

**TECH OFFER**

## Membrane Condenser for Efficient Dehydration, Waste Heat Recovery & Water Reclamation



### KEY INFORMATION

TECHNOLOGY CATEGORY:

Sustainability - Low Carbon Economy

Energy - Waste-to-Energy

TECHNOLOGY READINESS LEVEL (TRL): **TRL6**

COUNTRY: **SINGAPORE**

ID NUMBER: **TO175300**

### OVERVIEW

Industries involved in dehydration processes often face significant challenges, including high energy consumption, excessive water usage, and limited capacity to recover waste heat efficiently. These inefficiencies lead to increased operational costs, wasted resources, and a substantial environmental footprint, including higher carbon emissions and water wastage.

This technology offers an innovative solution to these challenges by utilizing specially engineered membranes to condense water vapor from hot and humid air or gas streams. This process not only produces high-quality liquid water for reuse but also dehumidifies and cools the gas stream, which can be recirculated to absorb low-grade heat for further material dehydration. By integrating membrane condensers into industrial operations, companies can improve energy and water efficiency, recover valuable resources, reduce cooling water needs, and minimize emissions and environmental impact. With applications spanning HVAC, food drying, ingredient concentration, desalination, and wastewater treatment, this versatile technology enables industries to lower costs while achieving more sustainable and eco-friendly operations.

The tech owner seeks industrial partners for test-bedding and potential adoption of their proprietary technology, particularly in sectors like F&B, laundry, commercial buildings, petrochemical, pharmaceutical, energy, wastewater treatment, or any industries using water-cooling or air-drying processes.

## TECHNOLOGY FEATURES & SPECIFICATIONS

The membrane condenser technology features a core component of hollow fiber gas separation membranes, housed within a large module. These membranes, made from polyvinylidene fluoride (PVDF), are semi-permeable and hydrophobic, offering **long-lasting hydrophobicity, sustainable high flux, high mechanical strength, and the ability to operate across a wide temperature range**. The system functions by integrating the membrane module with auxiliary equipment such as evaporators or dryers, heat exchangers, blowers or heat pumps, pipelines, and instrumentation control systems. This modular and versatile design allows for seamless integration into various industrial processes, particularly in sectors such as petrochemical, chemical, pharmaceutical, energy, food and beverage, and wastewater treatment.

## POTENTIAL APPLICATIONS

- **Waste Heat Recovery:** Substitute or complement cooling systems in industries like petrochemical, pharmaceutical, food processing, semiconductors, power stations, and HVAC, enabling efficient heat recovery with heat exchangers.
- **Drying and Dehydration:** Enhance energy efficiency in drying processes, improve food quality by preserving flavor, nutrients, and hygiene with lower temperatures and a closed-loop system, and reduce oxidative damage.
- **Water Recovery:** Reclaim clean water for reuse in industrial processes, increasing sustainability.
- **Sludge Drying:** Prevent air pollution and odors with an enclosed system that eliminates air emission discharge.
- **Wastewater Treatment:** Enable cost-effective Zero Liquid Discharge (ZLD) or Minimum Liquid Discharge (MLD) by utilizing waste heat for high energy and water efficiency.

## UNIQUE VALUE PROPOSITION

- **Higher energy efficiency:** Effectively recovers waste heat and reduces energy consumption, optimizing resource usage in industrial processes.
- **Lower water consumption:** Reclaims water from humid gas streams, minimizing reliance on fresh water and reducing overall water usage.
- **Modularity for retrofitting:** Its modular design allows seamless integration with existing systems, simplifying upgrades and enhancing process efficiency.
- **Lower maintenance downtime:** With fewer mechanical components, the system requires less frequent maintenance, ensuring uninterrupted operations.
- **Reduced environmental impact:** Decreases vapor and heat emissions, contributing to sustainability and lowering the carbon footprint.
- **Lower operating costs:** Achieves significant cost savings by combining energy efficiency and water reclamation to reduce operational expenses.