

Exergetic and Sustainability Evaluation of a Building Heating System in Izmir, Turkey

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Abstract : Heating, cooling and lighting appliances in buildings account for more than one third of the world's primary energy demand. Therefore, main components of the building heating systems play an essential role in terms of energy consumption. In this context, efficient energy and exergy utilization in HVAC-R systems has been very essential, especially in developing energy policies towards increasing efficiencies. The main objective of the present study is to assess the performance of a family house with a volume of 326.7 m³ and a net floor area of 121 m², located in the city of Izmir, Turkey in terms of energetic, exergetic and sustainability aspects. The indoor and exterior air temperatures are taken as 20°C and 1°C, respectively. In the analysis and assessment, various metrics (indices or indicators) such as exergetic efficiency, exergy flexibility ratio and sustainability index are utilized. Two heating options (Case 1: condensing boiler and Case 2: air heat pump) are considered for comparison purposes. The total heat loss rate of the family house is determined to be 3770.72 W. The overall energy efficiencies of the studied cases are calculated to be 49.4% for Case 1 and 54.7% for Case 2. The overall exergy efficiencies, the flexibility factor and the sustainability index of Cases 1 and 2 are computed to be around 3.3%, 0.17 and 1.034, respectively.

Keywords : buildings, exergy, low exergy, sustainability, efficiency, heating, renewable energy

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