Renewable Energy Solutions

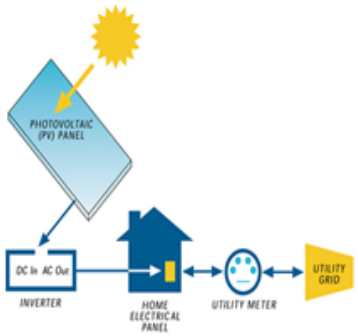
Solar photovoltaic electricity systems

2. Technical Information

With energy costs always increasing, it's no surprise that hotels are looking for new ways to reduce their energy consumption. Renewable energy technologies such as photovoltaic (PV) systems are a good solution that is becoming more cost effective as fuel prices rise and will help hotels stay competitive and profitable.

How does PV electricity power system work?

Photovoltaic cells are made of very pure semiconductor grade silicon similar to that used in computer chips. Silicon is the most common element in the Earth's crust. Electricity is produced as photons of sunlight penetrate the element, bumping electrons into a flow.



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PV cells are connected together to make a module. Modules are the building blocks connected together to make an array. Through a PV cell, solar radiation is converted into electricity: when sun light shines on the semi-conducting material the cell is made of it creates an electric field across them, making electricity to flow.

This is called —the photovoltaic effect and produces DC (DirectCurrent) electricity. This DC power is converted to AC (Alternating Curren) electricity to match the standards of AC frequency and voltage. The conversion is made by an important system component called the inverter. The array and inverter are engineered for efficiency and compatibility. PV allows you to produce electricity—without noise or air pollution—from a clean, renewable resource the sun.

PV systems for SME hotels are becoming more affordable all the time. Modules range in power output from about 10 watts to 300 watts. The capacity of an PV array is given in terms of its peak power production (kWp).

What are the basic components of a PV electricity power system?

A PV system connected or —tied to the utility grid has these components: One or more PV modules, which are connected to an inverter.

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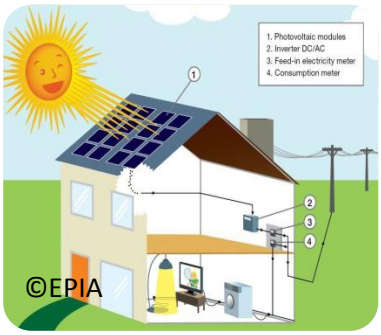
The inverter, which converts the system's direct-current (DC) electricity to alternating current (AC). Batteries (optional) to provide energy storage or backup power in case of a power interruption or outage on the grid and a special utility meter to let the hotel sell and/or buy electricity to and from the national grid and a consumption meter to displaying the electric power consumed by the appliance and the time period of consumption.



RECOMMENDATIONS

Designing your PV electricity power system

As a rule, the cost per kilowatt-hour goes down as you increase the size of the system. For example, many inverters are sized for systems up to 5 kilowatts, so even if your PV array is smaller (say, 3 kilowatts), you may have to buy the same size of inverter. Labor costs for a small system may be nearly as much as those for a large system, so you are likely to get a better price for installing a 2-kilowatt system all at once, rather than installing 1 kilowatt each year for two years.

Chose the perfect orientation to maximize energy generation!

The best way is to install your PV tilted and south oriented. Nevertheless, you are allowed some shifts without losing too much of your production.

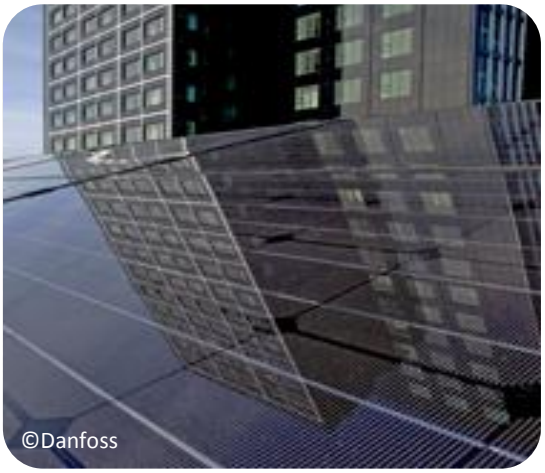
For instance, considering the mean latitude value for central Europe, a +/- 15° tilt shift can involve a slight 2% loss, while the same shift from the southern direction is merely capable of reducing a system's performance by 3% (*Source: PVSunrise project).*

Ways to install and/or integrate PV systems in your SME hotel Roof:

In order to install a PV system on a roof it is possible to either fix the array over the roof covering, so it sits above the tiles or slates, or to integrate the tiles into the finished roof. When the PV arrays are fitted over the roof covering, the arrays are fixed to the roof structure by drilling through the roof covering (tile, slate) directly into the rafters. Careful planning is required. Holes must also be made for cabling to and from the PV array to the inverters. These holes should be weather-sealed with roofing sealant.

