

8 CONCLUSIONS AND FUTURE SCOPE

The research has successfully tested the PV module performance when dust deposits over its surface. There are two distinct effects due to the dust deposition. One is the loss of power output performance and the other is the creation of a hot-spot. It is evident that the power output is reduced for complete string even when one PV cell is dust shaded. Reliable functioning of the bypass diode is essential for prevention of hot-spot creation. Very high magnitude of temperature at the hot-spot junction is observed.

The present work has studied the effect of partial shading on solar PV Module with bypass diode and without bypass diode by using different shading materials such as black masking tape, charcoal dust and hydrocarbon dust. In this, hot-spot phenomena caused cell damage, discolouration and reduction of power output performance was also observed on the solar panel.

It was noted that the maximum hot-spot temperature on rear surface of PV module reached to 347 °C with bypass diode not turned ON condition. Thus, the cell surface temperature reaches to temperature class T2 ($\geq 300^{\circ}\text{C} \sim \leq 450^{\circ}\text{C}$) which is well within AIT of many hydrocarbon vapour temperature class T2–T6. Partially shaded PV modules with hot-spots have potential to ignite a flammable vapour cloud and thus a fire hazard. It was avoided by using bypass diode(s). However, the reliability of the bypass diode function remains uncertain. It is recommended to use application of specific PV modules with custom design of by-pass diodes for hydrocarbon industries.

There is a possibility of fire risk/hazard potential in hydrocarbon industries, which need to be carefully analyzed and evaluated in order to be minimized. The present work has evaluated these hazards and recommended mitigating design or installation strategies.

As number of physical parameters and variables are influencing the behavior of the PV module under dust shade which need a complex algorithm to predict. Predictive Modeling PV modules hotspot under fault conditions are still unexplored which is a future challenge and apt for research studies. There is further scope for performing this research studies in on a Group-III /V and Group-II /VI material PV modules.