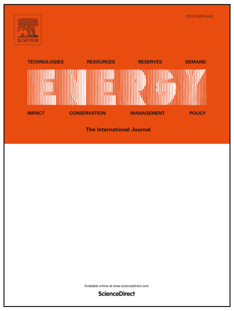

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Bahram Ghorbani, Mehdi Mehrpooya, Hossein Ghasemzadeh

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Investigation of a hybrid water desalination, oxy-fuel power generation and CO_2 liquefaction process

Bahram Ghorbani[*1] **, Mehdi Mehrpooya**[2,3]**, Hossein Ghasemzadeh**[2, 3]

[1]**Faculty of Engineering Modern Technologies, Amol University of Special Modern Technologies, Amol, Iran**
[2]**Renewable Energies and Environmental Department, Faculty of New Science and Technologies, University of Tehran, Tehran, Iran,**
[3]**Hydrogen and Fuel Cell Laboratory, Faculty of New Sciences and Technologies, University of Tehran,**

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In this paper, an integrated liquefied natural gas (LNG) production process, carbon dioxide separation and liquefaction, and fresh water production is proposed and analyzed. The hybrid system consists of three sections: power and heat generation by the process of combustion with pure oxygen, natural gas liquefaction with a two-stage refrigeration cycle (absorption refrigeration cycle and multi-component refrigerant), and multiple-effect distillation (MED) desalination. This integrated process produce 593.3 ton/h LNG, 84.62 ton/h carbon dioxide, and 74.58 ton/h fresh water. Exergy analysis shows that the highest exergy destruction is related to the shell and tube heat exchangers, which is about 38.8% and the lowest exergy destruction is related to the air coolers, 0.84%. Integrated process has an overall electrical efficiency (LHV Base) of 36.3%, a specific power of 0.179 kWh/kg LNG. Also the amount of energy consumed for producing carbon dioxide is 0.005 kWh/kg CO_2, and gained output ratio(GOR) of 2.87 is achieved by three-stage MED desalination. A sensitivity analysis is done to investigate and identify the important parameters affecting the integrated process performance.

Keywords: *Multi effect desalination; Liquefied natural gas; carbon dioxide capture; oxy-fuel power plant; exergy analysis*; *Sensitivity analysis.*

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[*] Corresponding author. Faculty of Engineering Modern Technologies, Amol University of Special Modern Technologies, Amol, Iran . Tel.: +98 9113220801. E-mail addresses: b.ghorbani@ausmt.ac.ir.