Thermodynamic investigation of a shared cogeneration system with electrical cars for northern Europe climate

Transition to alternative energy systems is indicated by EU Commission as a suitable path to energy efficiency and energy saving in the next years. The aims are to decrease greenhouses gases emissions, relevance of fossil fuels in energy production and energy dependence on extra-EU countries. These goals can be achieved increasing renewable energy sources and/or efficiency on energy production processes. In this paper an innovative micro-cogeneration system for household application is presented: it covers heating, domestic hot water and electricity demands for a residential user. Solid oxide fuel cells, heat pump and Stirling engine are utilised as a system to achieve high energy conversion efficiency. A transition from traditional petrol cars to electric mobility is also considered and simulated here. Different types of fuel are considered to demonstrate the high versatility of the simulated cogeneration system by changing the pre-reformer of the fuel cell. Thermodynamic analysis is performed to prove high efficiency with the different fuels.