

Solar Photovoltaic Pumping and Water Treatment Tools: A Case Study in Ethiopian Village

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Abstract : This research involves the Ethiopian locality of Jeldi (North Africa), an area particularly affected by water shortage and in which the pumping and treatment of drinking water are extremely sensitive issues. The study aims to develop and apply low-cost tools for the design of solar water pumping and water purification systems in a not developed country. Consequently, two technical tools have been implemented in Excel i) Solar photovoltaic Pumping (Spv-P) ii) Water treatment (Wt). The Spv-P tool was applied to the existing well (depth 110 [m], dynamic water level 90 [m], static water level 53 [m], well yield 0.1728 [m³h⁻¹]) in the Jeldi area, where estimated water demand is about 50 [m³d⁻¹]. Through the application of the tool, it was designed the water extraction system of the well, obtaining the number of pumps and solar panels necessary for water pumping from the well of Jeldi. Instead, the second tool Wt has been applied in the subsequent phase of extracted water treatment. According to the chemical-physical parameters of the water, Wt returns as output the type of purification treatment(s) necessary to potable the extracted water. In the case of the well of Jeldi, the tool identified a high criticality regarding the turbidity parameter (12 [NTU] vs 5 [NTU]), and a medium criticality regarding the exceeding limits of sodium concentration (234 [mg/L Na⁺] vs 200 [mg/L Na⁺]) and ammonia (0.64 [mg/L NH³-N] vs 0.5 [mg/L NH³-N]). To complete these tools, two specific manuals are provided for the users. The joint use of the two tools would help reduce problems related to access to water resources compared to the current situation and represents a simplified solution for the design of pumping systems and analysis of purification treatments to be performed in undeveloped countries.

Keywords : drinking water, Ethiopia, treatments, water pumping

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