



## **Converting Waste Heat into Electrical Energy: BorgWarner's Organic Rankine Cycle**

- *Supports mild hybrid commercial vehicles*
- *Enables CO<sub>2</sub> reductions and fuel savings of 3 to 5 percent*
- *A technology new to the commercial vehicle sector*

Auburn Hills, Michigan, September 13, 2018 – Ever-stringent emissions regulations as well as rising fuel prices call for innovative solutions – such as BorgWarner's Organic Rankine Cycle (ORC) waste heat recovery system, which is new to the commercial vehicle sector. In conventional applications, almost 50 percent of the engine's fuel energy is rejected to the environment as heat. ORC waste heat recovery presents one of the most effective solutions to this challenge. BorgWarner produces and develops a complete system, consisting of tailpipe and EGR evaporators, an exhaust flap bypass valve, a turbine expander as well as turbine expander power electronics and a condenser. Thus, the company provides its customers with an advanced solution which reduces CO<sub>2</sub> emissions, improves fuel economy by 3 to 5 percent and supports mild hybrid commercial vehicles.

"At BorgWarner, we constantly aim to drive the latest advancements in efficient mobility," said Joe Fadool, President and General Manager, BorgWarner Emissions & Thermal Systems. "By converting wasted exhaust heat into usable electrical energy, we support our customers and protect the environment at the same time."

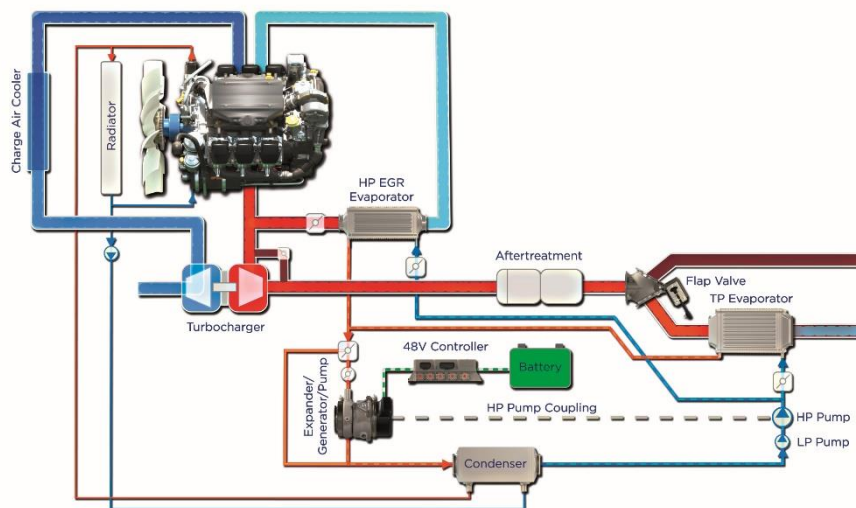
BorgWarner's ORC waste heat recovery system generates electrical energy by converting energy from the fuel that would be typically wasted as heat. The system takes advantage of the phase change characteristics of fluids similar to air conditioning or refrigeration systems. The cycle can be divided into four steps. First, the cool working fluid from the condenser is pumped to high pressure. Then, waste heat from the engine heats the working fluid to a superheated vapor, which in turn drives the turbine expander and generates electrical power. Finally, the low-pressure vapor is cooled back to a liquid state by the condenser, and the process repeats itself.

Featuring a 48-volt electrical output, BorgWarner's innovative ORC turbine expander is not only well-suited for combustion vehicles but supports mild hybrid commercial vehicles, an

emerging trend expected for the next five to ten years. Its oil-free bearing system and aerospace-inspired turbine allow for best-in-class efficiency. BorgWarner's evaporators enable improved balance between durability and high performance through an unparalleled design and manufacturing process. The exhaust bypass valve provides a valuable method for controlling the amount of heat entering the waste heat recovery system from the tailpipe exhaust system. At high engine loads, it is sometimes necessary to bypass the tailpipe evaporator. The company's exhaust bypass valve provides a proportional flow control of the exhaust and ensures low backpressure to maximize engine performance. The ORC waste heat recovery system strengthens BorgWarner's position as a global leader in clean and efficient propulsion systems.

### About BorgWarner

BorgWarner Inc. (NYSE: BWA) is a global product leader in clean and efficient technology solutions for combustion, hybrid and electric vehicles. With manufacturing and technical facilities in 66 locations in 18 countries, the company employs approximately 29,000 worldwide. For more information, please visit [borgwarner.com](http://borgwarner.com).



BorgWarner's ORC waste heat recovery system enables improved fuel economy by converting waste heat into electrical energy.

BorgWarner Inc. (Converting Waste Heat into Electrical Energy: BorgWarner's Organic Rankine Cycle\_EN) – 3

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