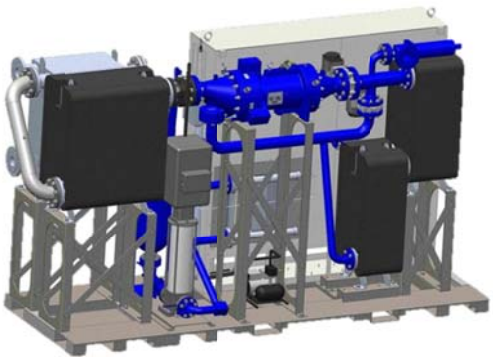
HEAT RECOVERY SOLUTIONS



Clean Cycle ™ II

Heat to power generator

The Clean Cycle ™ II is a compact, modular system that converts thermal energy – from an array of heat sources – into electricity. The conversion process is closed loop, requires no additional fuel, and results in base-load, zero incremental emission electricity that may be used onsite or sold to the grid.

The Clean Cycle ™ II system is the 2nd generation heat to power generator from CETY's Clean Cycle product line and builds on over a million of operating hours and years of success with the original product. The result: a more efficient, flexible, simple, and reliable system to convert heat into up to 140kW of electricity.

About the product

The same Clean Cycle II is flexible enough to be used in nearly every application where sufficient heat is available. The balance of plant (BOP) is designed according to the heat source.

The core of the Clean Cycle II is the IPM or Integrated Power Module. Inside it, a turbine generator spins at 27,500 rpm while floating on magnetic bearings to generate electricity. No external seals, no gearbox, no oil or lubricants are required.

Power electronics seamlessly convert electricity from the IPM into grid-ready AC power.

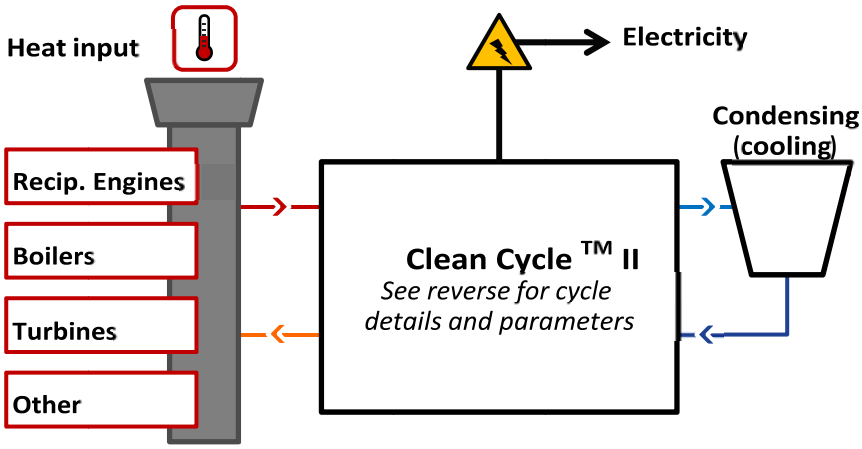
If the quantity of heat supplied fluctuates or shuts off, the Clean Cycle II will automatically adjust its electrical output accordingly.

The benefits

- Up to 140kW of reliable, base-load electricity production
- No additional fuel required
- No additional emissions produced
- Simple synchronization with the electrical grid or use on-site
- Smooth operation in variable heat input conditions
- Low maintenance
- Modular design

Turning heat into power

1. Thermal energy from a heat source is brought to the Clean Cycle II system using a high pressure hot water, steam, or thermal oil loop
2. The Clean Cycle II converts the thermal energy into electrical energy in a closed loop, emission free process called the Organic Rankine Cycle *(see back page for details)*
3. Electrical output is seamlessly matched to grid voltage and frequency
4. As part of the process, excess, lower temperature



heat is released using a condenser or cooling tower

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Cycle parameters

The Clean Cycle ™ II generates electricity in a process that is similar to the steam cycle, but instead of using water, it uses a working fluid with a lower boiling point, enabling access to a greater range of heat sources.

