

Modeling a solar desalination

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Abstract – In the next years the demand of freshwater will continuously rise, but the problem is that the freshwater resources are limited. In a few parts of the earth humans and animals do not have enough water to live their daily life. With the Sunwater project the feasibility to produce water with renewable energy sources is shown. For this a demonstration plant will be build in Egypt and it will be simulated and modeled. At the moment the most desalination units work with energy from fossil fuels and this will be very expensive in the next years, because the commodity prices will rise again. Furthermore the usage of fossils fuels have the disadvantages that they produce carbon dioxide and this is responsible for global warming. If the temperature rises the demand on freshwater will also jump up. This is a never ending circuit. So alternative sources are needed to produce freshwater in an environmental friendly way. This project tries to tackle this problem. For an effective realization a system model and a simulation of this demonstration plant is necessary.

SUMMARY

At the demonstration plant a water desalination unit (WDU) is installed which works with evaporation. The needed energy will be produced with flat plate collectors and the produced energy will be buffered and stored in a heat storage tank. Furthermore a heat pump was considered as a backup system. For this demonstration plant a system model was created and analyzed. An easy and simple simulation was made (Fig. 1) with a toolbox for Matlab. In Fig. 2 is the resulting working time of the WDU shown. Furthermore the simulation shows that it is not economic to install a very small heat pump of a few kW to extend the working time. The money for

the heat pump and the corresponding heat storage tank should better be used to increase the solar thermal area and to produce more heat during the day. This solves the problem that the size of the solar collector field was conceived a little bit too small to operate two water desalination modules from Terrawater. This water desalination unit was chosen, because it works with evaporation and this technology is very future - proof and environmental friendly. The primary idea of this project is to demonstrate that it is possible to produce freshwater with solar power. The upcoming installation in the next summer may validate the results of the simulation.

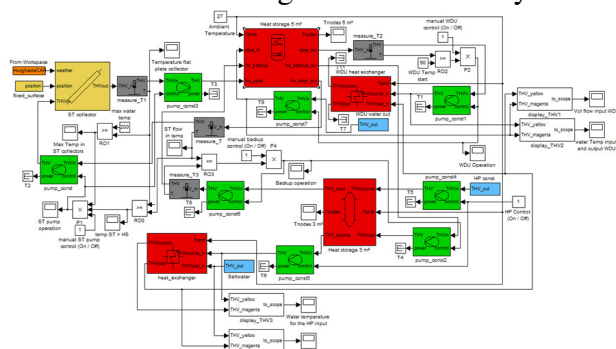


Fig. 1: Model of the demonstration plant with a Matlab toolbox and modifications (details in the paper)

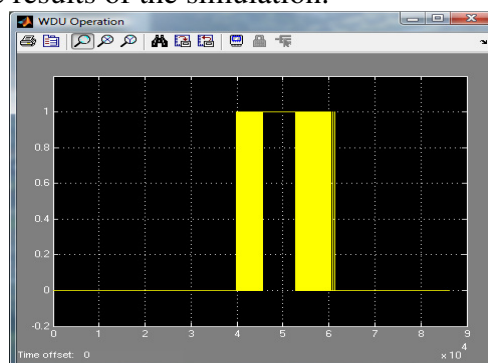


Fig. 2: Operation time of the two water desalination units (Yellow bars show the desalination working time)