

Performance Analysis of Organic Rankine Cycle Technology to Exploit Low-Grade Waste Heat to Power Generation in Indian Industry

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Abstract : The demand for energy is cumulatively increasing with time. Since the availability of conventional energy resources is dying out gradually, significant interest is being laid on searching for alternate energy resources and minimizing the wastage of energy in various fields. In such perspective, low-grade waste heat from several industrial sources can be reused to generate electricity. The present work is to further the adoption of the Organic Rankine Cycle (ORC) technology in Indian industrial sector. The present paper focuses on extending the previously reported idea to the next level through a comparative review with three different working fluids using practical data from an Indian industrial plant. For comprehensive study in the simulation platform of Aspen Hysys[®], v8.6, the waste heat data has been collected from a current coke oven gas plant in India. A parametric analysis of non-regenerative ORC and regenerative ORC is executed using the working fluids R-123, R-11 and R-21 for subcritical ORC system. The primary goal is to determine the optimal working fluid considering various system parameters like turbine work output, obtained system efficiency, irreversibility rate and second law efficiency under applied multiple heat source temperature (160 °C- 180 °C). Selection of the turbo-expanders is one of the most crucial tasks for low-temperature applications in ORC system. The present work is an attempt to make suitable recommendation for the appropriate configuration of the turbine. In a nutshell, this study justifies the proficiency of integrating the ORC technology in Indian perspective and also finds the appropriate parameter of all components integrated in ORC system for building up an ORC prototype.

Keywords : organic Rankine cycle, regenerative organic Rankine cycle, waste heat recovery, Indian industry

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