AUTONOMOUS DESALINATION IN INLAND RURAL AREAS
Cases of Tunisia and Morocco

B. Peñate, V. Subiela, V. Millán, J. A. de la Fuente

Water Department – Research and Technological Development Division - Canary Islands Institute of Technology (ITC)
Playa de Pozo Izquierdo, s/n, 35119 - Santa Lucía, Gran Canaria Island (Spain). (aguap@tccanarias.org)
Phone: 0034 928 72 75 11; Fax 0034 928 72 75 90. baltasarp@tccanarias.org

INTRODUCTION

Within the framework of the Spanish and Canary Islands international cooperation, two projects for supplying freshwater through RO desalination plants driven by stand alone solar photovoltaic energy had been executed. The first project, commissioned in June 2006, is located in Ksar Ghilène, an isolated village of 300 inhabitants in southern Tunisia, in the middle of the Sahara desert, 150 km away from the nearest electrical grid and 60 km away from the nearest freshwater well. Four more PV-RO systems had been installed in different locations of Morocco within the ADIRA project co-funded by the European Commission within the MEDA-WATER programme. The two plants installed in Essaouira were commissioned in December 2008 and the two installed in Tiznit in February 2009.

FEED WATER

Brackish water in Ksar Ghilène comes from an artesian well located inside the oasis, 2,000 meters away from the building of the project, where it arrives thanks to its natural pressure (37ºC). The water temperature is very fluctuant along the year, from 34ºC in summer to 13ºC in winter. The desalination plant designed is a compact BWRO desalination plant with 2.0 m³/nominal capacity.

KSAR GHILÈNE RO DESALINATION PLANT

The raw incoming water (3 m³/h) which supplies the desalination plant is stored with chlorine dosing in a 30 m³ tank, located inside the building with chlorine dosing. The water passes through a sand filter, and after adjusting pH level and scale inhibitor adding, water flows through an activated carbon filter. At the last stage of pre-treatment, water passes through a cartridge-type filter. After this stage a 70% of the total time it is blended with the raw water. Once the water is pretreated, it goes to the RO module (2.0 m³/h capacity – <300 µS/cm conductivity). The pH and chlorine is stabilized before the storage in the 25 m³ treated water tank. The system is completed with the brine discharge (0.9 m³/h) and the membrane chemical cleaning devices.

实际情况，Four more PV-RO systems had been installed in different locations of Morocco within the ADIRA project co-funded by the European Commission within the MEDA-WATER programme. The two plants installed in Essaouira were commissioned in December 2008 and the two installed in Tiznit in February 2009.

ADIRA project PV-RO desalination plants in Morocco.

CIVIL WORKS AND FACILITIES IN KSAR GHILÈNE

The building constructed for the installations was designed for demonstrating extreme climatologic conditions of room temperatures in summer and common sand storms by providing the highest thermal inertia possible. Furthermore, it was decided to build a semi-buried building, placing the photovoltaic generators on the flat roof and south facade for profiling it shading on the building. Inside the building there is a room which contains the desalination plant and the water supply tank, another room with the electric panels and power control equipment (controller – inverter) and the battery room.

SOLAR PHOTOVOLTAIC SYSTEM IN TUNISIA

The system is composed of 7 photovoltaic generators in parallel, coming up to 10.5 kW peak power of the field of panels (40º inclination). The panel generators supply energy to the isolated electric network, composed by a battery bank and a charge regulator equipment with a nominal power of 10 kW. This 10kW power control equipment is one of the most important parts of the photovoltaic system as it has the mission of controlling the battery charge as well as operating as an inverter. This equipment makes possible that the photovoltaic generator works at the maximum power point and it allows to modulate the output AC signal (pure sinusoidal) in order to keep it constant to 230V.

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