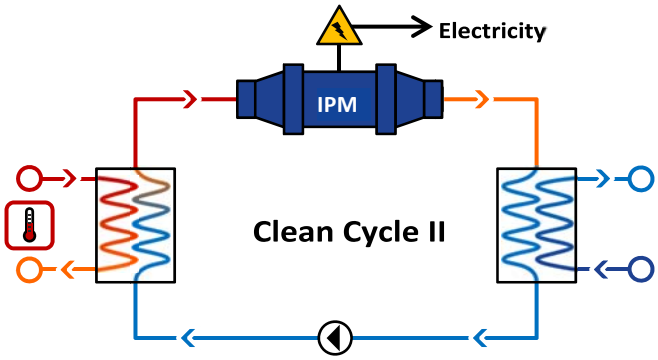
The cycle begins when the working fluid is exposed to thermal energy from the heat input and transforms from liquid to super-heated vapor. The vapor enters the IPM and expands across a turbine generator, causing it to spin and generate electricity. A condenser then cools the vapor back to a liquid so that it can be pumped back to the heat input and the cycle repeats.

Heat input

Thermal energy is transferred from a heat source to the Clean Cycle ™ II using:

- High pressure hot water, or
- Steam, or
- Thermal oil

The Clean Cycle II regulates the temperature and quantity of heat delivered to it



Condensing (cooling)

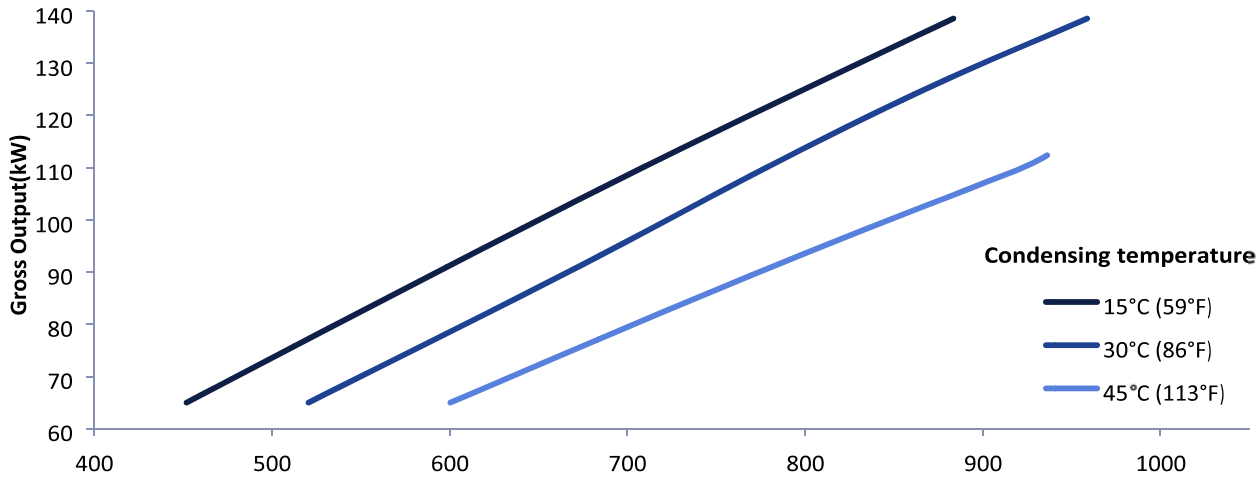
Vapor that leaves the IPM (where electricity is generated) is cooled to a liquid by an:

- Evaporative condenser (if a water source is available), or
- Air blast condenser

Some heat may be available for use in a process after condensing

Performance

The Clean Cycle ™ II automatically generates the maximum power possible based on the heat transferred to it and the condensing temperature. The temperature of the thermal energy delivered to the Clean Cycle II can vary and the chart below assumes it is 155°C (311°F). Have more heat available? Clean Cycle ™ II units are modular, so use several.



Heat Input (kWth)

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System design

Gross electrical output	50 - 140kW
Working fluid	R245fa (benign, non-ozone depleting)
Power electronics	Built in inverter – matches AC grid power
Electrical output	50 or 60hz AC 3-phase power
Dimensions	360.2 x 121.9 x 216.5cm 141.8 x 48.0 x 85.3in
Weight	3,523kg (7,767lbs)

Clean Cycle ™ II

Heat to power generator

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