Waste Heat Recovery for Offshore Applications

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Waste Heat Recovery for Offshore Application

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1 Motivation

With increasing incentives for reducing CO₂ emissions, energy optimization on offshore platforms becomes a focus area. Gas turbines efficiency in offshore application typically ranges from 20-30%. To enhance their performance a bottoming cycle is introduced. A preferable technology is the organic Rankine cycle (ORC) because of its low gas turbine outlet temperature, space and weight restrictions. The case of study is the Draugen platform in the Norwegian Sea.

2 Methods

DNA (Dynamic Network Analysis) is the simulation tool used for the system analysis. The fluid library has been extended by linking DNA with the commercial software REFPROP 9; more than a hundred real media including hydrocarbon fluids are now available.

3 Plant Analysis

The plant is constituted by the Siemens SGT-500 twin spool gas turbine, the intermediate loop and the ORC. The low and high pressure axial compressors are mechanically coupled by two distinct shafts with the low and high pressure turbines while the power turbine drives the generator. The fuel is assumed to be natural gas.

Table 1: Design point specifications for the Siemens SGT-500 twin spool gas turbine on the Draugen platform [1].

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4 Results & Discussions

Increasing ORC maximum pressure enhances the efficiency of the bottoming cycle. The area between DOWN THERM Q and the organic fluid is lowest for cyclohexane meaning that a higher performance is achieved. Moreover cyclohexane presents the lowest health hazard according to the HMIS. Previous works considered 20 bar as maximum pressure for the working fluid [3]. However, when maximum pressure is increased area requirements for the waste heat recovery unit are higher. In this sense toluene represents a valid alternative.

5 Acknowledgements & References

Funding from the Norwegian Research Council through Petromaks led by Teknova with project no. 203404/E30 is acknowledged.