In this article, a thermodynamic investigation of solar power tower assisted multigeneration system with hydrogen production and liquefaction is presented for more environmentally-benign multigenerational outputs. The proposed multigeneration system is consisted of mainly eight sub-systems, such as a solar power tower, a high temperature solid oxide steam electrolyzer, a steam Rankine cycle with two turbines, a hydrogen generation and liquefaction cycle, a quadruple effect absorption cooling process, a drying process, a membrane distillation unit and a domestic hot water tank to supply hydrogen, electrical power, heating, cooling, dry products, fresh and hot water generation for a community. The energetic and exergetic efficiencies for the performance of the present multigeneration system are found as 65.17% and 62.35%, respectively. Also, numerous operating conditions and parameters of the systems and their effects on the respective energy and exergy efficiencies are investigated, evaluated and discussed in this study. A parametric study is carried out to analyze the impact of various system design indicators on the sub-systems, exergy destruction rates and exergetic efficiencies and COPs. In addition, the impacts of varying the ambient temperature and solar radiation intensity on the irreversibility and exergetic performance for the present multigeneration system and its components are investigated and evaluated comparatively. According to the modeling results, the solar irradiation intensity is found to be the most influential parameter among other conditions and factors on system performance.