IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO - IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

TWO STAGE REGENERATIVE ORGANIC RANKINE CYCLE (ORC) HEAT RECOVERY BASED POWER GENERATION SYSTEM

IITM Technology Available for Licensing

Problem Statement

- Conventional two-stage cascaded systems offer simplicity with a single organic fluid and improved heat extraction from multiple heat sources and are only effective under specific heat source conditions.
- Existing ORC architectures are either **complex** with **extensive heat exchangers,** making them **less economical**, or they **have low thermal efficiency and performance.**

Intellectual Property

- **IITM IDF Ref. 1974**
- **IN202041008106**
- **PCT/IN2021/050178**

Technology Category/ Market

Category – Energy infrastructure/ Automotive
Applications –Clean energy , energy conservation, power generation, engines , turbines
Industry – Power generation , Automobiles
Market –The Global Power Generation Market size was valued at around USD 1,593.84 Billion in 2022 and is projected to reach **USD 2,111.80 Billion by 2030, growing at a CAGR of 3.59% from 2024 to 2030**.

Key Features / Value Proposition

Technical Perspective:

- **Two Stage Regenerative Organic Rankine Cycle (ORC)** with improved power outputs using trans-critical evaporation and regeneration stages
- The combination of supercritical heating in the **HP stage and partial evapouration and regeneration in the LP stage** can improve thermal match and also achieve increased heat source utilization
- Further, the regenerator can take various forms, including **a direct mixing vapor generator, an ejector, or a recuperator, and is used for energy recovery from the superheated vapor and two-phase organic fluid**

User Perspective

- **Improved thermal efficiency, improved regeneration without using additional heat exchanger, reduced superheat in the condenser inlet.**

Technology

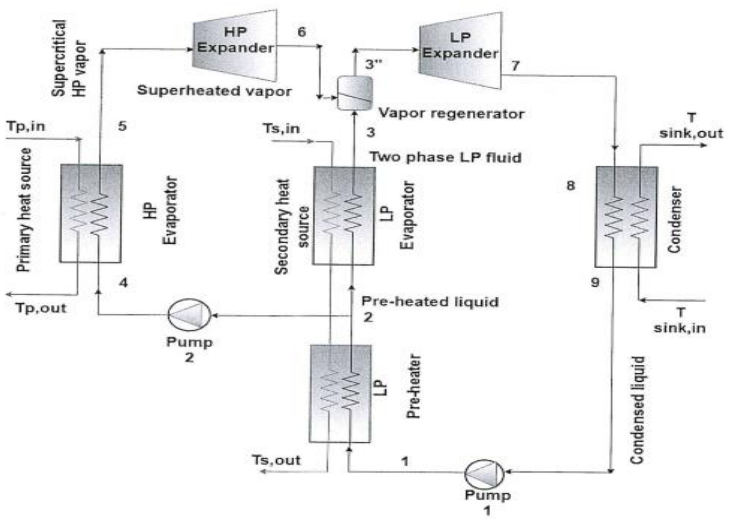

Fig. 1 Illustrates a schematic diagram of the TR-STORC heat recovery based power generation system using a vapor regenerator for the heat recovery

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The main components include:

Fluid Tank: Holds the organic fluid at both high pressure (HP) and low pressure (LP)

LP Pump : Circulates the organic fluid throughout the system

First Loop: Performs supercritical evaporation of the organic fluid to produce supercritical vapor

Second Loop: Performs sub-critical evaporation of the organic fluid to obtain subcritical vapor.

Two-stage Expander: Converts the mechanical energy from the trans-critical expansion of the organic fluid into electrical energy for power generation.

Regenerator: Recovers energy from the superheated vapor resulting from the trans-critical expansion of the organic fluid.

Condenser: Condenses the superheated vapor of the organic fluid into a saturated fluid after power generation.

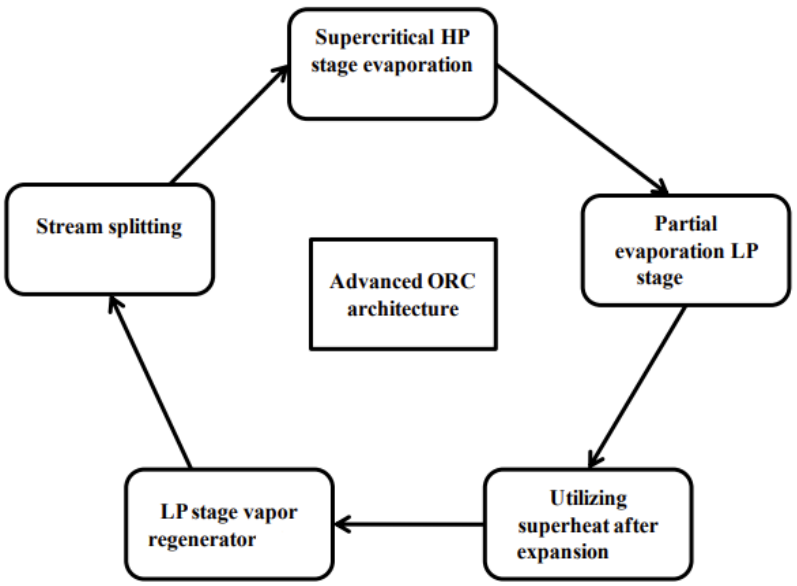

FIG. 2 is a schematic diagram illustrating a two stage regenerative Organic Rankine Cycle (TR-STORC) heat recovery based power generation system

Research Lab

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TRL (Technology Readiness Level)

TRL-2 , **Technology Concept formulated**

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