



Solar Energy on Farms—Module Overview

1. Ag Service Provider (ASP) Training Description

- a. Learning Objectives – Participants in the educator training session will understand the basics of solar energy and how it may be used to reduce energy costs on farms. This includes the ability to:
- Explain how solar energy (sunlight) may be collected and converted into electricity (photovoltaic or PV).
 - Explain how solar energy (sunlight) may be collected as thermal energy and utilized to heat water and/or space.
 - Estimate the amount of electric energy that may be produced at a specific location.
 - Estimate the amount of thermal energy that may be produced at a specific location.
 - Be knowledgeable regarding other benefits associated with the use of renewable energy (e.g., tax benefits and renewable energy credits.)
 - Understand siting issues related to solar energy applications.
- b. Presentation Outline –
- 05 min – Introduction – Introduce self, purpose of presentation (typical solar energy collection methods); give brief overview of solar PV and solar thermal concepts. Point out that it DOES matter where you live as slide four will illustrate.
 - 05 min – Methods of harvesting solar energy -- Outline the two methods for harnessing solar energy and describe why solar photovoltaic (PV) is often the preferred method due to improvements in efficiency and large reductions in component cost. Simple return calculations will follow in later slides.
 - 10 min – Solar geometry and its impact on energy collection – The location of the sun in the sky during the annual cycle affects solar system design and installation. The design azimuth (compass direction) of any solar installation substantially affects when energy production is greatest and total annual energy production. Likewise, the angle of collection panels determine what time of year the energy collection is at its maximum and the total energy collected.



- iv. 10 min – Design considerations – For solar PV, a farm can offset its electric demand charges by maximizing production when farm energy use peaks. If the farm does not have demand charges on its electric bill, it may be better to design for maximum energy production. Net energy metering enables the solar PV system to be optimally sized to produce the amount of energy the farm consumes annually.
- v. 5 min – Solar thermal design considerations – For solar thermal installations, it may be best to optimize energy collection in winter when the sun is low in the sky and the greatest amount of thermal energy is needed.
- c. Activity – ASPs will be asked to estimate solar PV electric energy production based on a specific geographic, orientation, and roof area.
- d. Calculation Tools – ASPs will use the PVWatts calculator to complete the activity. The user inputs several pertinent variables and the tool estimates electric production for the location. Explanatory notes guide the user through the process.
- 2. Presentation File - Solar Energy – ASP Presentation (PowerPoint)
- 3. ASP Activity Sheet – Solar Energy—Activity; Solar Energy Activity (Solution)
- 4. Calculation Tool – <http://pvwatts.nrel.gov/pvwatts.php>
- 5. Additional Reading for ASP – PA PUC Alternative Energy Standards (AEPS): <http://paaeps.com/credit/> and the PVWatts calculator instructions and background: <http://pvwatts.nrel.gov/pvwatts.php> and The Solar Foundation, DOE, Measuring the Costs and Benefits of Going Solar: http://thesolarfoundation.org/sites/thesolarfoundation.org/files/TSF_SolarAcct_Final.pdf

6. Farmer Training Description –

- a. Presentation Objectives – Farmers who participate will learn about on-farm solar energy applications and will be introduced to techniques which can estimate if solar energy is economically beneficial. This includes:
 - i. Being aware that solar energy (sunlight) may be collected and converted into electricity (photovoltaic or PV).
 - ii. Being aware that solar energy (sunlight) may be collected as thermal energy and used to heat water and/or space.
 - iii. Knowing that a calculator exists to estimate the amount of electric energy that may be produced in a location.
 - iv. Be aware of other benefits associated with the use of renewable energy (e.g., tax benefits and renewable energy credits) which can improve solar economics.
 - v. Understand siting issues related to solar energy applications.
- b. Presentation scripts – (ASP) Solar Energy—ASP Outline; (Farmer) Solar Energy—Farmer Outline
- 7. Slide File for Farmer Training – Solar Energy—Farmer Presentation (PowerPoint).
- 8. Fact Sheet for Farmer Training – Solar fact sheet.pdf – Describes solar PV system aspects and benefits.
- 9. Case Study for Farmer Training - <http://www.energysage.com/project/4383/large-residential-solar-project/>

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