RENEWABLE ENERGY

Constructing commercial buildings to be solar-electric ready

FACT SHEET

BIOMASS

SOLAR

WIND

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Flat, open rooftops on large commercial buildings offer the perfect real estate for solar electric systems, and commercial building owners are beginning to take notice. Whether they've heard about technological advances in solar electric equipment, success stories about existing systems, or available financial incentives, commercial building owners are now considering solar power for their own properties.

Even if an owner or developer chooses not to install a system as part of the initial construction, it makes sense to construct the building to be "solar-electric ready." A solar-electric-ready building reduces future installation costs and ensures there is suitable roof area for a system. Solar-electric readiness is an asset if the building is to be leased or sold. By incorporating a few simple ideas early in the design process, building solar-ready can be a smart and affordable decision that can help sell the building.

The solar industry forecasts rapid growth in solar electric installations on commercial buildings. These systems make sense whether building owners buy the equipment themselves or lease the rooftop to a third-party owner. Planning today for a future solar electric system ensures that building owners can take advantage of this growing market.

SOLAR READY—SIZE MATTERS

Specific preparations for making a building solar-electric ready depend on the size of system that is likely to be installed. Details, such as the number of conduit runs, and space considerations in the electrical room will differ. It is a good idea to work with a Focus on Energy commercial solar electric assessor or installer in advance to assess the potential generation capacity of the available roof space and to discuss mounting options and other factors that could influence the design of the solar electric system. Designing for the largest system possible will allow the greatest flexibility in the future.

RECOMMENDATIONS FOR SOLAR ACCESS

At a minimum, roof areas should be free of shading between 9 a.m. and 3 p.m. throughout the year. Shading can be caused by stacks, communications equipment, parapets, power lines and neighboring buildings. Solar electric systems have likely service lives of 30 years to 50 years, so consider future construction activity and tree growth when siting a system.

PHOTO: CHRIS JURIK, GE HEALTH CARE

Careful planning was essential to accommodate the conduit runs for the GE Healthcare solar electric installation in Waukesha, Wisconsin.

It is best to group mechanical penthouses, vents and other equipment as far to the north side of the building as possible to avoid shading from these sources.

RECOMMENDATIONS FOR PREPARING THE ROOF

1. Roof Area Needs

A solar electric system will require an open roof area, preferably on the southern roof. Table 1 outlines roof area requirements for a typical system. Currently, standard solar electric modules measure about three feet by four feet and weigh approximately 35 lbs. each.

2. Structural Needs

Most commercial building roofs are designed to accept 6 lbs./sq. ft. of live load, so extra roof support is usually not needed. Determining roof loading and strength requires consultation with a professional engineer. Array weight includes the modules, racks, additional roofing ballast and other system components, as well as wind and snow loading. The solar array's roof loading varies by mounting strategy, as illustrated in Table 1.

3. Roof Replacement

Because solar arrays must generally be removed during roof replacements, the mounting strategy for the solar system should anticipate future roof replacement and repair. It is recommended that solar modules be installed on roofs that are relatively new, with 10 years to 20 years of remaining life.

TABLE 1
SOLAR ELECTRIC SYSTEM TYPES WITH ROOF AREA AND LOAD REQUIREMENTS

TYPE	ROOF AREA NEEDS (SQ. FT./kW OF MODULE)	ROOF LOADING ESTIMATE (LBS./SQ. FT. OF ROOF AREA
Flush-mounted on south-facing roof	100	Less than 4
Rack-mounted on a flat roof	250	Approximately 15
Flush-mounted on a flat roof, using thin film modules	200	Approximately 1
Flush-mounted on a flat roof using crystalline modules	100	Less than 4

Roof area and load requirements vary by system type.

PHOTO: H&H SOLAR ELECTRIC

The electrical room at the Aldo Leopold Center in Reedsburg, Wisconsin, houses the nine inverters for its solar electric system.

4. Minimize Conduit Length

Costs can be reduced by minimizing the distance that electrical conduit needs to travel. If possible, locate the anticipated site of the modules close to the building's electrical room.

Conduit is best installed during roof construction and should be labeled clearly and permanently. The number of conduit runs depends on many variables and is best determined by an electrical professional aware of the specifications of the solar system.

5. Space in the Electrical Room

The solar electric system's inverter and protection systems are typically located in the electrical room, so plans must be made in advance to leave adequate space to install them. Protection systems include: safety disconnects, fuses, lightning protection and related components. For systems that produce less than 40 kW, these components are usually wall mounted and do not require floor space. A system in the 5 kW to 40 kW size range will require accessible wall space of roughly four feet by four feet per inverter.

Large systems may be installed with multiple small wall-mounted inverters (for example, rated at 2 kW to 20 kW each). Using multiple small inverters is more costly and requires more wall area, but this method may work better where portions of the system are shaded during different parts of the day.

If one or more large inverters are used (for example, inverters rated between 40 kW and 200 kW each), then adequate floor space must be provided for the inverter and the transformer. A 100 kW inverter measures about 85" x 60" x 35" and weighs approximately 1,000 lbs., while the transformer measures about 50" x 45" x 35" and weighs approximately 1,400 lbs.

6. Grounding the System

Solar electric systems must be grounded. Typically this requires that the system be tied into the building's "grounding electrode system." A solar-electric–ready building should have an accessible grounding electrode.

7. Easy Access

It is important to provide easy access and sufficient work space around the system components on the roof and in the utility room. This reduces installation and maintenance costs, and makes it safer and easier for visitors to tour the system.

8. Electrical Tie In

Solar electric system output can be connected to a building's electrical system in several ways. Currently, the most common practice is to tie into the circuit breaker on the main distribution panel. It is also possible to tie into the main service/metering cabinet. If the building owner is participating in a utility solar buyback rate program, the system can be tied into a separate electrical service.

Electrical code dictates that the distribution panel be rated to handle the maximum current from the main breaker plus the maximum current from the solar electric breaker.

FOR MORE INFORMATION

focusonenergy.com

Contact Focus on Energy to learn more about solar electric systems. Financial incentives are also available.

focusonenergy.com/reliterature

Focus on Energy offers a variety of information, fact sheets and case studies to help you learn more about solar electric and other renewable energy systems. Here are a few facts sheets to start with:

- Assess Your Property's Renewable Energy Potential
- Grid-Connected Solar Electric Systems
- Focus on Energy Guide to Solar Electric Systems
- Selecting a Solar Electric System for a Commercial Building Rooftop
- The Benefits and Costs of Large Commercial Solar Energy Systems