



2019「中技社科技獎學金」

2019 CTCI Foundation Science and Technology Scholarship

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Technical and Economic Evaluation of Seawater Freezing Desalination Using Liquefied Natural Gas



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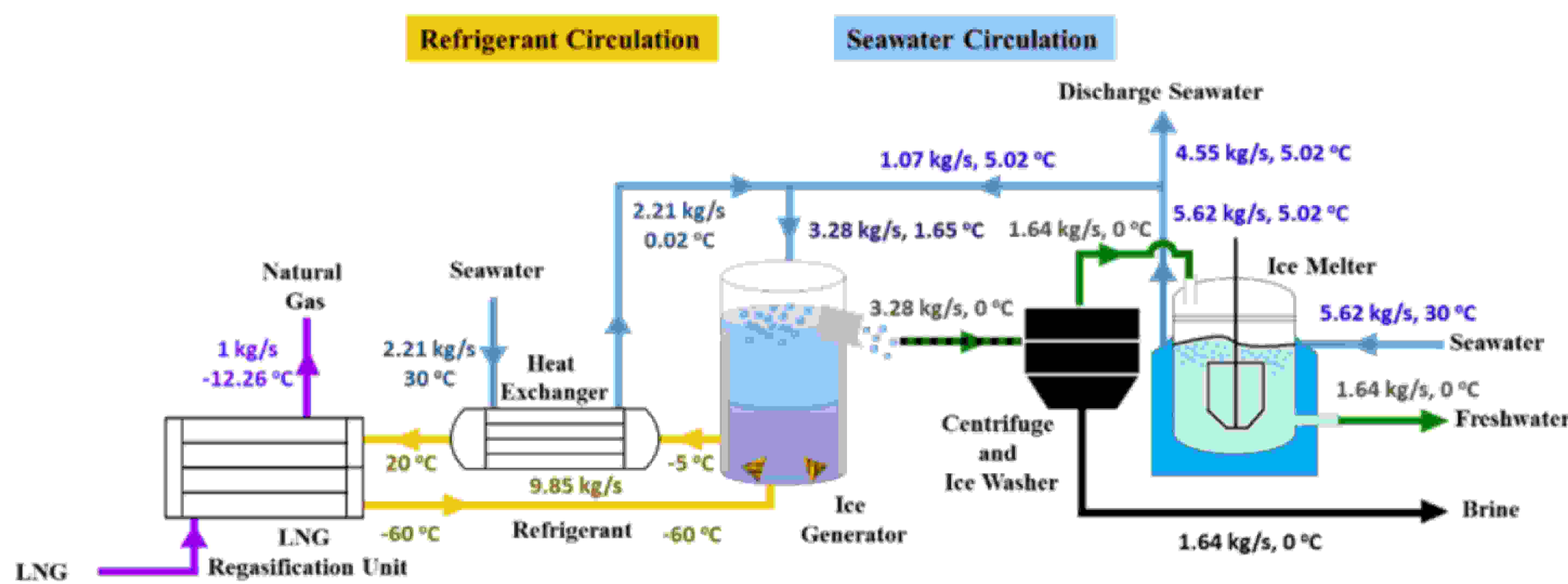
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Abstract

