TITLE: Making the Future Bright: Solar Technology Curriculum Workshop for Educators

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EFFORT: 0.6 months

OBJECTIVES: There are two objectives associated with this proposal:

1. **Add to the repertoire of OSU-produced curricula** by developing a compendium of five differentiated lessons for solar energy education. These activities will build off of existing solar energy outreach resources, incorporate real-time data generated by solar arrays at OSU’s Stone Laboratory, align with state academic standards and energy literacy principles and utilize inquiry-based pedagogical strategies. Having high quality lessons that are easily accessible and ready to use prepares OSU extension educators and outreach specialists to better assist formal and informal educators in Ohio with teaching about solar energy.

2. **Train 80 educators on the OSU-produced Solar Technology Curriculum** at two one-day workshops at Ohio State University’s Stone Laboratory. Each workshop will be open to both formal and informal educators, with an emphasis on 4H educators. Teachers will receive a copy of the 5 newly developed lessons and a tote box of all materials needed to complete the 5 lessons in a classroom of 30 students. Teachers will also receive meals and transportation while at Stone Laboratory.

METHODOLOGY: The solar energy education team will draft five differentiated lessons (see below) for the solar energy curriculum including teacher friendly instructions, classroom ready materials, and content-appropriate support materials.

**Solar Technology Curriculum:**
Lesson 1: Exploring Solar Technology
Lesson 2: Understanding the Mechanics of Solar Technology
Lesson 3: Using an Investigative Process to Explore Solar Thermal Technology
Lesson 4: Exploring Series and Parallel Circuits Using Solar Photovoltaic Arrays
Lesson 5: Using Real-Time Data to Relate Solar Energy Production to the Sun's Location

In an effort to improve scientific literacy among the next generation of decision makers, the Next Generation Science Standards (2013) and Ohio’s Model Science Curriculum (2011) place heavy emphasis on the integration of scientific inquiry and engineering design. Educators are required to integrate real-time data, science processing skills, cross-curricular applications, and scientific and educational technology with specific content knowledge. Therefore, a need clearly exists for locally relevant lessons, particularly those focused on solar energy, that fulfill the new scientific literacy standards. Members of the solar education team, with their expertise in renewable energy science and engineering, established solar energy infrastructure, previously
successful educational programming, and broad outreach networks, plan to maximize the opportunity to fill a curricular void and advance renewable energy education across the state of Ohio.

To disseminate the lessons developed, a graphic designer will customize the curriculum so it is ready for wide spread distribution and convenient classroom use. The Solar Energy Curriculum will be made available on websites maintained by each unit (ohioseagrant.osu.edu and energizeohio.osu.edu) and on greatlakesliteracy.net. Copies will also be printed for extension educators and outreach specialists to share directly with stakeholders. The solar energy education team members will further disseminate the curriculum at professional scientific, education and outreach conferences.

Dissemination of the lessons will begin at two train-the-trainer style workshops held at Ohio State University’s Stone Laboratory. Hosting the workshop at Stone Laboratory will allow educators to see first-hand the solar arrays that are producing the data used in the lessons. Each workshop will educate up to 40 formal (with a focus on middle and high school level) and informal educators (primarily 4H educators), reaching 80 educators in total. Each participant will spend the day on Gibraltar Island, with ferry transportation and meals provided. Attendees will begin their day conducting Lesson 1 as a Nearpod activity in the conference room of Stone Laboratory. From there, the group will split into four groups of 10 and rotate between lessons 2 through 5. Along with the extensive training on the five Solar Technology lessons, all participants will receive a tote box of all materials needed to conduct the lessons in a classroom of 30 students. This package will be worth over $170 each, but provided at no cost to the 80 educators.

RATIONALE: In 2012, the US Department of Energy facilitated the development of Energy Literacy Principles to foster literacy in the social and natural sciences; noting that “without a basic understanding of energy, energy sources, generation, use and conservation strategies, individuals and communities cannot make informed decisions on topics ranging from smart energy use at home and consumer choices to national and international energy policy” (US Department of Energy, 2012). Today, the U.S. relies on fossil fuels for over 80% of its energy. Solar energy – emerging as a practical source of electricity in the 1950s – provides less than 1% of the nation’s electricity (US Department of Energy, 2012). An increase in curricular opportunities for Ohio students will facilitate an increase in public understanding of solar energy use and benefits.

Ohio Sea Grant has active solar energy infrastructure that is used not only to reduce energy consumption, but also as an opportunity for research, education, and outreach. Visitors of Stone Laboratory’s website and Gibraltar Island are able to see, understand and use the energy production data and information while at the research facility or in homes, offices or classrooms. The research station contains both solar photovoltaic (PV) and solar thermal projects. These include (1) a solar pavilion that can be used as an outdoor classroom; (2) two ground mounts that can be manually tilted toward or away from the sun to enable experiments on energy production and orientation; (3) solar thermal on the...
dining hall that can generate more than enough hot water to prepare meals and clean the dining facility; and (4) 40 solar panels on the roof of the lab’s classroom building.

Each solar panel can communicate with Enphase Energy software to allow tracking of energy output. The real-time energy production of the solar PV and solar thermal systems can be found on the Ohio Sea Grant and Stone Lab website, www.ohioseagrant.osu.edu. There is an enhanced web display showing the energy production data of individual solar panels. Viewers will be able to compare the output of each type of solar panel and compare the performance of the different solar production strategies to assist them in choosing a solar design for their own project. Faculty and students are able to use the data for research and education.

The importance of renewable energy initiatives is obvious, yet less than 1% of electricity generated in Ohio is derived from solar energy. Furthermore, learners of all ages are largely uninformed about solar energy; there is a void of locally relevant, inquiry-based, data-driven lessons easily accessible to formal and informal educators throughout Ohio. Bringing a wealth of knowledge, experience and resources together, Ohio Sea Grant, Ohio State Extension, and Energize Ohio are well poised to develop a high quality, locally relevant solar energy curriculum to be used by formal and informal educators. This curriculum will be a springboard for additional collaborative efforts to develop Ohio-focused renewable energy curricula, and can be showcased as a model approach to be used by environmental educators everywhere. We will draft five lessons for the proposed solar energy curriculum, including teacher-friendly instructions, classroom-ready materials, and content-appropriate support materials. The lessons will incorporate online, real-time and historical energy production by the solar photovoltaic installations at OSU’s Stone Laboratory on Gibraltar Island. We will also train 80 educators on how to conduct the five lessons in their classroom at two, one-day workshops. Teachers at the workshop will receive all materials needed to complete the lessons in their classrooms, which is very important to many educators. Together, these efforts promote an energy-literate citizenry of informed and responsible decision makers and environmental stewards.