

SOLAR PANEL EFFICIENCY

Solar panel, or more correctly solar cell, efficiency measures how much of the sun's radiant energy that falls on the cell is converted into electrical energy. It is stated as a percentage. For example, a 15 percent efficiency rating means that of all the radiant energy that falls on a cell, 15 percent is converted into electricity. A cell's efficiency is mainly determined by the type of technology it embodies.

For any given level of efficiency, the amount of electricity a cell will produce depends on two key factors. First, the panel's angle of tilt toward the sun. Second, the panel's overall physical condition, including its cleanliness.

Solar Cell Technology

Not all solar cells are equal. Some are more efficient than others depending on the technology they incorporate. The most critical design factor is the material used in the cell to absorb or capture sunlight. Based on this criterion, solar cell technologies divide into two dominant streams – crystalline silicon (cSi) and thin film technologies. The crystalline silicon segment further divides into monocrystalline and polycrystalline cells. The thin film segment further splits according to the type of absorbent semiconductor used in the cell, the main types being amorphous silicon (a-Si), cadmium telluride (CdTe) and copper indium gallium selenide (CIGS). Thin film technologies are so-called because they reduce the amount of absorbent material required to produce a solar cell. Although this reduces material cost, it may also decrease conversion efficiency. Thin film silicon cells are widely used in the solar power industry because of their low cost,

flexibility in use, light weight and ease of integration compared to silicon cells. On the other hand, crystalline silicon cells generally have higher efficiency.

Experts are divided as to which technology offers the best potential.

Interestingly, the General Electric Company (GE) has put its money behind thin film technology. Early in April 2011, GE announced plans to build the USA's largest solar panel plant to produce panels based on thin film technology.

GE also announced that it had achieved the highest publicly reported efficiency for CdTe thin film solar cells. The efficiency of the cell was measured by the National Renewable Energy Lab (NREL) at 12.8 percent. GE believes CdTe thin film technology is the most affordable technology in the industry if both cell efficiency and its overall cost are taken into account.

Inclination To The Sun

Solar panels used in homes and offices are usually positioned on the roof. To maximize their exposure to sunlight, the panels face south in the northern hemisphere (and vice versa) and are angled at about 30 degrees to the earth's surface.

If a panel's angle to the ground is fixed, its angle to the sun varies as the sun's position in the sky changes during the day and from season to season. Research studies confirm that the amount of sunlight captured by a panel can be significantly boosted, by as much as 20 to 30 percent, if it is installed on racking system that tilts so that the panel's angle to the sun is constantly optimized. These tilting racking systems are known as Solar Trackers. They are not feasible for all installations.

Physical Condition

Like all equipment, solar panels degrade over time through normal wear and tear. They are designed to provide an operating life of about 25 years. Efficiency during that period is not expected to degrade materially.

Importantly, even when new, the amount of electricity a panel produces can be significantly decreased if sunlight is prevented from striking its solar cells. This can occur if dirt and grime is allowed to accumulate on the panel's protective glass sheets. These sheets should be regularly cleaned.

Progress

When solar cells first began to be developed during the 1950s and 1960s, their efficiency was very low at around 1 percent. By the time they started being produced on a commercial basis during the 1970s, their efficiency had climbed to 3 or 4 percent. Since those early years, better technology has greatly boosted efficiency. Today, cells used in solar panels installed at homes and offices typically have an efficiency ranging from 12 to 20 percent.

Most experts estimate that solar cell efficiency will reach closer to 25 percent within the next decade.

Practical difference between different solar panel efficiencies

All else equal, you can fit a larger solar system (measured in kw) on the same size roof using higher efficiency panels. For example, take a 10,000

sq ft rooftop space. Utilizing highly efficient solar panels (ie. 18% efficiency from SunPower) you could fit approximately 120kw on the roof. However, with a lower efficient module (ie. 14%) you could only fit 100kw.

Source: <http://brightergy.com/education/solar-panel-efficiency/>