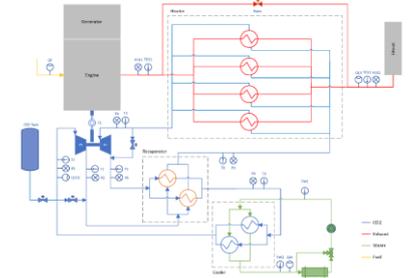
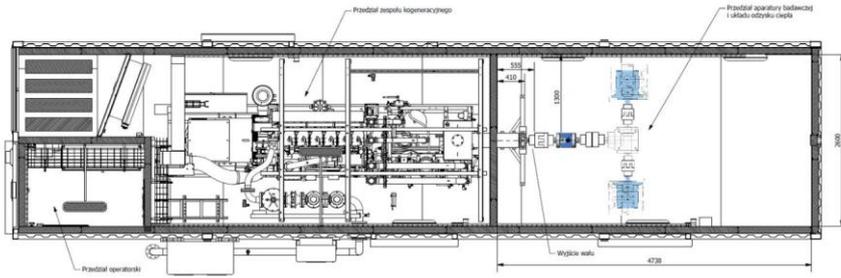


# sCO<sub>2</sub> Waste Heat Recovery Module for Reciprocating Engines

A regenerative closed Brayton cycle mechanically and thermally integrated with a gas reciprocating engine.



## Product overview

AFTERMOST recovers exhaust heat from a reciprocating engine and converts it into additional shaft or electrical power. CO<sub>2</sub> is compressed close to the critical point, which reduces compression work and improves cycle potential. The prototype was designed for integrated setup with an engine.

## Main result for commercialisation

- technical documentation of the sCO<sub>2</sub> prototype and the installation
- manufacturing / detailed drawings of key components
- mass and energy balances, process stream parameter and process schemes
- package sections: general, process, mechanical, instrumentation & control, electrical
- basic engineering package for a 500 kW engine installation with CAPEX/OPEX analysis

## Validated prototype data

<b>Additional sCO<sub>2</sub> power output</b>	up to 42.03 kW (10% of the engine power)
<b>Share of engine electrical power</b>	~10.0%
<b>CO<sub>2</sub> mass flow</b>	up to 0.915 kg/s
<b>CO<sub>2</sub> pressure level</b>	approx. 75.4 / 130.3 bar
<b>CO<sub>2</sub> temperature</b>	35.2°C before compressor 397.5°C before expander 60.8°C after recuperator
<b>Shaft speed</b>	engine 1500 rpm compressor and expander 3000 rpm
<b>Gear ratio</b>	2:1
<b>Heater / recuperator / cooler area</b>	30.4 / 45.2 / 15.2 m <sup>2</sup>
<b>CO<sub>2</sub> piping</b>	42 m; 60.3 × 12.5 mm; 16Mo3 steel

## How it works

CO<sub>2</sub> compression → preheating in the recuperator → exhaust heat input in the heater → expansion in the expander → cooling and cycle closure.

## Main elements

- sCO<sub>2</sub> compressor
- sCO<sub>2</sub> expander
- exhaust gas–CO<sub>2</sub> heat exchanger (heater)
- CO<sub>2</sub>–CO<sub>2</sub> recuperator
- CO<sub>2</sub>–water cooler
- CO<sub>2</sub> tank, valves and piping
- gearbox, couplings and torque meter
- automation, control and measurement system

## Key features

- closed regenerative sCO<sub>2</sub> cycle
- compression close to the CO<sub>2</sub> critical point
- positive displacement vane-type compressor and expander
- direct shaft integration with the engine and a single generator
- power control by expander bypass valve
- operation designed at nominal and 50% engine load

## Application areas

- natural-gas gensets and CHP units
- biogas and landfill-gas engines
- distributed waste heat recovery systems
- retrofit of existing reciprocating-engine plants

Project outcome status: validated prototype plus a basic engineering package for scale-up.