Farm Energy IQ

Solar Energy on Farms—ASP Presentation Outline

The intent of this lesson is to provide information and skills to the attendees who have an interest in solar energy applications on the farm as a means of reducing farm energy costs and utilizing renewable energy.

Slides 1-3: Introduction. The presenter introduces self and points out that, although the topic may be complex, it can be useful to understand how solar energy is collected and put to good use; either as electricity or as thermal (heat) energy; and how potential energy savings are estimated. The second slide enumerates the learning objectives.

Slide 4: Geographic location matters with respect to how much solar energy may be collected.

Slides 5-7: The effects of the seasonal cycle as an introduction to its effects on solar energy availability. Major siting considerations for solar collection.

Slide 8: Illustration of a solar photovoltaic (PV) module and its important features. A solar panel is the building block of a PV system and it is rated by its capacity in watts, which is a function of current and voltage. Modules are combined both physically and electrically to provide the array's power output. Direct and alternating current are introduced. Solar PV modules produce direct current electricity. Alternating current is most useful in homes and businesses; however, direct current may be desired for battery charging or to operate small motors or lights.

Slide 9: Major components of a typical solar PV installation connected to farm wiring include modules, inverter, and metering. The inverter is the device that converts DC electricity to AC. It also provides protection during power outages. When an inverter senses loss of electricity supply by the power company, it shuts down the system to protect it and the linemen who are restoring electric service.

Slides 10 and 11: Introduce the concept of net metering. Net metering enables an electric customer with a solar PV system to 'net' electricity use against electricity production, usually on an annual basis. Whenever the solar PV system produces more electricity than is needed on the farm (for example on a bright June afternoon), excess is sent to the electric company grid. When the opposite occurs (at night or in winter), the utility supplies electricity to the farm. The meter keeps track of all the electricity. The typical goal is to design the solar PV system to produce about the same amount of electricity per year that a farm uses in a year. Net metering makes it possible for the solar PV system owner to produce all a farm's energy and avoid electricity company energy charges.

Slide 12: Introduces the 'how much' aspect of solar PV systems based on the locale and weather data. This

Slide 13: Concept of renewable energy credits. Electric companies are required to supply part of their electricity from renewable energy sources. They purchase credits from renewable energy sources to satisfy this requirement. Many solar PV system owners are entitled to payment for the credits created by power production. One credit is created for each 1,000 kWh (one MWh) generated. The value of the credits varies over time due to supply and demand.

Slide 14: Compares the value of the electricity produced by one square foot of solar PV module with the value of corn grown on one s.f. of land. About $5 vs $0.03 respectively, which is a very favorable comparison.

Slide 15: Data from the PVWatts calculator. This calculator estimates the energy produced by a solar PV system of a specific capacity in a specific location.

Slides 16-19: Roof and ground mounted solar PV systems and typical configurations.

Slide 20: Safety related issues related to solar PV installations. Most solar PV systems are connected to the electric company grid. If the electric company grid fails, the inverter senses this failure and automatically shuts down the solar PV system. This prevents injury to anyone working to restore electric service. Although beyond the scope of the module, an off-grid solar PV system (i.e., one that is not connected to an electric company grid) is configured differently.

Slides 21-24: Installation, typical thermal panel configuration, and the equipment required for a solar thermal system.

Slide 25: Climatic issues affect solar thermal systems. When the temperature falls, PV systems are subject to freezing. Drain back systems provide a means for draining all fluid back into the structure to preclude freezing. In closed-loop systems, antifreeze is used in circulating fluid to prevent freezing.

Slides 26: Issues pertaining to implementation of solar energy systems.

Slides 27 through 30: Benefits of solar PV installations. Slides give the example of payback of a 5,000 watt solar PV system installed in PA. Simple payback period is 11 years. This payback period is typically unacceptably long for businesses that often do not consider non-economic issues. Another point is that an installation in a different location would be subject to different energy and renewable energy credit prices. Do the math!

Slides 31 and 32: The economic benefit of a solar thermal system. Compare it to solar PV to see the substantial difference. Solar PV is usually the economic choice.

Slide 33: Summary of the goals of the module.

Slide 34: Questions?

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