Instituto Tecnológico de Canarias



Spanish Cooperation project in Southern Tunisia: PV-RO desalination unit in the village of Ksar Ghilène (Fernando Castellano)

azahar

ADU-RES 26 September 2005, Hammamet - Tunisia



Gobierno de Canarias Consejería de Industria, Comercio y Nuevas Tecnologías



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KSAR GHILÈNE: Needs and solutions Partners ITC: previous experiences Project description Objectives Phases Technical solution Success of the project

Ksar Ghilène. Location





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Situation: Southern Tunisia



Location: Ksar Ghilène, Kebili

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Characteristics of the village



Population: 51 families (~300 inhabitants)
Facilities: school, mosque, National Guard, community clinic
Activity: agriculture and cattle raising







Water supply: Needs and solution



Needs of water for agriculture, animals and services
Nearest drinking water well: 60 km (Bir Soltane)



Solution:

- Reverse Osmosis (RO) desalination plant
- Supply of energy by a Solar Photovoltaic (PV) power plant

Project co-financed by Spanish International Cooperation.

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Pariners of the Project





Spanish International Cooperation Agency: Spanish Ministry of External Affairs and International Cooperation (Azahar Program)



- Agence Nationale de Maîtrise de l'Énergy (ANME): Attached to the Tunisia Ministry of Environment and Country Planning
- <u>Commissariat Régional au Développement Agricole</u> <u>de Kèbili (CRDA)</u>: Attached to the Tunisia Ministry of Agriculture, Environment et Hydraulic resources



Regional Government of the Canary Islands: General Directorate of Relations with Africa

 <u>Canary Islands Institute of Technology (ITC)</u>: Public company of the Canarian Government, attached to the Regional Ministry of Industry, Trade and New Technologies

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Canary Islands Institute of Technology (ITC)



Fields of activities:

- Energy (renewable energies, energy management, ...)
- Water Technologies (desalination, waste water treatment, ...)
- Environmental Technologies
- Biotechnology
- Medical Engineering
- IT Systems...







Canary Islands Institute of Technology



- Electricity production, penetration of REs in weak electrical grids, development of small-medium size wind energy systems
- Fresh water production, development and evaluation of desalination and water treatment systems (RO, ED, solar MD)
- Hydrogen production
- Cold and ice production
- Application in buildings and agriculture
- Testing of solar thermal collectors
- Sustainable energy and water management...











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ITC previous experiences



Renewable Energies & Water Technologies: Drinking water supply with stand alone systems

- DESSOL Reverse osmosis desalination plant driven by a stand alone photovoltaic system
- DESALPARQ Modular reverse osmosis desalination plant driven by an off-grid wind farm
- AEROGEDESA Sea water desalination plant directly driven by a wind turbine
 - **<u>CONTEDES</u>** Water desalination container (stand alone, grid connection not necessary)



ITC previous experiences (I)



Renewable Energies & Water Technologies: Electricity supply to isolated areas

- MORENA Container with hybrid system (windphotovoltaic-diesel) for electricity supply in small rural villages
- HYBRID SYSTEMS Hybrid systems for electricity supply (wind-photovoltaic-diesel) to isolated villages
- PUNTA JANDIA Wind–Diesel System for the production of electricity, water, cold and ice in remote village



ITC previous experiences (II)



Cooperation with Greek, Macaronesian islands and African countries (Morocco, Mauritania, Senegal, Cape Verde, Tunisia)

- Feasibility study for the electrification and water supply (using renewable energy systems) of 32 villages in Morocco
- Installation of a hybrid PV-wind-diesel system for the electrification in the village of Ouassen (Morocco)
 - Elaboration of the wind atlas of Northern Mauritania

Thematic Parc on RES, Desalination and Drip Irrigation at the Faculty of Sciences and Technology of the University of Nouakchott, Mauritania

4 RO desalination plants at the National Parc Banc d'Arguin (Mauritania). Supply of the 4 plants with RES (2 phase)



Ksar Ghilène: Project objectives



- Supply of drinking water to the population
- 2. Installation of a desalination unit supplied by a solar PV system
 - **Dissemination of the results**
 - Management of the produced water



Phases of the project



- Design of the desalination unit and the solar PV generator
- 2. Study of infrastructures and hydraulic works
- **3.** Civil engineering works
- **4.** Acquisition of equipments
- 5. Elaboration of operation and maintenance manuals
 - Equipment transportation to the village
 - Installation and execution
 - **Practical training of local technicians**
 - Follow-up and evaluation of the project

6.

Project description

Design parameters:

- Daily water consumption:
- Solar Irradiation (annual avg.):
- Ambient temperature (annual avg.): 26 °C (0 45)

Technical solution:

- Well brackish water source. Hydraulic conduction
- Building (passive cooling architectural solution)
- Reverse Osmosis Desalination plant
- PV solar generator



15 m³/day (SUMMER)

5600 kWh/m²

Source of water



Artesian well (brackish water)

- Located inside the oasis
 - Distance from village: 2 km
- Uses: irrigation of palms, crops and tourist services.
- Water characteristics:
 - Concentration: 3500 mg/L
 - **SDI > 3**
 - Temperature: 35 °C







Building



General distribution





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Passive cooling: Semi-buried construction





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Simulation



BALANCE ENERGÉTICO (radiación baja)





Success of the project



- Follow-up and evaluation of the project: 9 months
 - Practical training of local technicians:
 - ITC facilities
 - During the start-up of the system



Management of the produced water





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THANK YOU FOR YOUR ATTENTION

