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Modeling of a parabolic solar-collector system for water desalination

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This paper presents the design of a parabolic-trough solar-collector system for water desalination in Gaza, Collector-aperture and rim-angle optimization together with the receiverdiameter selection are presented. A comparison of concentrating collectors against conventional flat-plate collectors is presented. It is shown that for large scale water production the parabolictrough collectors are more efficient than the flat plate ones. The analysis considers visible radiation transfer, IR radiation exchange, conductive and convective losses and energy transferred to a fluid flowing through the collector tube. The collector may have a tilted northsouth axis, an east-west axis or it may fully track the sun and geometric parameters associated with tracking the sun are considered.

Keywords: Parabolic-trough collectors, Solar radiation, Solar desalination

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Hierarchical modelling of electrodialysis desalination process

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In recent years, thanks to the development of ion exchange membranes (IEMs) manufacturing industry, Electrodialysis (ED) is spreading as a viable alternative to the more common membrane desalination processes. Therefore, many research efforts have been recently devoted to studying this process both via experimental and modelling activities.

In the present work a novel mathematical model for ED was developed using a multi-scale approach. This method allows to build a hierarchical simulation tool that is able to gauge the impact of all the phenomena involved in the process. The lower-hierarchy model describes the behaviour of the elementary unit of an ED stack, namely cell pair. This model is based on differential mass balance equations and accounts for transport phenomena including salt migration and diffusion as well as water osmosis and electro-osmosis. In addition, Kirchhoff's law together with the Nernst's law for the non-Ohmic voltage drop was used to determine the electrical behaviour of the equivalent circuit. Interestingly, the model makes also use of CFD correlations from a lower scale as input data in order to predict the effect of concentration polarization. In the higher-hierarchy model the whole stack was described, allowing the simulation of multiple cell-pairs together with the end electrode compartments. Again, CFD correlations were used to include the contribution of pumping loss in the overall energy consumption.