



Technical, Economic and Environmental Advantages of The Solar PV Pumping System for Onion Irrigation in Agadez, Niger

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Abstract

In Niger, the main sources of energy used to pump water in private and community irrigated areas are: gasoline (6%), gas (65%) and solar (29%). To highlight the importance of these sources for irrigation, a comparative analysis of the technical, economic and environmental advantages when used for onion irrigation is undertaken. The primary purpose is to provide farmers with better assistance when selecting an onion irrigation system. Based on field data collected, this study optimally sizes three irrigation systems for a one-hectare onion field. It then assesses their various costs in order to compare performance parameters, such as the levelised cost of electricity (LCOE), the irrigation cost and the carbon footprint over a 20-year lifetime. The findings indicate that the solar photovoltaic system is more efficient than others systems. In fact, it has an LCOE of 85.30 versus 197.70 and 257.20 FCFA/kWh; then an irrigation cost of 8.30 versus 17.10 and 26.20 FCFA/m³; and also, a very low carbon footprint of 2.25 versus 25.90 and 27.60 teq CO₂ respectively for solar, gas and gasoline. The results also indicate that farmers who utilize solar systems generate significantly higher profits than their counterparts. This is due to their reduced irrigation system costs, which result in savings of 5,858,000 and 3,831,000 FCFA respectively, compared to those who use gasoline and gas. While gas users save FCFA 2,027,000 compared to gasoline users. Furthermore, the usage of gas reduces CO₂ emissions by approximately 2 teq than gasoline. Moreover, the findings reveal that allowing a high share of solar energy can help to safeguard the environment by avoiding emissions of 25.30 and 23.60 teq CO₂, respectively as compared to gasoline and gas. This study clearly shows that investing in the integration of a solar system for irrigation is the best technical, economic and environmental solution for small and medium-sized areas, followed by gas and gasoline systems.

Keywords: Solar PV pumping; Gas pumping; Gasoline pumping; Economic analysis; Environmental impact; Irrigation.