

## Comparative Study of Sub-Critical and Supercritical ORC Applications for Exhaust Waste Heat Recovery

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**Abstract :** Waste heat recovery by means of Organic Rankine Cycle is a promising technology for the recovery of engine exhaust heat. However, it is complex to find out the optimum cycle conditions with appropriate working fluids to match exhaust gas waste heat due to its high temperature. Hence, this paper focuses on comparing sub-critical and supercritical ORC conditions with eight working fluids on a combined diesel engine-ORC system. The model employs two ORC designs, Regenerative-ORC and Pre-Heating-Regenerative-ORC respectively. The thermodynamic calculations rely on the first and second law of thermodynamics, thermal efficiency and exergy destruction factors are the fundamental parameters evaluated. Additionally, in this study, environmental and safety, GWP (Global Warming Potential) and ODP (Ozone Depletion Potential), characteristic of the refrigerants are taken into consideration as evaluation criteria to define the optimal ORC configuration and conditions. Consequently, the study's outcomes reveal that supercritical ORCs with alkane and siloxane are more suitable for high temperature exhaust waste heat recovery in contrast to sub-critical conditions.

**Keywords :** internal combustion engine, organic Rankine cycle, waste heat recovery, working fluids

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