Abdelhady, S., Borello, D., & Tortora, E. (2014). **Design of a small scale stand-alone solar thermal co-generation plant for an isolated region in Egypt**. Energy Conversion and Management, 88, 872–882.

ABSTRACT

Most of Egypt's population is concentrated in the Nile Valley (5% of Egypt's area), while the western desert occupies an area of 50% of the total area of Egypt with a small number of inhabitants. The New Valley is the largest governorates in Egypt which occupies 45.8% of the total area of the Country and 65% of the Western Desert and it is the least densely populated governorate in Egypt. However, New Valley has started to receive the migrated people from the Nile valley and Delta region and the demand for the energy is continuously increasing. However, the rural area in New Valley still suffers from lack of access to energy services. The very high transmission losses and costs are the main challenges for electrification in this area. Then, it is worth to investigate the opportunities for distributed energy generation. This area of Egypt receives some of the highest solar radiation in the world (up to 3000 kW h per square meters per year), making it a prime location for use of this resource. In this study, performance and economic assessment of a small scale stand-alone solar thermal co-generation plant using diathermic oil is presented. This configuration is considered as a promising and sustainable solution to provide electricity and heat to an isolated area satisfying the local loads. Parabolic trough plant has been modeled in TRNSYS simulation environment integrated with the Solar Thermal Electric Components (STEC) model library. Both solar and power cycle performances have been modeled based on the solar energy data of the plant site. The mirrors area and the solar collectors have been designed to optimize the incident solar energy. As a result, the parabolic trough solar power plant can produce 6 MW of electric power and 21.5MW of heat power with an overall efficiency of about 85%. The analysis demonstrated that the solar operation time of the CSP plant in the selected site can be expanded to run during the all day without recurring to fossil fuel backup. The levelized cost of electricity (LCOE) of the proposed power plant is estimated to be equal to 1.25 USD/kW h. The avoided GHG emissions are equal to about 7300 toe/year.