

Thermo-Economic Analysis of Organic Rankine Cycle for Power Generation

Thurairaja, K.
Dept. of Mechanical Engineering,
University of Moratuwa
Moratuwa, Sri Lanka
kankeyan.t@gmail.com

Wijewardane, M.A.
Dept. of Mechanical Engineering,
University of Moratuwa
Moratuwa, Sri Lanka
anusha@uom.lk

Ranasinghe, R.A.C.P.
Dept. of Mechanical Engineering,
University of Moratuwa
Moratuwa, Sri Lanka
chathurar@uom.lk

Abstract— This paper deals with the thermodynamics aspects and economic aspects of one of the predominant methods of low grade energy recovery, Organic Rankine Cycle. Different working fluids (R245fa, R600a, R601a, neopentane, methanol, ethanol, cyclopentane, propanone and isohexane) are considered for the analysis in two different layouts and they are modelled in MATLAB with linked to thermophysical properties database REFPROP. Different aspects of costings such as exergy costing, total annual cost, safety cost and environmental cost are considered in the analysis and net present value analysis is developed to analyse the best working fluid for a specified operating condition. The modelling system is proposed based on two different conceptual experimental test rig containing expander, condenser, pump, evaporator and superheater, containing expander, condenser, pump and evaporator only. Based on the performed thermo-economic analysis, it could be concluded that the ethanol is the best working fluid for the ORC for the heat source temperature of 200 °C in the Layout II. Based on investment period of 10 years & 15 years, the unit electricity price can be quantified as LKR. 32.12 & LKR. 31.60 respectively for the best working fluid in the above specified condition.

Keywords—*Thermo-economic analysis; Organic Rankine cycle; Working fluid selection;*