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CPV water pumping systems for agricultural uses: Sizing process, simulation and economic evaluation

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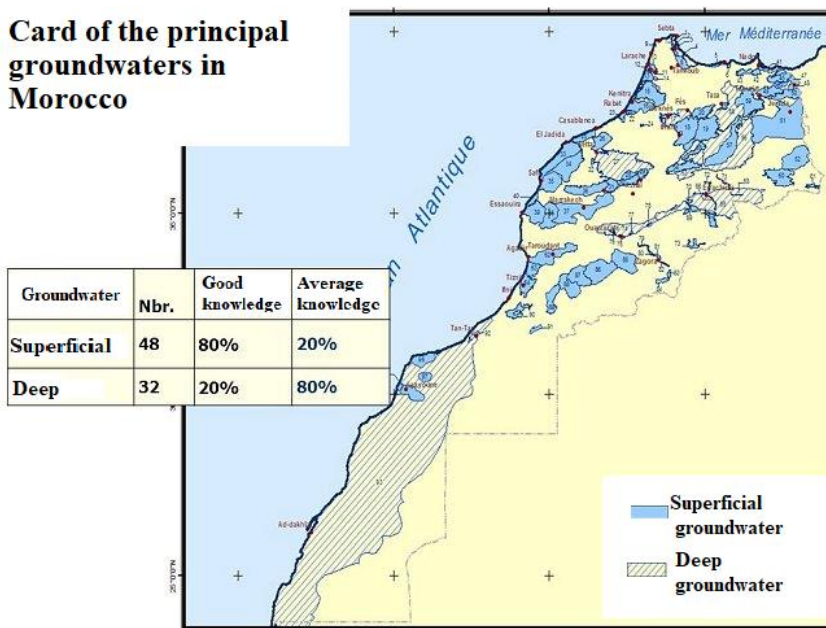
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Abstract

Water resources are a necessity for agricultural uses [1]. During years of drought, farmers pump water from groundwater [2] that is recognized as an environmentally and sustainable solution.

Card of the principal groundwaters in Morocco



Many works were proposed for studying water pumping using photovoltaic panels [3][4] but almost none presented a configuration using concentrated photovoltaic.

This paper proposes a new methodology to make water pumping for agricultural uses based on concentrated photovoltaic technology. The objective of this work is examining a CPV system configuration that is able of supplying a solar pump system to answer needs of three isolated farms located in middle Atlas in Morocco. A detailed methodology for the design of a CPV water pumping system based on real water needs is proposed.

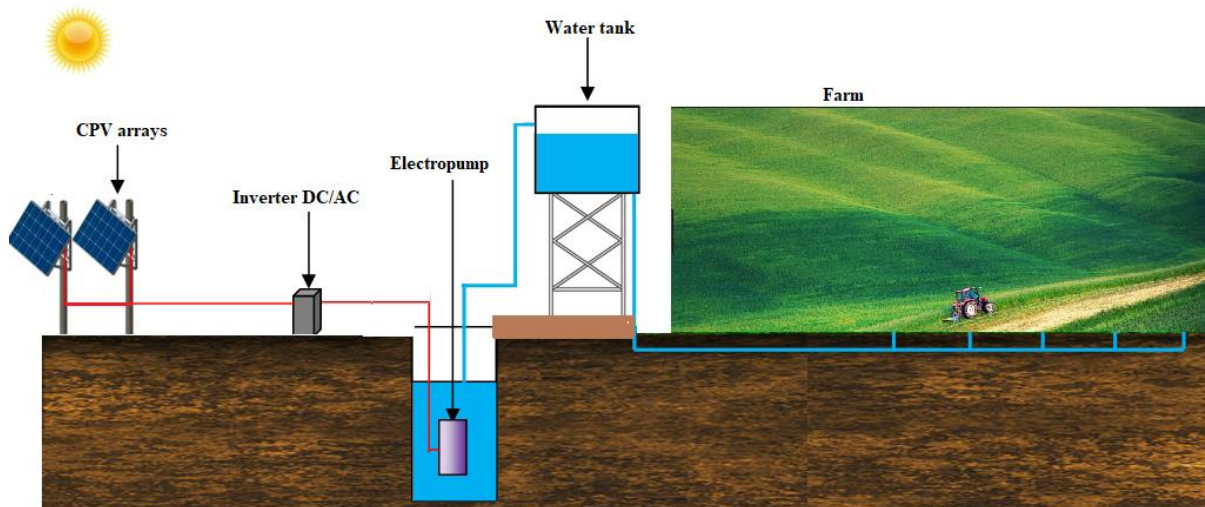


Fig. 1. Layout of the CPV water-pumping system

Fig. 1 is illustrating the layout of the CPV water pumping system with its main components: CPV arrays, inverter, electro-pump and water-tank.

The software used in order to perform simulations was PVSYST [5]. Sizing of such system is made by following main steps that are: Evaluating water needs, calculation of necessary hydropower, determination of solar energy and choice of the components [6][7].

The chosen concentrated photovoltaic module was Concentrix Technology gen II [8] made by Soitec with the triple junction GaInP2/GaAs/Ge and a power of 87 Wp. The chosen pump was Watermax WC [9].

In the following article, sizing procedure is first detailed. Then simulations are conducted in order to have economic and performance indices.

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