

5ER-O07: Performance Evaluation and the Returns of Investment of different Solar PV Panel Types in the Utility-Scale: Cases of the Installation in Multi-region in Thailand.

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Abstract

Grid-connected solar PV systems have become the best alternatives in renewable energy on a large scale. Performance analysis of these grid-connected plants could help in designing, operating, and maintenance of new grid-connected systems. A solar farm that has normally at least 10 MW installation of photovoltaic grid-connected power plant commissioned in Thailand is one of the largest solar power plants with the site receiving a good average solar radiation potential. Thailand has a solar radiation potential with an average of 17.8 MJ/m² per day. However, solar radiation potential varies with the geological areas. The potential of solar PV installation is high in the central and northeastern regions. The northeastern region has average solar radiation of 18.0 MJ/m² per day, while the central region has 18.1 MJ/m² per day, followed by 17.7 MJ/m² per day in the southern region and 17.5 MJ/m² per day in the northern region. Thailand has great potential and a history of success to develop solar PV for electricity generation. It also has carried out the objective of promoting renewable energy investment for power generation. This study aims to investigate the performance analysis and the returns of investment of solar PV installation of the selected power plants in the utility-scale of different Solar PV panel types in each region of Thailand. The performance results of the plant are also compared with the simulation values obtained from Solar-GIS software. The performance analysis includes The final yield of each plant installation, an annual performance ratio (PR), and an annual electricity generation (MWh/annum). The economic viability of investment in solar PV installation is in comparison by using the usage of the net present value (NPV), internal rate of return (IRR), and payback period (PB). The PV system performance in this study varies from 71.1% to 84.5% and their energy yields per annum vary from 1,361 kWh/kW_p to 1,467 kWh/kW_p (poly c-Si); 1,492 kWh/kW_p to 1,635 kWh/kW_p (a-Si); 1,381 kWh/kW_p to 1,495 kWh/kW_p (CIS). The returns of investment namely: Equity %IRR is in the range of 9-11%, and the payback period is less than 10-11 years. The solar PV installations can reduce emissions at a maximum rate of 773 tons of CO₂ per year of 1 MW installation.

Keywords: Solar PV, Solar PV in the utility-scale, Performance analysis, Returns of investment, Solar-GIS and PV-GIS.

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