Multi-objective optimization of organic Rankine cycles for waste heat recovery: Application in an offshore platform

This paper aims at finding the optimal design of MW-size organic Rankine cycles by employing the multi-objective optimization with the genetic algorithm as the optimizer. We consider three objective functions: thermal efficiency, total volume of the system and net present value. The optimization variables are the working fluid, the turbine inlet pressure and temperature, the condensing temperature, the pinch points and the fluid velocities in the heat exchangers. The optimization process also includes the complete design of the shell and tube heat exchangers utilized in the organic Rankine cycle. The methodology is applied to recover the waste heat from the SGT-500 gas turbine installed on the Draugen off-shore oil and gas platform in the North Sea. Results suggest two optimal working fluids, i.e. acetone and cyclopentane. Thermal efficiency and net present value are higher for cyclopentane than for acetone. Other promising working fluids are cyclohexane, hexane and isohexane. The present methodology can be utilized in waste heat recovery applications where a compromise between performance, compactness and economic revenue is required.

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