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Development of Concentrating Solar Thermal System for 250℃ High Temperature Steam Generation

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High temperature steam below 250 °C is widely used in the industry for many purposes. It is generally used in oil refining system, food sterilization such as milk, styrene-butadiene-rubber production. In order to produce high temperature steam, a traditional steam boiler system is widely adopted mainly due to its simple configuration, fast response to generate steam, and wide selection of heat resources.[1] In this study, we demonstrate solar thermal concertation system for high temperature up to 250 °C steam generation. Parabolic though concentrator is selected for solar irradiation concentration, and the solar concentration rate is 50 suns to achieve the temperature we intended. The parabolic though concentrator is firstly designed based on the solar concentration rate, and the multiple simulations are conducted in order to verify and evaluate the concentrator. From the simulation analysis, we confirm that the parabolic though concentration system can withstand the wind speeds up to 40 m/s and it has reflection > 90 % in the wavelength ranges between 700 – 1500 nm. Also, the incident rays are well reflected from the entire plane of the PTC, and then are focused in the vacuum tube accurately. The measured acquired heat and power generation from the actual system are very similar to the simulation results.

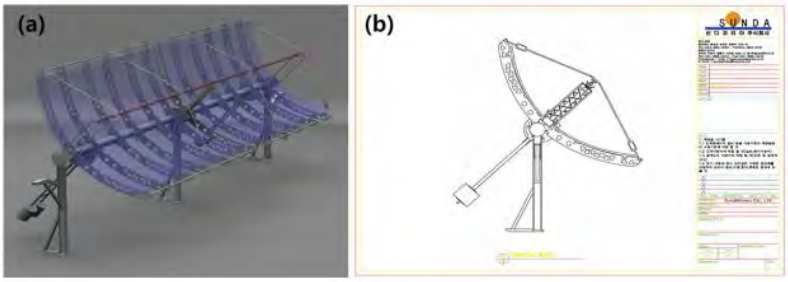

Figure 1. (a) 3D modelled prototype PTC system and (b) blueprint of the system

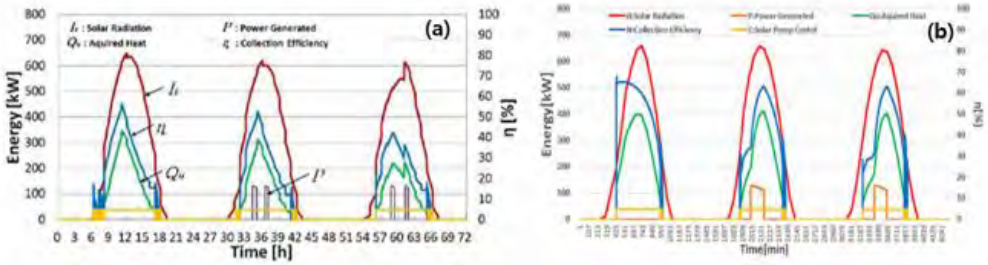

Figure 2. TONATIUH simulation results for PTC (a) measured result and (b) simulated result

References

[1] Tian, Y. and Zhao, C.Y., 2013. A review of solar collectors and thermal energy storage in solar thermal applications, Applied energy, 104, pp.538-553.