Integrated roof: To integrate an array into the roof finish, PV tiles are used to replace individual ordinary roofing tiles or slates. Either a part of the roof can be replaced with PV tiles or the whole covering. The PV tiles are anchored onto the roofing battens and are screwed in place. The tiles overlay like single-lap roof tiles and are connected electrically together with the cabling taken back to the electrical inverter.

Façades integration: PV systems that are integrated into the façade of a building are called —Building Integrated PV – BIPV . BIPV can be used in many different ways in the building envelope. In order to exploit the maximum of the PV system, though, it is advisable this has a good exposure (i.e. it is tilted and south oriented, no core or half shadows). In these kinds of applications, different types of modules can be used such as classic (framed) modules, flexible crystalline or thin-film on metal substrate, roof-tiles with solar cells, transparent monocrystalline modules, modules with colored solar cells, semitransparent micro perforated amorphous etc. For this reason, BIPV can be applied on both new and existing buildings and can allow a variety of different designs. A building façade with good design and structure is the first requirement to have a good BIPV system installed. Once this prerequisite is fulfilled, BIPV can be used in a broad array of ways, other than for producing electricity. (Weather protection, heat insulation, sun protection, noise reduction, modulation of daylight).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Window integration: Glass PV laminates can be applied to windows providing a semi-transparent façade. The transparency is normally achieved using either of the following methods: The PV cell can be so thin or laser grooved that it is possible to see through. This will provide a filtered vision to the outside. Semitransparent thin-film modules are especially appropriate for this application. Another option is to use semi-transparent crystalline solar cells. Crystalline solar cells on the laminate are spaced so that partial light filters through the PV module and illuminates the room. Light effects from these panels lead to an ever changing pattern of shades in the building itself. The room remains shaded, yet not constrained.

PV combined with other solutions

Solar garden lights can be used in your hotel. These lights use a small photovoltaic panel at the top of the light. This panel draws the sunlight in, and then charges and stores the energy it makes into the battery under the PV panel in the light. As it charges throughout the day, it stores enough energy to light a walk way or a garden path throughout the night, repeating the cycle again when the sun rises.

Photovoltaic panels can be combined with biomass generators or a wind turbine, as far as RES technologies are concerned.

BENEFITS FOR THE HOTELS

COST REDUCTION

- The sun doesn't send monthly bills!!!
- PV can produce energy!

PV modules, unlike any other building materials, produce energy and therefore allow a hotel to recover the initial cost of their investment. More in particular, all electricity generated can be injected and sold to the electricity provider at higher price than the price paid in your monthly electricity bill. This mechanism, called —feed-in tariff , enables you to pay-back your investment in a short time. Some other systems exist to develop renewables (green certificates, tendering, tax credit).

GUEST INVOLVEMENT

Install a demonstration diagram to show your guests how the sun is generating electricity for your hotel. By motivating your guests, they will also feel more responsible and involved in taking care of your hotel! Guests will value the fact that your hotel is environmentally conscious.

BENEFITS FOR THE ENVIRONMENT

CARBON EMISSIONS REDUCTION

How much CO2 a solar roof can save will depend on many factors, including: - the energy source that the solar production is replacing (coal, gas, hydro-electric, nuclear...); - the quantity of energy produced by the solar roof (depending on the roof's location, orientation, inclination and shading); - the "energy habits" of the solar roof owner (does the solar roof owner use less energy now that they are aware of the cost of producing electricity? Or do they see their production as a "bonus" so that they can use more electricity than before?).

The first point is the most important - if your electricity comes from a coal fired power station, each kWh you use will release around 1 000g of equivalent carbon (various greenhouse gases converted into 'equivalent carbon units' for comparison). However, if your original electricity comes from a hydro-electric power station, it is producing much less carbon equivalent emissions (less than 10g). So clearly the amount of CO2 you will be saving is very dependent on the source of your 'normal' electricity.

(*Source: PVSunrise project: http://www.pvsunrise.eu/about-pv/faq.html#c56)*