

The Performance Improvement of Solar Aided Power Generation System by Introducing the Second Solar Field

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Abstract : Solar aided power generation (SAPG) technology has been proven as an efficient way to make use of solar energy for power generation purpose. In an SAPG plant, a solar field consisting of parabolic solar collectors is normally used to supply the solar heat in order to displace the high pressure/temperature extraction steam. To understand the performance of such a SAPG plant, a new simulation model was developed by the authors recently, in which the boiler was treated, as a series of heat exchangers unlike other previous models. Through the simulations using the new model, it was found the outlet properties of reheated steam, e.g. temperature, would decrease due to the introduction of the solar heat. The changes make the (lower stage) turbines work under off-design condition. As a result, the whole plant's performance may not be optimal. In this paper, the second solar field was proposed to increase the inlet temperature of steam to be reheated, in order to bring the outlet temperature of reheated steam back to the designed condition. A 600MW SAPG plant was simulated as a case study using the new model to understand the impact of the second solar field on the plant performance. It was found in the study, the 2nd solar field would improve the plant's performance in terms of cycle efficiency and solar-to-electricity efficiency by 1.91% and 6.01%. The solar-generated electricity produced by per aperture area under the design condition was 187.96W/m², which was 26.14% higher than the previous design.

Keywords : solar-aided power generation system, off-design performance, coal-saving performance, boiler modelling, integration schemes

Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development

Conference Location : Chicago, United States

Conference Dates : December 12-13, 2020