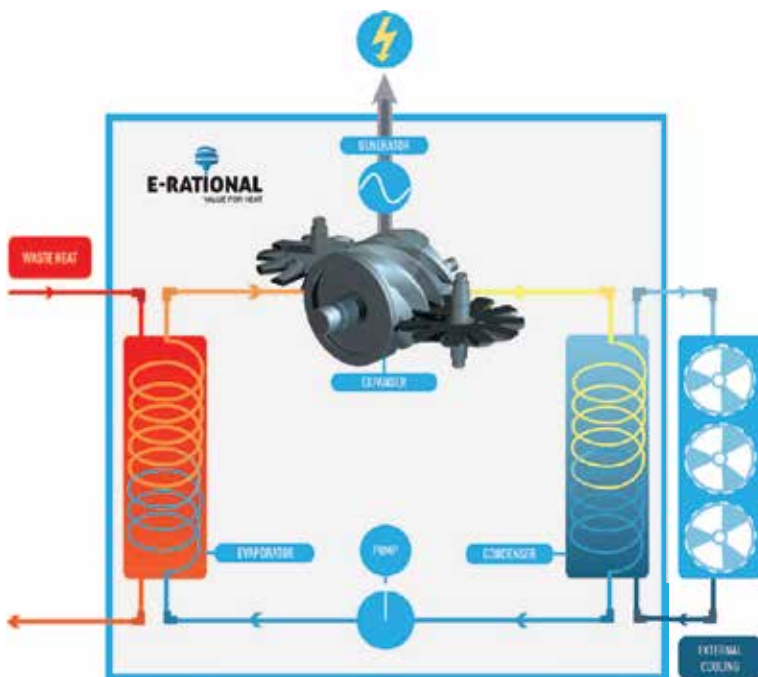


# The answer is ... yes!

Can plain machines save costs and energy at the same time as saving our beautiful planet?

## ENERGY CONCERN

Today's society is based on fossil fuel. Due to limited resources, environmental concerns and volatile prices, new objectives came into the picture. Improvement of current technologies but also renewable energy sources and sustainable energy production are the keystones for energy management. The ORC-technology approaches these ideas in multiple ways: The reuse of waste heat to produce electricity, emission-free, with a cost-effective result **making an ecologically beneficial.**



