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Evaluation of Possible Application of Cold Energy in Liquefied Natural Gas Complexes

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Abstract : Usually liquefied natural gas (LNG) gasification is performed due to atmospheric heat. In order to produce a liquefied gas a sufficient amount of energy is to be consumed (about 1 kW•h for 1 kg of LNG). This study offers a number of solutions, allowing using a cold energy of LNG. In this paper it is evaluated the application turbines installed behind the evaporator in LNG complex due to its work additional energy can be obtained and then converted into electricity. At the LNG consumption of G=1000kg/h the expansion work capacity of about 10 kW can be reached. Herewith-open Rankine cycle is realized, where a low capacity cryo-pump (about 500W) performs its normal function, providing the cycle pressure. Additionally discussed an application of Stirling engine within the LNG complex also gives a possibility to realize cold energy. Considering the fact, that efficiency coefficient of Stirling engine reaches 50 %, LNG consumption of G=1000 kg/h may result in getting a capacity of about 142 kW of such a thermal machine. The capacity of the pump, required to compensate pressure losses when LNG passes through the hydraulic channel, will make 500 W. Apart from the above-mentioned converters, it can be proposed to use thermoelectric generating packages (TGP), which are widely used now. At present, the modern thermoelectric generator line provides availability of electric capacity with coefficient of efficiency up to 15%. In the proposed complex, it is suggested to install the thermoelectric generator on the evaporator surface is such a way, that the cold end is contacted with the evaporator's surface, and the hot one – with the atmosphere. At the LNG consumption of G=1000 kgr/h and specified coefficient of efficiency the capacity of the heat flow Qh will make about 32 kW. The derivable net electric power will be P=4,2 kW, and the number of packages will amount to about 104 pieces. The carried out calculations demonstrate the research perceptiveness in this field of propulsion plant development, as well as allow realizing the energy saving potential with the use of liquefied natural gas and other cryogenics technologies.

Keywords : cold energy, gasification, liquefied natural gas, electricity
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