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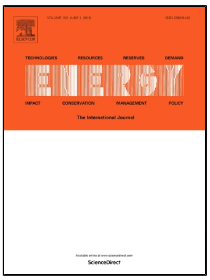

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Mohammad Olfati, Mehdi Bahiraei, Setareh Heidari, Farzad Veysi

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A comprehensive analysis of energy and exergy characteristics for a natural gas city gate station considering seasonal variations

Mohammad Olfati[1,2*], Mehdi Bahiraei[3], Setareh Heidari[1], Farzad Veysi[1]

[1] Mechanical Engineering Department, Faculty of Engineering, Razi University, Kermanshah, Iran

[2] Head of Technical and Engineering department, National Iranian Gas Company (NIGC), Kermanshah, Iran

[3] Department of Mechanical Engineering, Kermanshah University of Technology, Kermanshah, Iran

* Corresponding Author: Mohammad Olfati

Email: m_olfati@yahoo.com

Abstract

Comprehensive energy and exergy analyses are conducted on a City Gate Station (CGS) having nominal capacity of 20,000 SCMH. For this purpose, thermodynamic properties of Natural Gas (NG) fed into the CGS are firstly determined using American Gas Association Equation of State (AGA-8 EOS). Then, a quantitative analysis is carried out to explore magnitude and exact locations of energy/exergy losses as well as exergy destructions. To this end, four different seasonal strategies are regarded. In all strategies, the largest losses occur within the stack. Although from energy viewpoint, the regulator is a high-efficiency equipment, it is found to be the most exergy destructive component in the CGS. Moreover, maximum and minimum exergy losses occur in the winter (15.33 kW) and summer (1.60 kW), respectively. The best performance based on the second law of thermodynamics for the CGS occurs in the winter with exergy efficiency of 77%, whereas the lowest one happens in the summer with exergy efficiency of 69%. The exergy destruction due to pressure drop in filter and pipes are insignificant. The results obtained from this study can be employed as a guide to reduce exergy destruction in the whole CGS with recognition of the main sources of irreversibility.