Off-Grid Solar (2 hrs)

for SW Ohio, Northern KY & SE Indiana
by John F Robbins CEM / CSDP

2.0 continuing education hours for engineers, contractors, designers and energy professionals

Course Description

Most solar electric systems nowdays are connected to an electric utility's power grid. Their design relies on the electric grid for backup when power is needed but either sunlight is unavailable or power demand exceeds the solar system's output. Engineers, contractors and designers occasionally encounter existing and proposed situations needing electricity where access to a utility grid is not close, convenient or desired. In these situations, everything in the solar system design must be more carefully and precisely planned, from sizing of solar panels to batteries needed to store electricity.

"**Off-Grid Solar**" begins by introducing the types of photovoltaic (PV) panels and their typical electricity-producing characteristics, including the significant monthly differences of expected sunlight per month in the Ohio Valley. PVs and many applications in off-grid solar rely on DC electricity at less than utility voltage, so a short presentation about DC electricity is included. Since the amount of electricity usage more directly affects component sizing and costs in off-grid solar than grid-tied solar, cost-effectiveness of minimizing electric loads in preparation for off-grid solar is discussed. Energy audits of the presenter's off-grid solar-powered office are presented to show the large extent to which reduced electricity usage and demand results in much less cost and complication for an off-grid solar system. Minimizing "line losses" by using lower-gauge wire than typical for AC is also discussed.

Guidelines and examples are presented for the 2 most common types of off-grid solar. The first includes devices and equipment which already have internal or detachible rechargeable batteries, so no additional batteries are required, just an understanding of proper charging of the batteries. The second includes devices and equipment which do not have electricity storage so batteries must be included in the off-grid solar design. Photos are presented showing both portable and permanent off-grid examples, including installation details. Rules of thumb are presented for how to plan and design for both types. Formulas are presented for sizing PVs, batteries, charge controllers, DC voltage converters and DC-to-AC inverters.

Three examples are presented in detail, including step-by-step sizing and selection of each major component. The first covers the design of the presenter's own off-grid solar system, a permanent system serving a variety of AC and DC loads. The second covers an off-grid security light, an all-DC example as might be appropriate for a detached structure. The third covers a small portable design to satisfy small AC and DC loads for an RV owner.

Learning Objectives

- Understand how off-grid solar design differs from grid-tied solar design
- Become familiar with optimal solar siting and orientation as well as likely monthly sunlight
- Appreciate the importance of lowering electricity usage and load prior to off-grid solar design
- Learn about the major components in off-grid solar electric systems, including PVs, batteries, charge controllers, voltage converters and inverters.
- Become familiar with HOMEPOWER magazine (www.homepower.com), one of the best resources for detailed information about off-grid installations and components

J O H N F R O B B I N S CEM / CSDP
3519 Moffett Road, Morning View, KY 41063-8748
(859) 363-0376 john@johnfrobbins.com www.johnfrobbins.com