Explore our Technologies
ORC (Organic Rankine Cycle) Waste Heat Recovery System
for commercial vehicles
CHALLENGES FOR COMMERCIAL TRUCKS

- Better fuel economy
- Lower emissions

Standard CV On-Highway Engine Setup

Motivation for Waste Heat Recovery Systems
- Almost 50% of an engine's fuel energy is wasted as rejected heat
- Enables reduced CO₂ output in anticipation of upcoming legislation
- 3-5% fuel savings potential in long haul trucks

ORC Waste Heat Recovery System

How it works
- Converts wasted exhaust heat into usable electrical energy
- The Rankine Cycle makes use of the phase change characteristics of fluids in the same manner as refrigeration and air conditioning systems
- Cycle consists of 4 steps:
  1. Pump
  2. Evaporate
  3. Expand

Rankine Cycle Explained
- Step 1: Cool liquid working fluid from the Condenser is pumped to high pressure
- Step 2: Exhaust gas heats the working fluid to a superheated vapor in Evaporators
- Step 3: Superheated vapor drives the Turbine Expander, generating electrical power
- Step 4: Low pressure vapor is cooled by the Condenser to a liquid state and the process repeats

BorgWarner ORC Waste Heat Recovery Products

Tailpipe and EGR Evaporators
- 60+% Tailpipe Evaporator efficiency
- 80+% EGR Evaporator efficiency
- Based on proven BorgWarner EGR Cooler technology
- Thermally decoupled tube-shell construction
- Compact, modular design for ease of packaging and low cost

Exhaust Flap Bypass Valve
- Bypasses exhaust around Tailpipe Evaporator when required
- Two types: Exhaust Flap Valve & Throttle Valve (not shown)
- CAN-based eActuators for fast, precise proportional control
- May be installed upstream or downstream of Evaporator
- Low pressure drop minimizes impact on engine performance

Turbine Expander/Generator/Pump
- 48V output
- 7 kW nominal, 13 kW max output
- 65% peak turbine efficiency
- Very low weight < 10 kg mass, compact package
- Integrated high pressure pump
- No oil lubrication required

Heat Exchanger/Condenser
- EGR Cooler technology yields compact, high efficiency design
- Stacked brazed plate & fin construction maximizes efficiency
- Proprietary brazing materials ensure long-term reliability
- Stainless steel provides compatibility for corrosive working fluids (e.g., ethanol)

BorgWarner ORC Waste Heat Recovery System

System Level Expertise
- Proprietary software tools enable rapid specification to a customer’s engine requirements
- System-level Simulations, Controls, and Testing have resulted in numerous design enhancements
- BorgWarner ORC components have run hundreds of hours on proprietary ORC system test rigs
- A broad product portfolio and system-level approach allow BorgWarner to maximize overall performance and durability at the lowest cost

For Additional BorgWarner Turbo Systems Information:
turbos.borgwarner.com