

A TRNSYS dynamic simulation model for a stand-alone hybrid wind-PV system powering a reverse osmosis desalination unit with energy recovery system

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This paper presents a simulation model of a stand alone hybrid wind-PV system for powering a reverse osmosis (RO) desalination unit with energy recovery system of pressure exchanger type using the TRNSYS simulation program.

The (RO) unit consists of one 25-40 inch spiral wound sea water membrane (Filmtec) with potable water production capacity of 70 l/h at 25 °C. The feed water (NaCl solution of 35000 ppm) is transferred from the mixing tank to the Clark pump by a rotary van type pump powered by a DC motor of 300 W. The system is installed at the Agricultural University of Athens. A data acquisition system with appropriate sensors is used to collect all necessary measurements to record the system performance.

TRNSYS simulation program was used in order to design the wind-PV hybrid system, including battery sub-system and also perform dynamic system simulation. TRNSYS has a modular structure; it recognizes a system description language in which the user specifies the components that constitute the system and the manner in which they are connected. The TRNSYS library includes many of the components commonly found in electrical energy systems, as well as component routines to handle input of weather data or other time-dependent forcing functions and output of simulation results. The modular nature of TRNSYS gives the program tremendous flexibility, and facilitates the addition to the program of mathematical models not included in the standard TRNSYS library. TRNSYS is well suited to detailed analyses of any system whose behavior is dependent on the passage of time.

New TRNSYS components were created and added to the TRNSYS library such as membrane component, energy recovery component, DC motor component and rotary van pump component. The size of the hybrid system and the battery bank is obtained from the several program runs until the energy needs of the DC motor is covered for a specific operation hours.

In the paper are presented detailed simulation results and also preliminary experimental results for validating the simulation model.