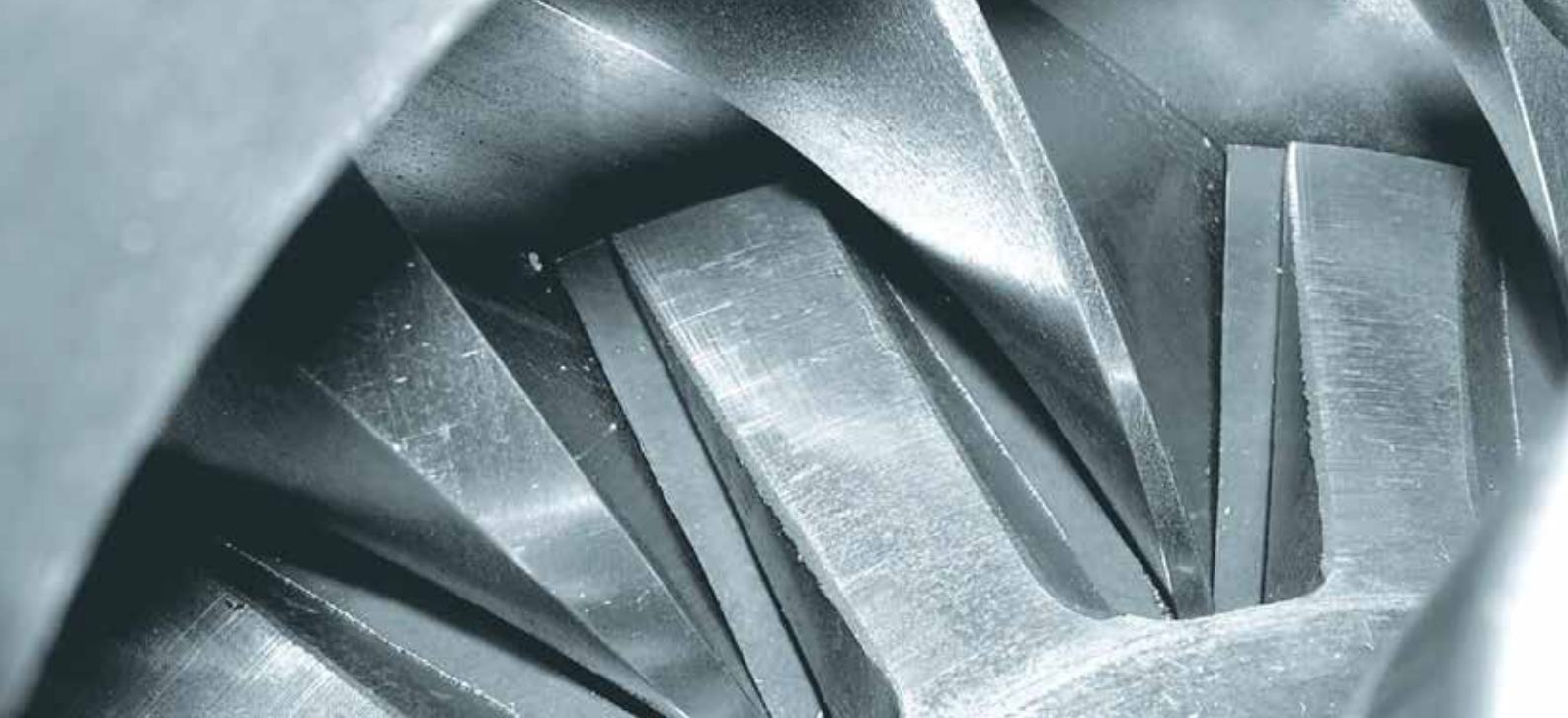
## ORC TECHNOLOGY

ORC or Organic Rankine Cycle technology is based on the principle used in power plants: water is heated and evaporated into steam. The steam drives a turbine, which is connected to a generator to produce electricity. The same principle is held for ORC, but organic fluids or refrigerants are used instead of water.

## WORKING PRINCIPLE

The working principle of the machine is represented in the figure on the left. The cycle is started at the pump, which is pumping the refrigerant – the fluid of the internal circuit of the machine – to the evaporator. At the evaporator, the available waste heat is used to evaporate the refrigerant. The saturated gas at the outlet of the evaporator is sent to the expander. The expansion of the gas is delivering the work to drive the generator, resulting in the production of electricity. Supersaturated low pressure gas is leaving the expander to be condensed in the condenser. The fluid leaving the condenser will be pumped up again to restart the cycle. All refrigerants used by E-RATIONAL are non-toxic and non-flammable with a low global warming and zero ozone depletion potential.





### E-RATIONAL ORC

A modular and scalable design makes almost any kind of waste heat suitable for cheap green energy production. The main focus for E-RATIONAL, during design phase of the machine, has been on a maximized uptime and efficiency at a minimized operational and maintenance cost, resulting in a skid-mounted, modular, CE compliant machine with plug-and-play connections for convenient installation. The synergy between state-of-the-art technology and traditional, standard components makes the E-RATIONAL ORC machines to what they are today: user-friendly, robust and economically viable installations. Consistent reasoning combined with proven facts has led to our product range.

E-RATIONAL has chosen to use, as far as possible, industrial grade standard components having proven qualities and reliability. For some of them we further optimize and improve, utilizing our own expertise and extensive research results. The heart of the ORC unit is the E-RATIONAL single screw expander, directly connected to an asynchronous generator. The design and modification of the expander is in-house knowledge. Advantages of the single screw expander in comparison to a turbine are the high robustness and reliability with preservation of performance at part load conditions.

