



Techno-economic study of a solar photovoltaic and diesel powered irrigation systems

Mohammad Z. Al-Nabulsi^a, Robhul Miah^a, Shafiqur Rehman^{b,*},
Fahd Abdulaziz Al-Sulaiman^{a,c}

^aDepartment of Mechanical Engineering, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia, emails: g201520570@kfupm.edu.sa (M.Z. Al-Nabulsi), g201403960@kfupm.edu.sa (R. Miah)

^bCenter for Engineering Research, Research Institute, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia, email: srehman@kfupm.edu.sa

^cCenter of Research Excellence in Renewable Energy, Research Institute, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia, email: fahadas@kfupm.edu.sa

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ABSTRACT

The paper presents the feasibility of photovoltaic water pumping system (PVWPS) to determine its suitability for irrigation purpose in Saudi Arabia. The study analyses an irrigation system for 4,900 m² land having 100 orange trees. Six distinct geographical locations have been considered to explore the feasibility of the proposed system. The study has discussed two scenarios for water pumping. In the first and second scenarios, water demands of 12 and 36 m³/d have been considered. The proposed PVWPS fulfilled the water demands in both scenarios based on number of selected photovoltaic (PV) panels. The life cycle cost (LCC) analysis showed that for all the scenarios and cases, the total cost of PVWPS for 30 years was almost half of the total cost of diesel generator water pumping (DGWP) system. In scenario 1 (case 1), the capital cost of the DGWP was 1,600 US\$ while that of PVWPS 3,173 US\$ but the operation and maintenance and LCC costs were 6,240 and 14,320 for diesel and 3,637.7 and 6,804.7 for PVWPS, respectively. Overall, the larger PV systems were found economically more attractive. The subsidy played an advantageous role in making the system further economically attractive. Proposed systems can be deployed in Saudi Arabia and the regions having similar soil and climatic conditions.

Keywords: Photovoltaic; Diesel generator; Water pumping; Irrigation; Crop farming

* Corresponding author.