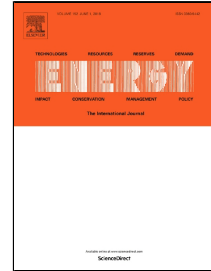


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A comprehensive analysis of energy and exergy characteristics for a natural gas city gate station considering seasonal variations

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11

12 **Abstract**

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

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