

# **“PARAMETRIC STUDY OF COMBINED COOLING AND POWER PLANT INTEGRATED WITH PARABOLIC TROUGH SOLAR COLLECTORS”**

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Due to depletion in fossil fuels at an unprecedented rate, increasing energy demands of the world, and environmental hazards due to greenhouse gases, the world is exploring alternative and sustainable ways of energy generation to commensurate the supply-demand gap. This study attempts to perform a detailed energy analysis of parabolic trough solar collectors (PTSCs) driven combined cooling and power (CCP) plant. The integrated cycles; vapor absorption refrigeration cycle (VARC) and organic Rankine cycle (ORC) are used to produce cooling and power respectively. Six organic working fluids, namely, R113, R141b, R123, R245fa, R142b, and isobutane were selected for ORC, while LiBr-H<sub>2</sub>O pair was used in VARC. Four key energetic parameters, useful heat gain, work output, cooling rate, and energy utilization factor (EUF) were examined during varying direct normal irradiance (DNI) and mass flow rate of heat transfer fluid (HTF). A parametric study was carried out in three modes of operation, power only, combined power and cooling and cooling only under the limits of DNI from 0.6 kW/m<sup>2</sup> to 0.88 kW/m<sup>2</sup> recorded on the yearly-average basis in two cities of Pakistan, Lahore, and Quetta respectively. Also, the parametric study was performed in above-mentioned modes of operation while varying the mass flow rate of HTF from 0.3 to 0.8 kg/s. As it can be seen, R113 given the highest thermal efficiency of 17.12%, while isobutane gave the least thermal efficiency of 7.88%, hence R113 was chosen as organic working fluid for further study. The maximum EUF was found in the cooling mode of operation which increased from 63.95% to 66.79% at 0.6 kW/m<sup>2</sup> and 0.88 kW/m<sup>2</sup> respectively. During the combined cooling and power mode, maximum cooling rate, power output, and EUF were 3456 kW, 822.5 kW, and 41.34% respectively at 0.88 kW/m<sup>2</sup>.