Philadelphia, will offer 7th- and 8th-grade science and engineering classes a unique opportunity to experiment with the energy infrastructure of the future. Students will work in teams to build model alternative-energy vehicles and to test the efficiency of their designs. They also will develop the charging infrastructure to fuel their vehicles and will compare the effectiveness of various energy storage methods. Finally, students will consider how their experimental systems might contribute to the construction of a more reliable energy grid. Our primary goal for the 21st Century Energy Innovation Lab program is to get low-income Latino middle school students excited about STEM fields, where Latinos are currently only 2% of the workforce nationally.

### **Penn State Wind Energy Club**

*University Park, PA*

Penn State's Wind Energy Club is motivated to inspire secondary school students to pursue STEM and renewable energy careers while also teaching them about the energy that is present in their own backyards and being renewed on a daily basis. They propose to construct an interactive, portable wind turbine to encourage high school students to learn more about wind energy while also exploring novel science, engineering and math concepts! With the help of the E2 Energy to Educate Grant, Penn State's Wind Energy Club will be designing, testing, and manufacturing a portable wind turbine designed to educate secondary school students on the power in the wind available in their own school yard. The previous experiences the team has with designing and building a fully operational wind turbine for the Department of Energy Collegiate Wind Competition will be brought to bear into the design of the current system. The proposed project has two components: the development of the turbine itself and the design of interactive, educational activities for secondary school students to participate in.

### **Rochester Institute of Technology**

*Rochester, NY*

RIT's K-12 Education for Electricity Generation Using Fuel Cells program is designed to take what we know about the importance of alternative and clean energy resources, and make that knowledge a part of curriculum. This program has two goals: 1.) To conduct workshops for high school teachers that address how to bring issues of global warming, the need for clean energy, and the changing technology of fuel cells to their classrooms. 2.) To conduct a summer program for students in grades 7-12 to expose them to new technology in energy, allow them to conduct experiments in this field, and to increase their overall knowledge of and interest in alternative clean energies. The program consists of teacher workshops and student summer programs that include lectures, hands-on experiments, and laboratory tours all devoted to subjects like solar power, hydrogen fuel cells, environmental sustainability, and how all of this is improved through the study of the various sciences.

### **Solar One**

*New York, NY*

Solar One's Green Design Lab™ (GDL) program is an award-winning K-12 environmental education program and curriculum, developed in partnership with the NYC Department of Education (NYC DOE), and is the only curricular blueprint of its kind that utilizes the school building as both a laboratory for learning and a tool for environmental change. As part of our Green Design Lab programming, Solar One will deliver a "backyard generation" unit, over 6 weeks, to 6 classes at the East Village Community School. Up to 25 students will be in each class, and thus the program will reach 150 students. The lessons and activities will focus on energy, PV solar and battery storage. During the 2015-2016 school year, we reached 295 teachers and more than 200 students through the NYC Solar and NYS K-Solar programs.

### **Southern Illinois University East St Louis**

### *East St Louis, IL*

Students will participate in weekly hands-on project-based units designed to increase critical thinking skills, build their interest in energy careers, and teach them team work and the thrill of cooperative competitive. The program will be implemented using an evidence-based renewable energy curriculum developed by the SIUE STEM Center supplemented by guest speakers and workplace learning opportunities with the National Corn-to-Ethanol Research Center (NCERC) at SIUE. East St. Louis Zero Waste Challenge will target middle and high school students from SIUE's Upward Bound Program. Upward Bound serves low-income first generation college students from Greater East St. Louis region school districts (East St. Louis District 189, Brooklyn United District 188, and Cahokia Unified School District 187, East St. Louis Charter High School and Madison School District). The project targets a community that is severely disadvantaged in STEM, with the goal of narrowing the achievement gap and providing enhanced opportunities in STEM for minority students. The project will enhance our science, technology, engineering and math (STEM) programming with an energy education curriculum for 825 middle and high school students, project based learning and a competition aimed at eliminated waste in East St. Louis.

### **University of Maryland**

#### *College Park, MD*

The U.S. Department of Energy Solar Decathlon challenges collegiate teams to design, build and operate solar-powered houses that are cost-effective, energy-efficient and attractive. The 2017 Solar Decathlon will take place October 5th through 15th, 2017, in Denver, Colorado. Teams are challenged to demonstrate the best blend of affordability, consumer appeal, and design excellence with optimal energy production and maximum efficiency. An anticipated 90,000 visitors will attend the competition, providing high visibility as teams showcase the most innovative and cutting edge in energy-efficient, sustainable technology. University of Maryland College Park's last entry, in 2011, was awarded first place.

### **University of Pittsburgh**

#### *Pittsburgh, PA*

Over 700 students from Pittsburgh's universities (University of Pittsburgh, Robert Morris University), local schools and summer programs will be engaged in an innovative hands-on Energy curriculum that revolves around teams of students designing and building energy technology prototypes. Building upon successful outreach programs enabled by the Mascaro Center for Sustainable Innovation seed grant, the curriculum will focus on student learning of fundamental science and engineering concepts by synthesizing our energy curriculum around Energy "Inventor-labs". Student-teams will embark on a 3-tiered Design-Build Energy challenge by inventing prototypes that demonstrate

- Energy Generation and Conversion (Tier 1)
- Increased Energy Efficiency (Tier 2)
- Sustainable Energy Technology (Tier 3)

Upon completion of the 3-tiered challenge student teams then select an energy design problem of their choice. These final projects will culminate in a design expo in the Summer of 2015 and December 2015 where student teams and prototypes from all schools and programs will be showcased and celebrated at a public event at the universities. While two "teach the teacher" sessions will occur in the summer as part of a continuing education program to reach an additional 500 students, the ultimate goal is to catalyze the creation of a team-oriented, learning focused, hands-on spaces and

culture in our classrooms that will attract support and further the Energy to Educate goals long after the completion of the project. An essential element is that the rapid prototyping and physical modeling of energy technologies will require students to practice high-level thinking (e.g. analysis, synthesis, evaluation) while building a culture geared toward Energy tech innovation.