OPTIMIZATION OF PHOTOVOLTAIC (PV) POWER PLANT

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Project Description

• The PV power plant is established to supply electricity to approximately 3,000 houses in the U.S.A., generated electricity will be sold to an energy supplier under Power Purchase Agreement (PPA).
• Depending on the client’s interests, optimization may be achieved for either energy production or revenue.

Design Approach

• The basis of PV design, semiconductors and module supporting structures, is selected based on performance, cost, and efficiency.

Semiconductor technology:
• Crystalline Silicon (Mono & poly-Si)
• Thin Film (a-Si, Cd-Te & CIGS)
• Multi & Single-junction cells

• Module supporting structures:
  - Tracker supporting structure [2]
  - Fix Tilt supporting structure [3]
  - Typical c-Si module [4]

PV Power Plant Design

Site description:
• Palm Springs, California
• Desert-like climate

PV power plant specifications:
• Fix tilt poly-Si modules: 45,360
• Installed capacity: 13.15 MWdc

Environmental impact:
• 21,600 MWh of clean energy per year
• Mitigates approximately 14,000 metric tons of CO2 emissions

Financial aspects:
• PV power plant cost: $26
• Cost 2.28 $/Wp
• Payback period: six years

Testing / Implementation:

• Achieving either high energy sale or high Net Present Value (NPV) is the main focus of the project. These two goals are obtained by generating energy production, revenue and financial simulations based on the best combination of DC/AC ratio, tilt angle, and azimuth orientation.

References:

M.Eng.Design
W.G. Booth School of Engineering Practice, GMC Centre for Engineering Practice, McMaster University

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