Alfa Laval E-PowerPack

Efficient power production from waste heat energy on board

The Alfa Laval E-PowerPack is a compact, easily installed module for converting waste heat energy into clean electrical power. Based on Organic Rankine Cycle (ORC) technology, it gives marine vessels a plug-and-play efficiency upgrade that reduces fuel costs, shrinks carbon footprint and enables compliance with sustainability requirements.

Application

The E-PowerPack can generate electrical power from a wide variety of liquid or gas heat sources on board. These range from jacket water (supplied at 75–109°C) to engine exhaust gas (supplied at temperatures up to 550°C). Available in two sizes, the E-PowerPack can deliver a net electrical output of up to 100 kW or 200 kW per module, producing maximum results by adapting to the heat source with excellent partial load capacity.

By taking advantage of otherwise wasted thermal energy, the E-PowerPack significantly lowers fuel consumption and reduces the need to use the auxiliary engines. As a result, it simplifies compliance with sustainability requirements, allowing a vessel to improve its Energy Efficiency Index (EEDI/EEXI) and Carbon Intensity Indicator (CII). Combined with lower emissions, this can provide a competitive advantage by making it possible to maintain higher speeds.

Moving forward, the E-PowerPack can help offset the cost of switching to new fuels like methanol, which are both more expensive and less energy-rich than traditional marine fuels.

Benefits

- Significant savings through maximum use of fuel energy
- Improved Energy Efficiency Index (EEDI/EEXI)
- Improved Carbon Intensity Indicator (CII) and vessel rating
- Reduced emissions and carbon footprint
- Easy installation and little maintenance
- Reliable, automatic operation in all marine conditions

Marine approvals

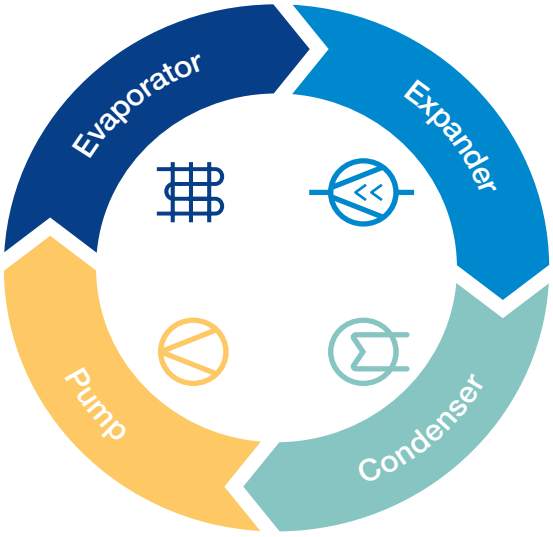
The E-PowerPack is marine-certified by leading classification societies.

Working principle

The E-PowerPack generates electricity by means of an Organic Rankine Cycle (ORC), a closed thermodynamic system where the liquid-vapour phase change of an organic refrigerant is used to drive a generator. Compared to water, which is used in a standard Rankine Cycle, the organic fluid has a low boiling point that allows low-temperature heat sources to be utilized.

Waste heat is fed into the E-PowerPack at two different levels. High-temperature waste heat enters by means of a heat exchanger and an intermediate hot water loop. Low-temperature fluids are fed into the unit directly.

The heat enters an evaporator, where the liquid refrigerant becomes superheated vapour that moves into an expander. In the expander, the expansion of the gaseous refrigerant turns rotary screws that drive the unit's generator, producing electrical power. The refrigerant is then reliquefied in a condenser and repressurized by the feed pump, ready to enter the evaporator and begin the cycle again.

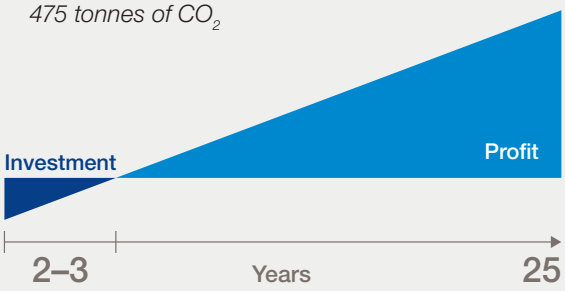


Savings example

Conditions

- Steam surplus: 2300 kg/h
- Avg. power output: 150 kW
- Operating hours per year: 7200
- Annual power output: 1080 MWh

Annual savings	Payback time
• $115,000 per year at $0.10/kWh ($530/tonne VLSFO) *670 tonnes of CO_2*	2.9 years
• $130,000 per year at $0.12/kWh ($600/tonne VLSFO) *670 tonnes of CO_2*	2.5 years
• $138,000 per year at $0.13/kWh ($800/tonne LNG) *475 tonnes of CO_2*	2.4 years



Design

The E-PowerPack comprises standardized components in marine-grade materials. The module itself houses the closed ORC circuit, which utilizes a standard organic refrigerant that is non-toxic, non-flammable and non-ozone-depleting.
It also contains the generator, which can be connected to the vessel's grid directly (most common) or via power electronics. The module is steered from a separate control cabinet.

Modules are available in two sizes, providing net electrical outputs of up to 100 kW and 200 kW respectively.

Technical data

Module	100 kW	200 kW
Thermal input power	560–1100 kW thermal	1000–2100 kW thermal
Max. rated electrical output	100 kW net (124 kW gross)	200 kW net (255 kW gross)
Heat sources	• Exhaust gas (max. 550°C) • Saturated steam (120–180°C) • Thermal oil (120–180°C) • Jacket cooling water (75–109°C)	
Electrical data (auxiliaries supply and default grid connection)	380–415 V (3~ + PE), 50 Hz / 440–480 V (3~ + PE), 60 Hz	
Module dimensions (W x L x H)	1130 mm x 1394 mm x 1982 mm	2300 mm x 1700 mm x 2100 mm
Weight (filled with refrigerant)	2300 kg plus electrical cabinet (130 kg)	4500 kg plus electrical cabinet (300 kg)

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How to contact Alfa Laval
Up-to-date Alfa Laval contact details for all countries are always available on our website at www.alfalaval.com