

Thermographic trouble shooting of solar photovoltaic panel (SPV) & balance of plant (BOP)



Objective

- To find out defects in solar modules, cells, junction boxes, array box, cables, diode junction box, inverter section, LT panels, LT cables, power transformers & transmission lines.
- To establish correlation between SPV panel thermal profile and module efficiency & life.

Introduction

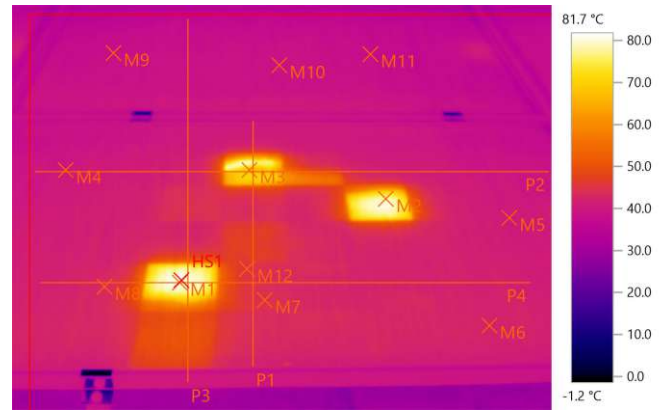
A photovoltaic power station or a solar power plant, is a large-scale array of photovoltaic system designed to utilize the solar energy and supply electricity to grids. This set up is an excellent alternative for the conventional sources of energy and is eco-friendly as well. Photovoltaic systems are an important contribution to the energy transition, and to a sustainable handling of resources. In recent years, they have been one of the greatest sources of power and electricity. But with great results there are some serious threats that tend to jeopardize the power output of the system. This makes the maintenance of the plants a significant aspect to tackle such threats concerning the functioning of a solar set up.

Potential threats to Photovoltaic Plants

Even a small technical defect in the plant is sufficient to have a considerably negative effect on the solar yield – and therefore the economic viability of a photovoltaic plant.

Some of the biggest problems that could be witnessed are

- Hotspot
- Open/Short circuit in the modules
- Overheating of panels or joints
- Micro-cracking & cell ruptures
- Corrosion & loose connections
- Defects in balance of plant



Identifying the defected solar cells by thermography

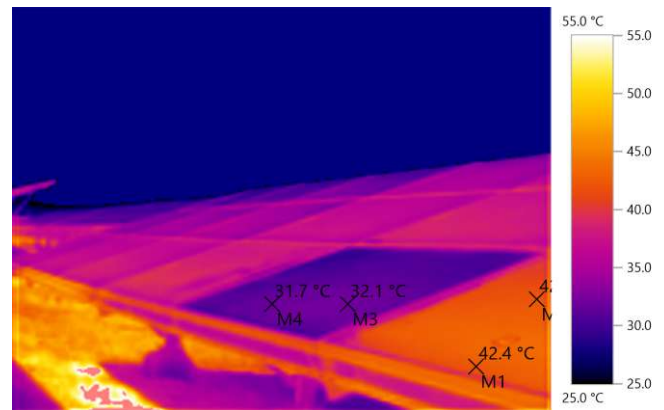
Case Study 1: Mahagenco Solar Power Plant, Chandrapur, Maharashtra

Thermography of Solar Photovoltaic Panels

The solar power plant set up is mostly exposed to the open environment due to which it is prone to all kinds of physical aspects such as dust, wind, moisture etc. This leads to the deposition of dirt & dust on the surface of solar panels. The panels which are not cleaned for dust & dirt are likely to get more heated than those which are regularly cleaned. This excess heating leads to faster deterioration of the panel & hence thermal inspection of all the modules is a must.

Bird drop is another issue which leads to localized heating of the portion of the module due to which the entire module fails. If this error is not identified at an early stage then it might lead to major losses in generation, revenue and availability of the plant.

Thermal Imager testo 872 is best suited for SPV panels and was used to take the thermal image of modules to monitor the panel heating with respect to dust, dirt or bird drops on the panels.



Identifying the panel cleaning issues and temperature variation in the cells.

Case Study 2: Sakri Solar Power Plant (125 MW), Dhule, Maharashtra

Trouble shooting in Balance of Plant (BOP)

In addition to the thermal inspection of modules, the cables joints, junction boxes, blocking diodes if not inspected properly may lead to major fire accidents and other catastrophic failures in the power plant.

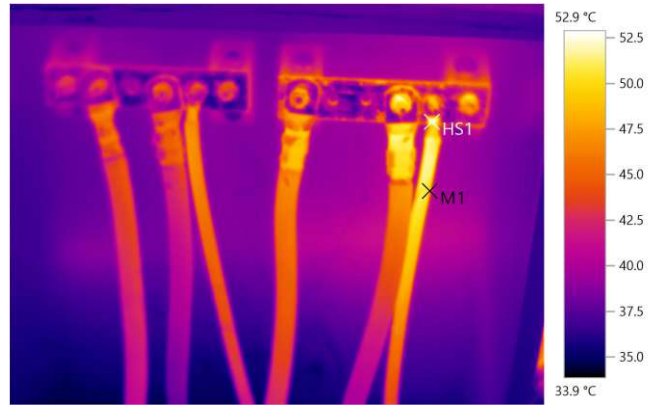
Inverter section is also a major asset to be monitored and thermal imaging is a very vital tool for checking healthiness of inverter section as due to continuous usage it might get overheated. If it gets excessively heated, it will lead to inefficient operations and may cause component failure which is fatal and can cause availability issues.

Thermal inspection of assets such as switch yard and transmission lines up to POC (Point of Coupling) at transmission utility is very necessary. If there exists any issue which is not attended on time may lead to grid unavailability and can cause losses to government or Independent power Producers (IPP) in terms of revenue and time.

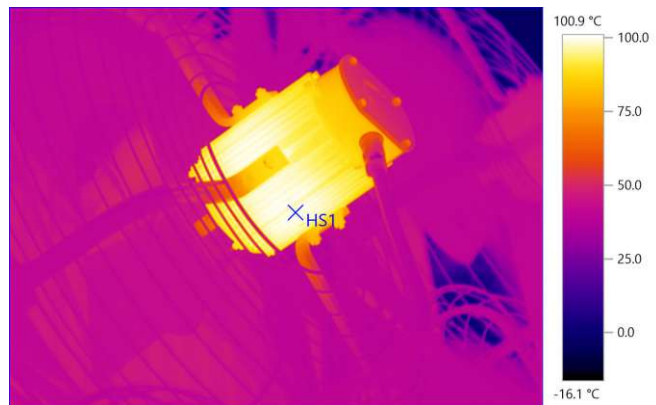
Testo 885 was used for monitoring and thermal analysis of the entire Balance of Plant of the solar power facility which helped in identification of several aspects & defects such as cooling fan motor issue of the transformer radiator.

Features that make Testo Thermal Imagers the best solution for trouble shooting in solar power plants

- IR resolution of the detector is 320 X 240 pixel or higher which is recommended for large PV systems.
- Solar mode - storage of solar radiation intensity together with the thermal image for easier interpretation and evaluation.
- Exchangeable lenses for time saving inspections of large module surfaces from a safe distance.
- Analysis software testo IRSofT for fast and convenient creation of professional evaluations & reports.
- Interfacing of thermal imager with temperature, humidity probe & clamp-meter for solar power analysis.



Determination of cable heating using thermography



Determination of cooling fan motor defect in transformer radiator



testo 885



testo 872 with bluetooth connectivity

Subject to change, including technical modifications, without notice.

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