Area: AREA 8, PV SYSTEMS INCLUDING BOS COMPONENTS

INVERTER SIZING FOR A GRID CONNECTED SOLAR PHOTOVOLTAIC POWER PLANT USING GROUND MEASURED SOLAR IRRADIANCE AND TEMPERATURE: ANALYSIS USING NEW SIMULATION APPROACH

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This paper investigates the sizing aspects of the inverter capacity required for a solar photovoltaic (PV) power plant. The capacity of an inverter in a solar power plant, is decided based on the DC output from the PV modules which is instantaneously varying with respect to the irradiance and ambient temperature at any given instant. The DC to AC ratio of the inverter, often termed as P_{nom} , is used to fix the capacity of the inverter. PV industry follows a general thumb rule in the range of 1.2 to 1.25 for the P_{nom}.The higher value of P_{nom} indicates lower inverter capacity and hence, the lower cost. But for those locations, with high intense irradiance and low ambient temperature, the choice of P_{nom} is near to 1. The availability of number of hours of high intensity solar irradiance is normally not taken into consideration while deciding the P_{nom}. The decision to choose the best P_{nom} is always a challenge, as it depends on weather parameters of any given location and there is always a room for optimisation in inverter sizing.

A simulation methodology is formulated in this paper with solar irradiance, ambient temperature and other plant efficiency parameters as input to facilitate the optimal selection of P_{nom} for any given location. The application of the proposed simulation is demonstrated for two locations, Chennai (Hot and Humid) and Gurgaon (Hot and Semi-Arid) in India. The ground measured solar irradiance and ambient temperature data for a given year, with one minute interval, is used in the analysis.

The results from the proposed simulation methodology indicates that, 1.13 and 1.11 are the best P_{nom} for the Chennai and Gurgaon considering only the peak generation. However, further optimising based on hours of peak generation reveals that, P_{nom} can be optimised to 1.18 and 1.26 respectively for Chennai and Gurgaon. The results also provides useful insight into the monthly variation in the P_{nom} which is useful input for the scheduling the maintenance of inverter. The capacity utilisation of the inverter for every minute is another useful product of the proposed simulation, which will serve as a useful input to the designer in evaluating the effective kWh (example as given in Figure 1) and, also for the operation and monitoring team for the staggering operation. The proposed simulation methodology is generic, and this can be extended to any locations.

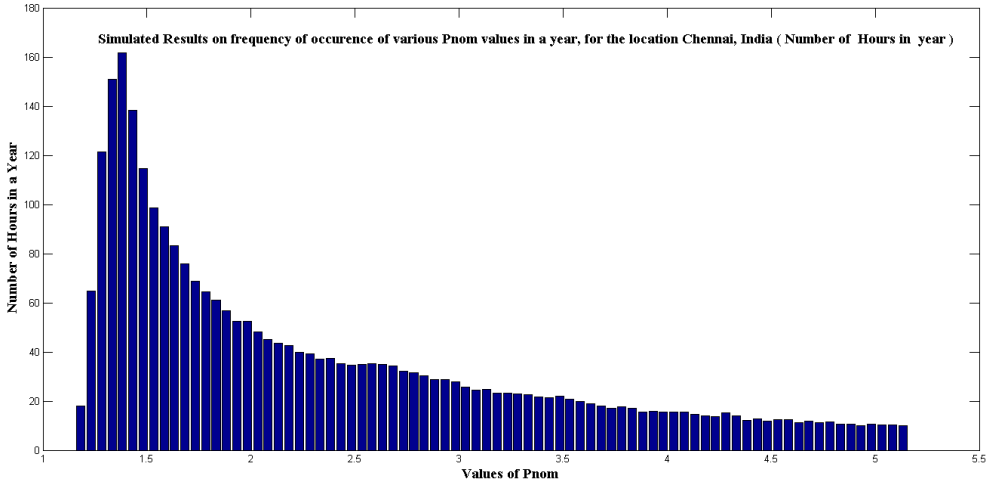

Figure 1: Simulated Results on frequency of occurrence of various P_{nom} values in a year, for the location Chennai, India (Number of Hours in year)