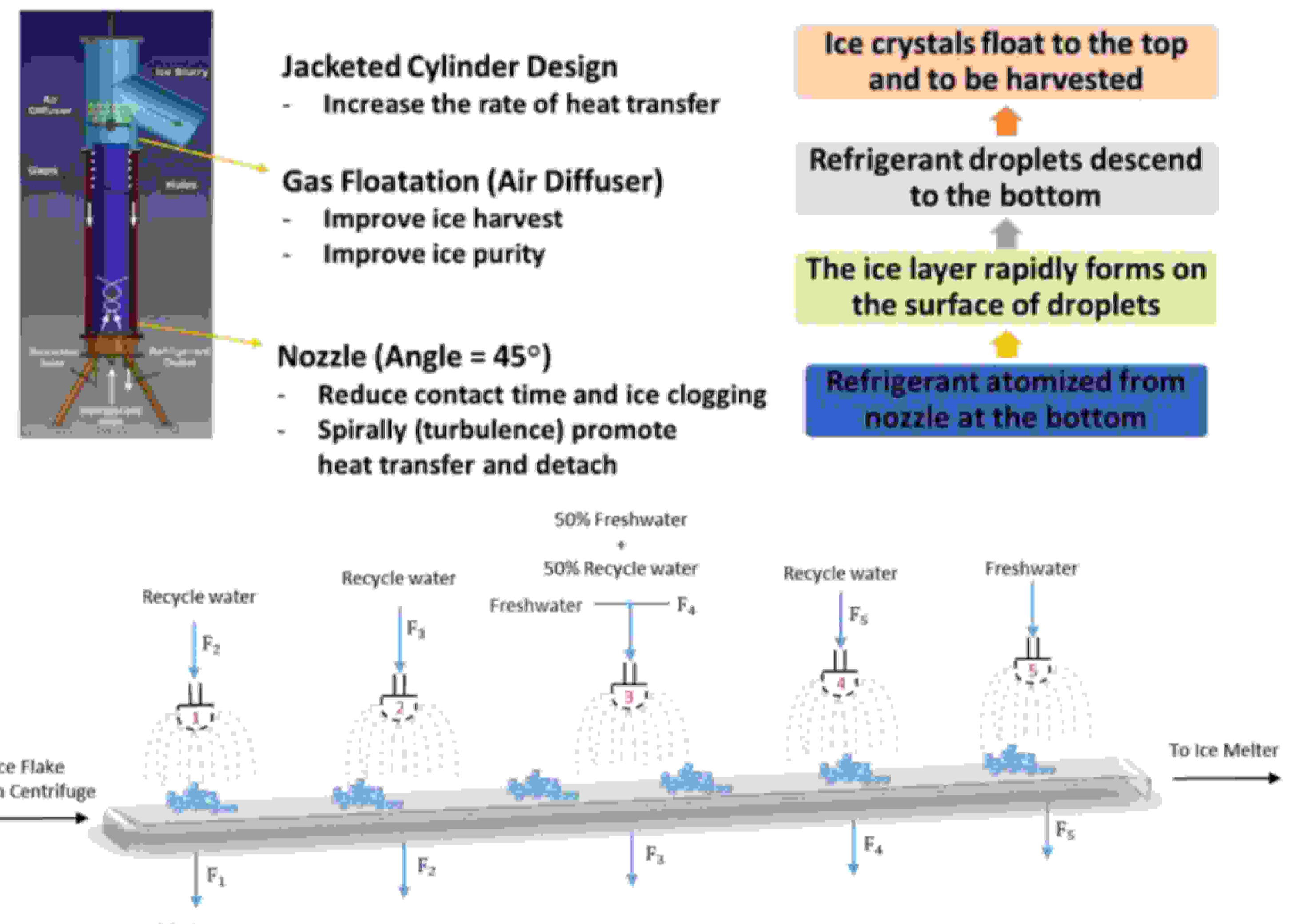
This research aims to evaluate the technical and economic feasibility of the direct contact type seawater freezing desalination (SFD) process proposed by Xie et al. (2017), where the cold energy is provided by the regasification process of liquefied natural gas (LNG). In the SFD process, the immiscible refrigerant that contains the cold energy from the LNG regasification is injected into a seawater tank to generate freshwater ice. The freshwater ice is then separated and melted to obtain the freshwater. Process analysis, integration and optimization are carried out with the aid of detailed material and energy balance models. The influences of some important operating variables of the ice generator are emphasized in this study including the inlet temperatures of refrigerant and seawater, the seawater flow rate and the ratio that is crystallized into freshwater ice. Considering that the main operating cost and income of SFD process are strongly affected by both electricity and water prices, the comparison and effect of these prices in different regions are discussed. The sample calculation with basis of 1 kg LNG/s shows that the optimized SFD process is able to produce 1.64 kg/s of freshwater using 7.83 kg/s seawater and consume 1.66 kW of electric power.

