

Frequently Asked Questions: The CPV Consortium and CPV Technology

What is the CPV Consortium?

The CPV Consortium is a global industry organization that supports the development and long-term success of the Concentrator Photovoltaics industry with the goal of providing a low-cost, reliable source of renewable energy. Its members include designers and manufacturers of CPV panels, CPV cell suppliers, and tracker suppliers. The membership also includes a large base of companies working on the deployment, test, materials, and other parts of the industry infrastructure.

Can I be a member of the Consortium if my company does not directly supply CPV systems?

Yes, the vision of the CPV Consortium is to have a global organization covering all facets of CPV, from the components through the deployment. Current members are cell suppliers, tracker suppliers, panel suppliers, support companies, system integrators and installers, research labs, power generators and universities.

What is “CPV” and how is it different from other solar technology?

CPV stands for concentrator photovoltaics. A concentrating photovoltaic (CPV) system converts light energy into electrical energy in the same way that conventional photovoltaic technology does. The difference in the technologies lies in the addition of an optical system that focuses a large area of sunlight onto each cell. Solar concentrators of all varieties may be used with the base technology either being refractive or reflective. The other primary difference is in the cells. Traditional PV systems utilize large amounts of silicon solar cells. In contrast, CPV systems utilize a small amount of high-efficiency solar cell material. These cells used in high concentration CPV systems are referred to as multi-junction or III-V cells. The CPV panels are mounted on to keep the focal point on the cell as the sun moves across the sky. CPV is sometimes confused with CSP – Concentrating Solar Power. Whereas PV converts light energy directly to electricity, CSP systems utilize heat from the system to generate power in a traditional steam engine power plant environment.



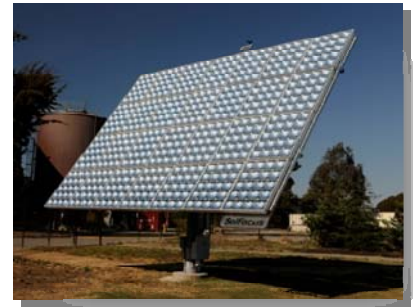
What value does CPV bring to the solar industry?

CPV, with its higher efficiency delivers higher energy production per megawatt installed, provides the lowest cost of solar energy in high solar regions of the world. The technology is in its early stage with significant headroom for future innovation, and it has the ability to ramp to gigawatts of production very rapidly. Many of the limitations for PV in the past are overcome by advances in CPV technology.



Do CPV systems perform better than traditional silicon based PV?

CPV systems have much higher efficiency than do traditional systems. Because they are concentrating, they can only use direct sunlight, not indirect or diffused sunlight. In regions of the world where there is high solar resource, CPV systems will produce significantly more energy than traditional PV systems. The fact that the CPV cells do not degrade in performance when temperatures are high provides another advantage to CPV in the high solar resource areas where high temperatures are common. CPV systems also track the sun throughout the day which correlates to more energy production that is an excellent match to peak demand load. CPV systems will produce electricity at a steady rate late into the day, a capability not available to fixed tilt PV systems.



Where will CPV systems be most efficient?

CPV systems perform best in areas with plenty of direct sunlight, since clouds and overcast conditions create diffused light that essentially cannot be concentrated. Ideal markets for this technology include the Mediterranean (Spain, Italy, Greece and other parts of southern Europe), the Southwest US (California, Nevada, Arizona, New Mexico, Texas, Colorado), Australia, North Africa, the Middle East, as well as other areas in the southern hemisphere.

What is the efficiency of CPV systems?

The efficiency and the energy yield of CPV systems are exponential. Efficiency can vary by distributor, but the typical range for commercial terrestrial application systems is 30 – 35%. However, it is important to keep in mind that there are a lot of ways that efficiency is referenced so in comparing systems and efficiencies it is important to understand how efficiency is being measured. Regardless, CPV technology is more efficient than conventional silicon solar systems.

What is the efficiency rating of PV panels?

A typical PV panel today would have a rated efficiency of around 15%. There are some panels available in the 18+ % range, but they are the exception to the commonly available PV panels. It is important to note that the rated efficiency does not take into account such things as performance degradation due to temperature, and other variations that affect panel efficiency.

What is different about solar cells used in CPV systems?

The photovoltaic cells used in high concentration CPV systems differ from those used in traditional photovoltaic systems which are usually crystalline silicon cells. CPV cells, referred to as “multi-junction” or “III-V” cells were originally created for space applications. Now they are being used in terrestrial solar applications, and it is the availability of such cells that has been a key enabler of CPV technology. These cells provide energy conversion efficiencies much higher than traditional silicon cells – approximately 37+% today with planned efficiencies over the next few years moving into the 45% range.

Why are trackers needed?

Because CPV systems use optics which function much like telescopes, focusing sunlight onto small PV cells, the units must stay in direct alignment with the sun throughout the day. Different systems have different fields of view with varying acceptance angles, however, above 10X concentration, tracking is required.

What maintenance is required for these systems?

Maintenance on CPV systems is similar to that of traditional PV solar systems. The panels must be cleaned periodically, and the trackers require simple maintenance for the gears and motors. System maintenance and personal training are important to ensure that the panels are performing at their top potential. Since operation and maintenance is specific to a given system, it is best to talk directly to the manufacturer about its recommended maintenance.

How does CPV technology keep the environment in mind?

Compared with other solar technologies, CPV has the most environmentally favorable footprint. While all systems vary in detail, overall you will find CPV systems to provide the best use of land, support distributed generation models for minimal disruption of land, have a lower energy payback period than other technologies, use next to no precious water resources, allow flexibility in site layout to utilize already disturbed lands, have no permanent shading, and are much more highly recyclable.



What is LCOE?

LCOE stands for Levelized Cost of Energy. Basically, it is the net present value of the total cost of generating energy, divided by the amount of energy produced. The key in using this as a metric for evaluating energy options is that it encompasses all of the costs and measures that against the amount of energy generated, providing a much more appropriate measure than such metrics as \$/watt which fail to take into account actual energy production. Levelized cost of energy also allows solar energy to be compared with other forms of renewable and conventional energy.

What do all these electrical terms mean?

Watt – Unit of power

kW (kilowatts) – 1000 Watts

MW (megawatt) – One Million Watts (10^6)

GW (gigawatt) – One Billion Watts (10^9)

TW (terawatt) – One Trillion Watts (10^{12})

kW-hr – power consumed over time (W x time)