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HEAT TO PROFIT

Higher Efficiency – Less Emissions



eP M 050.100



eP M 150.200

ORCAN EFFICIENCY PACK

Efficient power production from waste heat energy on board

The Orcan efficiency PACK 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 efficiency PACK 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 efficiency PACK 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 efficiency PACK 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 efficiency PACK 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.

MARINE APPROVALS

The efficiency PACK is marine-certified by leading classification societies.

The marine modules gain many operating hours at sea, i.e. in the following reference project:



Look inside the engine rooms of „MS Willem Barentsz“ and “MS Willem de Vlamingh“ equipped with efficiency PACKs: The high-efficiency catamarans of the Dutch shipping company Doeksen combine particularly environmentally friendly technologies and materials to make ship operation in the nature-protected Wadden Sea as sustainable as possible.

WORKING PRINCIPLE

The efficiency PACK 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 efficiency PACK 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.

TECHNICAL DATA

Module	eP M 050.100	eP M 150.200
Thermal input power	560 – 1100 kW thermal	1000 – 2100 kW thermal
Max. rated electrical output	100 kW net (124 kW gross)	200 kW net (240 kW gross)
Heat sources	Exhaust gas (max. 550 °C) Jacket cooling water (75 – 109 °C) Thermal oil (120 – 180 °C) Saturated steam (120 – 180 °C)	
Module dimensions	1180 mm x 1400 mm x 1982 mm	2200 mm x 1650 mm x 2060 mm
Weight (filled with refrigerant)	2300 kg + electrical cabinet (130 kg)	4600 kg + electrical cabinet (300 kg)

ANNUAL SAVINGS

Savings example

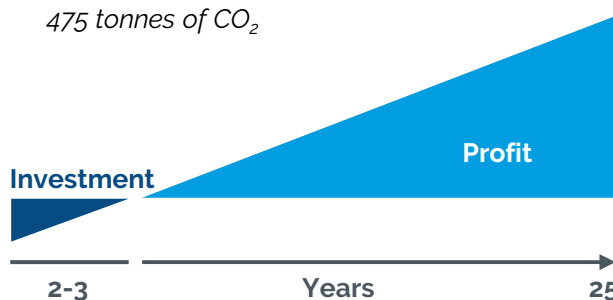
Conditions

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

Annual savings

- \$115,000 per year at \$0.10/kWh → **2.9 years**
(\$530/tonne VLSFO)
670 tonnes of CO₂
- \$130,000 per year at \$0.12/kWh → **2.5 years**
(\$600/tonne VLSFO)
670 tonnes of CO₂
- \$138,000 per year at \$0.13/kWh → **2.4 years**
(\$800/tonne VLSFO)
475 tonnes of CO₂

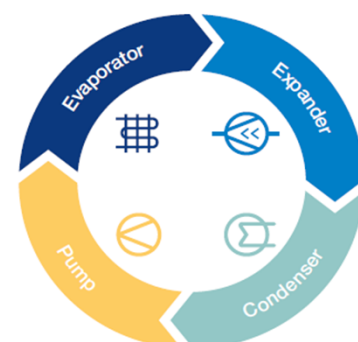
Payback time






DESIGN

The efficiency PACK 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.



BENEFITS

 Increased efficiency Significant fuel savings and an improved EEDI, EEXI and CII	 Plug & Play Waste heat recovery system for engines from 1,000 kW and upward	 Carbon reduction Less CO2 and other emissions (NOx, SOx, HC and PM)
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ADDITIONAL BENEFITS

- Attractive NPV (Net Present Value) and IRR (Internal Rate of Return) on investment made
- Accumulated free cashflow positive from day 1 of start deployment
- Significant hazardous emission reductions (savings), (complementary to CO2)
- Operates independent of type of fuel used, for new sustainable fuels, like Ammonia & (bio) Methanol, the business case will be even more significantly improved
- Increase of energy efficiency and as a consequence this will significantly reduce carbon tax (when introduced by EU & IMO) payments
- Compensation for extra air compressor electrical power when Air Hull Lubrication technology is applied on vessels
- More propulsion power available due to less shaft generator power demand (only in case of a shaft generator present)
- Well selected and class approved rugged marine components that require minor scheduled maintenance, first TBO at 120.000 running hours