Research Focus

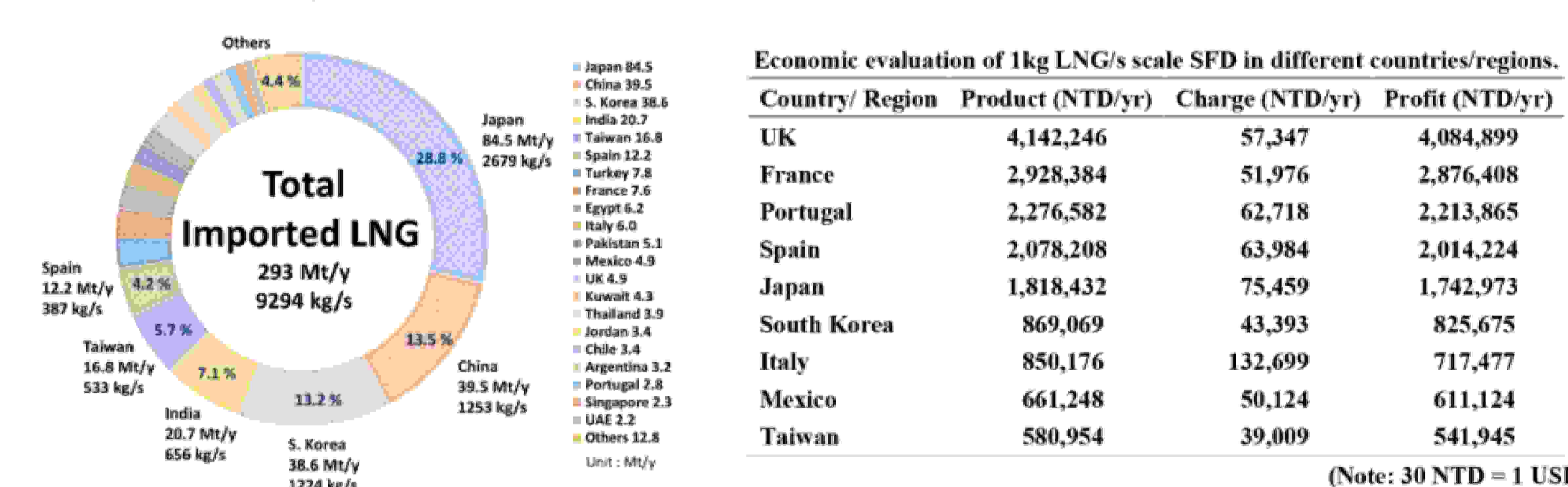
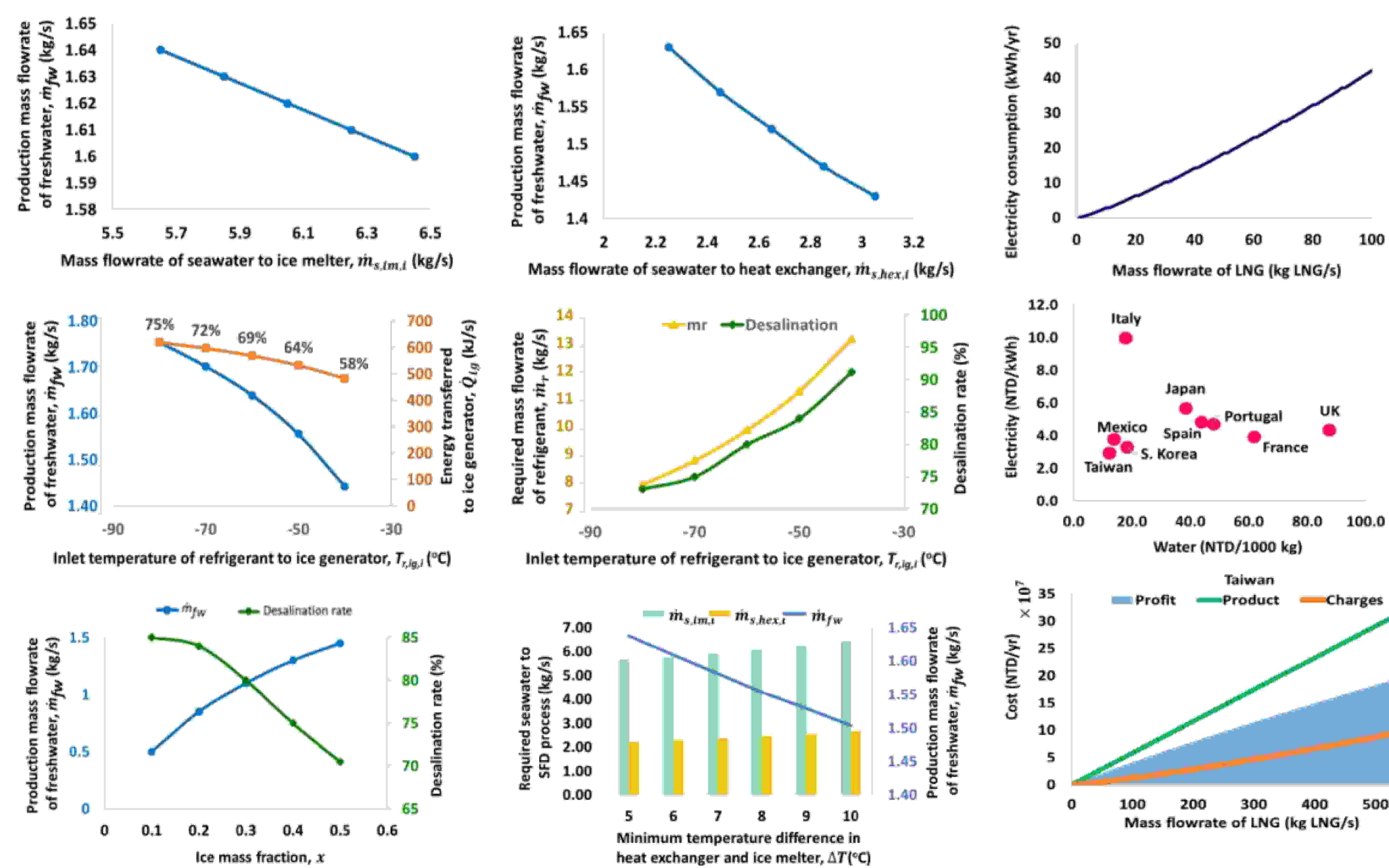
Process Demonstration



Apparatus



Process Variable Analysis



Conclusion

Since natural gas (NG) is one of the cleanest fossil fuel, increasing the imported liquefied natural gas (LNG) amount around the world is considerable. According to the economic evaluation results, local water and electrical prices are the absolutely pivotal factors to evaluate the feasibility of the SFD process in a typical region. Nevertheless, the prospect of developing and implementing the SFD process is promising through the efforts of multidisciplinary approaches.