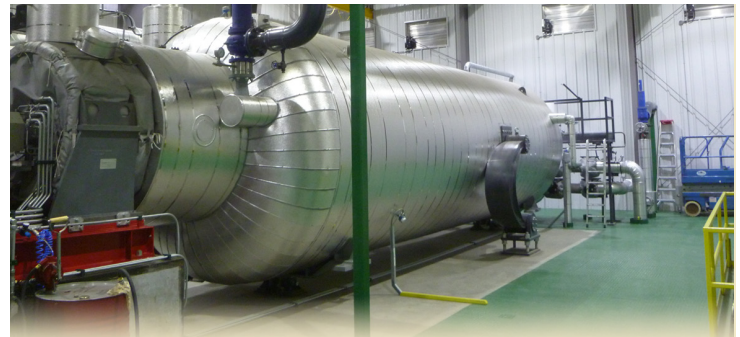# Organic rankine cycle
A technology worth replicating

Fast facts

Technology: **Organic rankine cycle (ORC)**
Replicability: **Strong potential**
Capital cost: **$2 to 8 million**
Output: **Renewable energy (200 kW to 15 MW)**
 Water up to 90°C used as a utility for the plant

Advantages of organic rankine cycle in biomass applications

- High cycle efficiency
- Very high turbine efficiency (up to 90%)
- Low mechanical stress of the turbine, due to low peripheral speed
- Very long operational life of the machine due to the characteristics of the working fluid (non-eroding and non-corroding liquid)
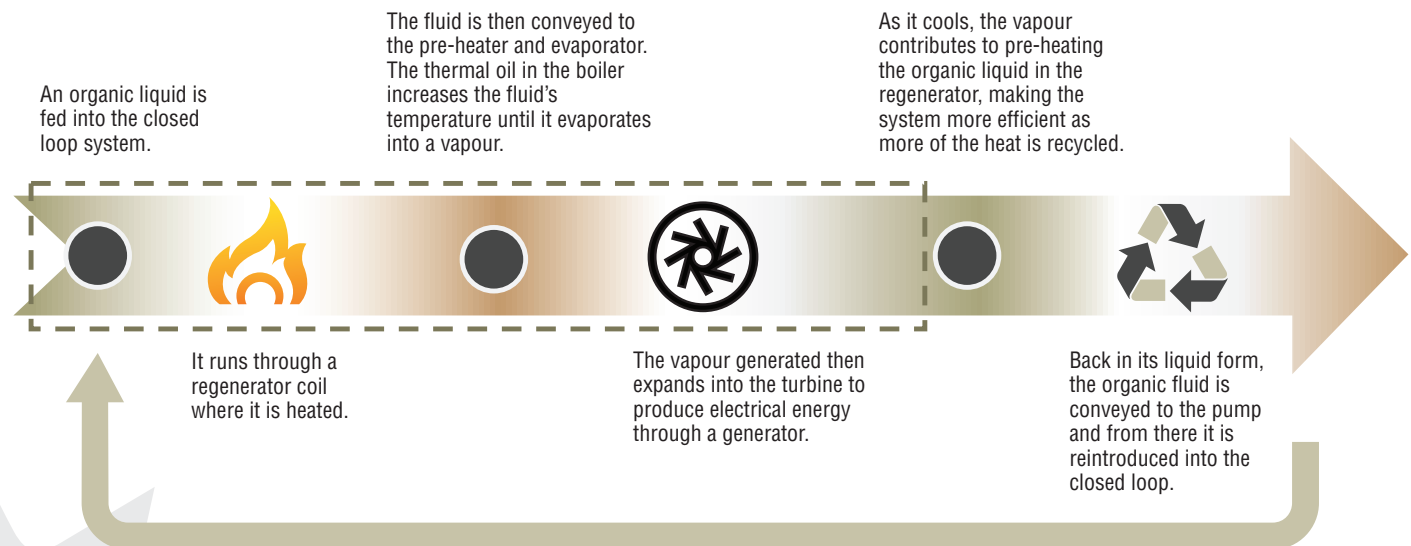- No water treatment system necessary

Success story

Nechako Lumber Co. was the first Canadian forest sector facility to install Organic Rankine Cycle (ORC) technology to convert waste heat from the company's operations into electric power.

