It is expected during mid/end **2013** to test the two-stage ORC engine in the laboratory using an electric heater, before connecting it to the solar field (*photo 4*) for further testing under real conditions.

Photo 4: Solar field

Consortium

Agricultural University of Athens
www.aua.gr
www.renewables.aua.gr

TEMAK SA
www.temak.gr

Hellas Energy
www.hellasenergy.gr

University of Patras
www.physics.upatras.gr

National Technical University of Athens
www.mech.ntua.gr

Duration and Funding

The project duration is 36 months (start: December 2010) and is receiving funding by the Greek General Secretary of Research and Technology (GSRT), under the program "SYNERGASIA 2009" with grant agreement n° 09SYN-32-982 [Two-stage RO-Rankine]

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Two-stage RO-Rankine

Development and experimental evaluation of two-stage solar organic Rankine cycle system for RO desalination

[*Two-stage RO-Rankine*]

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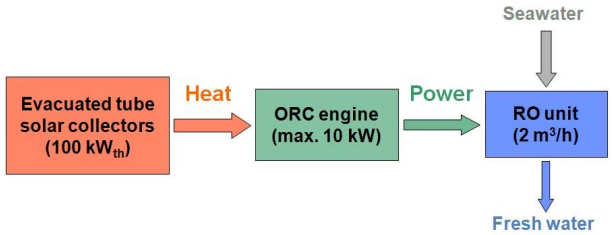
Two-stage RO-Rankine

Concept

Concept

This project deals with the investigation of a solar two-stage organic Rankine cycle (ORC) configuration for reverse osmosis (RO) desalination with maximum fresh water production of 2 m^3/h. The main objective involves the design and optimization of such combined system. The heat produced from the solar field feeds a subcritical ORC engine with maximum net power production of 9-10 kW. The power produced drives a RO unit for seawater desalination.



Integrated system concept

Main objectives and work implemented

The main objective of the project is to develop, optimize, construct and test a small-scale solar two-stage ORC engine for RO desalination with a maximum fresh water production of 2 m^3/h. The expected end result is to produce fresh water with a reduced specific cost.

During 2011 there was a detailed investigation of each process (solar collectors circuit, ORC engine, RO unit), in order to simulate their operation under different conditions. Their design has been optimized, while the combined system simulation has been also implemented, which revealed the system's performance during the whole year under the weather conditions of Athens, Greece.

The design phase ended at the beginning of 2012, when the manufacture of the ORC engine was initiated. This involved at first the adaptation of the two scroll expanders (hermetic scroll compressors in reverse operation, *photo 1*).

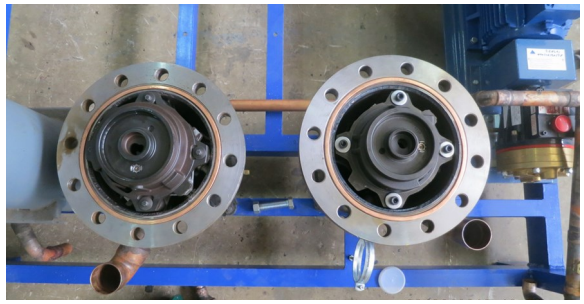


Photo 1: Hermetic scroll expanders

Then, the assembly of all components into a common basis was implemented, with the appropriate piping circuit and measurement instruments (*photo 2*).

Photo 2: ORC engine

The manufacture of the three RO sub-units has been also implemented, which will be coupled to the two-stage ORC engine (one sub-unit in *photo 3*).

Photo 3: RO sub-unit