PV COOLER

A PROPOSAL TO EDF EN

11 09 2013

PV Cooler

Photovoltaic Cooling System

The effect of temperature

Photovoltaic cells performance depends on ambient temperature. In order to generate electrical power, In the process of converting sunlight to effective current most of the available energy received by sun light radiation is dissipated in the form of heat. Only 10-20% of this energy is converted to useful electrical power. Heat is a form of energy which requires physical means for transfer. It is not possible to simply get rid of heat; it needs to be transferred by one of four forms: Conduction, Convection, Radiation or Phase change. PV Cooler uses water to perform two methods of heat transfer. PV panels sprayed with room temperature water conduct heat to the fluid raising the water temperature and lowering panel ambient temperature. At the second stage, water changes phase to vapor removing an additional substantial amount of heat.

Hard Water

Hard water forms deposits that stick to PV panels. These deposits, called "scale", are composed mainly of calcium carbonate ($CaCO_3$), magnesium hydroxide ($Mg(OH)_2$), and calcium sulfate ($CaSO_4$). Calcium and magnesium carbonates tend to be deposited as off-white solids on the surface of the PV panel. This precipitation (formation of an insoluble solid) is principally caused by thermal decomposition of bicarbonate ions but also happens to some extent even without such ions. The resulting build-up of scale restricts sun light reducing cell efficiency over time.

Water Treatment

PV Cooler addresses hard water by carefully filtering it using a four stage reverse osmosis system

Reverse osmosis (RO) is a water purification technology that uses a semipermeable membrane. In RO, an applied pressure is used to overcome osmotic pressure, a colligative property that is driven by chemical potential, a thermodynamic parameter. RO can remove many types of molecules and ions from solutions and is used in both industrial processes and in producing potable water. The result is that the solute is retained on the pressurized side of the membrane and the pure solvent is allowed to pass to the other side. Filtered water used for cooling contains less than 10ppm of calcium carbonate and magnesium hydroxide salts which means it can be used safely over extensive periods without causing scale. An additional advantage arises from the readily available treated water on site which can be used to clean panels safely.

Algorithm

PV cooler uses a water saving energy maximizing automatic control algorithm which runs on a microcontroller. A control loop measures the outside air temperature, PV panel temperature and sun radiation; this information is used to determine the amount of water required to cool the panels as both temperature and radiation vary. The water supply is modulated in an inverse linear ratio. The typical range for PV panels can be from 20ºC to 80 ºC as the outside ambient temperature varies from 20ºC to 40ºC.

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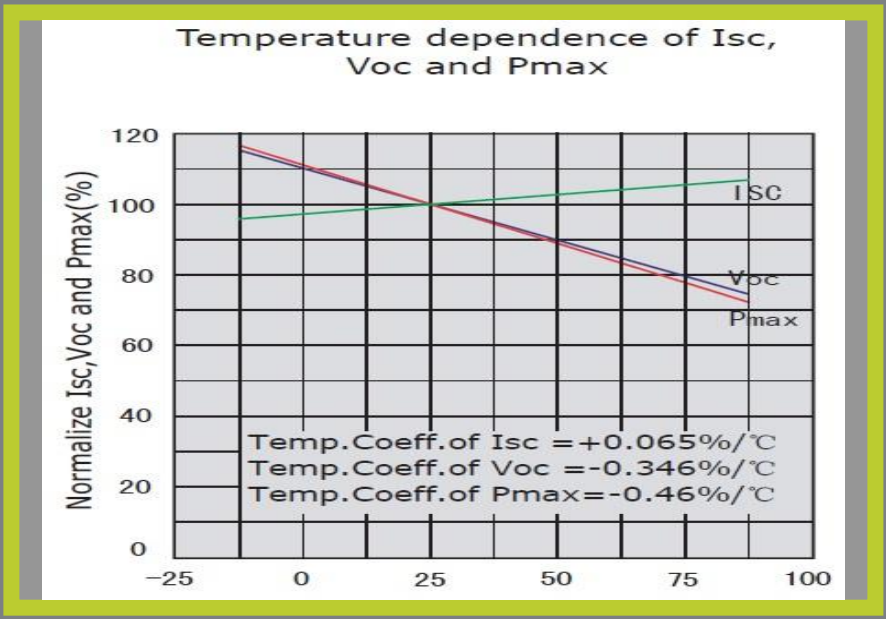

PV Cooler performance gain

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Month Day Year

PV Cooler Offer

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PV Cooler

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