Applied Energy Symposium 2020: Low carbon cities and urban energy systems
October 10-17, 2020
Paper ID: xxxx

Thermodynamic investigation of a solar driven distributed energy system integrated with the combined dry and steam methane reforming

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ABSTRACT

To alleviate the current shortage of natural gas resource and realize carbon-free emission step by step, a solar driven distributed energy system integrated with the combined dry and steam methane reforming is proposed in this study. In the system, the concentrated solar energy collected by a dish collector is used as heat source to drive the methane reforming reaction, which upgrades solar thermal energy into the chemical energy of the syngas products. As solar radiation intensity cannot satisfy the design requirement, the system can be operated continuously. The cascade utilization of chemical energy from syngas is achieved in the distributed energy system for trigeneration. The thermodynamics performances of the system are numerically investigated under on-design and off-design conditions. The results indicate that the proposed system has remarkable advantages from the energy and environmental evaluation, as compared with a conventional reference system. The excellent off-design thermodynamic performance under varying irradiation and user loads is achieved. The research findings provides an efficient and stable method for the reduction of natural gas consumption and the utilization of solar energy

Keywords: Methane reforming; Distributed energy system; Solar; Thermodynamic

Selection and peer-review under responsibility of the scientific committee of CUE2020