Touch screen



Our machines are equipped with comprehensive and user friendly software, covering a seamless connection to the power grid as well as monitoring of multiple parameters including energy production per hour, per day, per week and per month. The machine is controlled by a PLC to ensure maximized efficiency at all times. The operating panel, connected to the PLC, allows the operator to follow up the machine production, even by remote connection.

### E-RATIONAL'S MISSION

E-RATIONAL's mission is to provide sustainable energy solutions based on common sense:  
No Heat to Waste!

E-RATIONAL stands for a rational, logical approach of sustainable energy production... Creating green electricity out of low temperature waste heat... Reliable ORC solutions with attractive pay-backs!



INSIDE IT IS WORKING  
TOWARDS A BETTER PLANET



315kWe installed power



90kWe installed power

## ORC MARKET

In spite of highly efficient processes, there is still a vast amount of energy lost as waste heat, even more than the potential of all alternative energy resources together. Thanks to ORC-technology we can now recover a part of the wasted heat and turn it into clean electricity without burning any fossil fuel and without emissions. The ORC units are heat powered by hot water, low pressure steam or thermal oil coming from a variety of heat sources: waste heat from industrial processes, residual heat from CHP units, excess heat or geothermal heat from district heating nets.





## TYPICAL APPLICATIONS

### INDUSTRIAL WASTE HEAT

E-RATIONAL ORCs can recover waste heat coming from various industrial processes such as furnaces, steel factories' walking beam ovens, exothermal reactions, cooling processes, etc. By introducing a heat exchanger, the waste heat is recovered by a heat transfer fluid such as (pressurized) water, steam or thermal oil and sent to the hot side of the ORC.



### COMBINED HEAT AND POWER

Cogeneration is a process that generates electricity and heat at the same time. The benefit of this process is that the efficiency is maximized therefore optimizing the fuel consumption.

This is viable for combustion engines fueled by natural gas, biogas, diesel or vegetable oil. E-RATIONAL ORC can increase the electrical efficiency and the power-to-heat ratio of such micro-generation plants by recuperating the heat released by the engines.

Diesel or gas engines convert about 40% of the available fuel energy to usable power. The remaining 60% is lost as heat. E-RATIONAL ORC can recover this low grade heat, derived from jacket cooling and/or exhaust gas cooling.



### DISTRICT HEATING

These days, district heating networks are common in Germany and Scandinavia. Such heating networks distribute hot-water to households and offices.

The heat sources for the hot water are industrial processes and incinerators. Due to the changes of the ambient conditions between different seasons (winter vs. summer), the heat demand of the consumers changes proportional, resulting in a heat excess on the net. The excess heat needs to be cooled as to keep the factory-to-district loop stable, which is an extra electrical cost.

By installing an E-RATIONAL ORC, the excess heat can be converted to electricity. As such, the E-RATIONAL ORC can be the "handshake" between industry and energy utilities, and at the same time, support our future economic and environmental values.



### GEOTHERMAL HEAT

Also for geothermal heat, the E-RATIONAL ORC can offer a viable solution. The brine water of the wells is pumped towards a first heat exchanger. This heat exchanger is robust for the brine which is containing solids and salts. A second circuit (typically hot water) recovers the heat from the brine. After the heat has been recovered, the brine is sent back to the well in order to create a closed circuit. The secondary circuit, delivers the heat to the E-RATIONAL ORC to produce electricity.





#### COMPANY

E-RATIONAL, a division of BEP Europe, is the first Belgian enterprise to provide the world with a compact solution for converting waste heat into green, sustainable energy.



As a company, BEP Europe has 30 years of experience as equipment manufacturer for automation projects (such as Tire and Wheel assembling), end of line test equipment for automotive industry (such as Roll/Brake test systems) and industrial set-ups for reliability testing of vehicles (laboratory tests such as dynamometers). The experience in development of new products and the close cooperation with local universities were a good basis to develop the E-RATIONAL ORC machine.



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