ORC technology provides the opportunity to reduce a facility's operating costs and carbon footprint. It also offers the potential to provide surplus power to local grids, or to support economic development in northern communities.

How it works

An organic liquid is fed into the closed loop system.

The fluid is then conveyed to the pre-heater and evaporator. The thermal oil in the boiler increases the fluid's temperature until it evaporates into a vapour.

As it cools, the vapour contributes to pre-heating the organic liquid in the regenerator, making the system more efficient as more of the heat is recycled.

It runs through a regenerator coil where it is heated.

The vapour generated then expands into the turbine to produce electrical energy through a generator.

Back in its liquid form, the organic fluid is conveyed to the pump and from there it is reintroduced into the closed loop.

Source: Investments in Forest Industry Transformation (IFIT) Performance Report

Need funding?

Access the Canadian Business Network database of government grants, loans and financing options at **canadabusiness.ca/eng/program/search/** for opportunities in your region.

Canada

Technology maturity (very high)

Has the technology been commercialized outside Canada?

- ORC technology has reached a level of full maturity in biomass applications, with over 300 applications of this technology in biomass systems across the world.

Ease of implementation (very high)

How easily can the technology be replicated, with regards to process complexity, capital costs or intellectual property issues?

- ORC systems simply require a sufficient waste heat source for the production of electricity and straight forward process integration, making them easily replicable.

- There are multiple ORC suppliers worldwide, and as it is a more mature technology, the capital costs for such projects are reasonable and stable.

Potential for replicability (very high)

Are there multiple sites available with the potential to facilitate such a project?

- ORC technology can be replicated in any industrial sector where low-quality (temperature) heat is available (i.e., exhaust gas of gas turbines, gas pipeline compressor stations and waste heat from industrial processes), making the technology an attractive option to hundreds of facilities across Canada.

Market opportunities (high)

Is the relative market size targeted by this technology accessible?

- Biomass-based ORC cycles can be implemented anywhere electricity can be sold to the grid or where local regulations favour on-site electricity production and usage.

- As such, the availability and price of electricity in the region will have an important impact on the profitability of projects and represent a key driver for replication.

Socio-economic benefits (high)

Would the project lead to job creation opportunities, environmental benefits and the potential to transform the industry?

- The implementation of ORC units in forest product facilities will help diversify revenue and improve the financial stability of companies, thus stabilizing jobs and creating economic growth in forest-dependent communities.

- The electricity produced by biomass-based ORC systems would be considered carbon neutral, thereby enhancing a company's environmental profile and supporting the forest sector's transition to greener energy sources.

Replicability Radar Diagram

Disclaimer: This replication analysis is based on the technology implemented under the project funded by IFIT. The IFIT program does not endorse any specific technology provider and has produced this brief analysis for the benefit of those considering implementing this type of project.
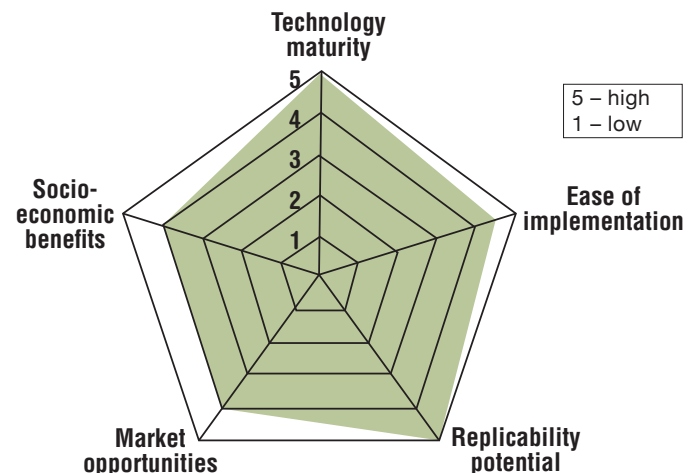
Is it suitable for you?

- ☑ Large sawmills with access to waste heat or exhaust from pulp dryers or paper machines
- ☑ Pellet manufacturing companies
- ☑ MDF/OSB panel manufacturers