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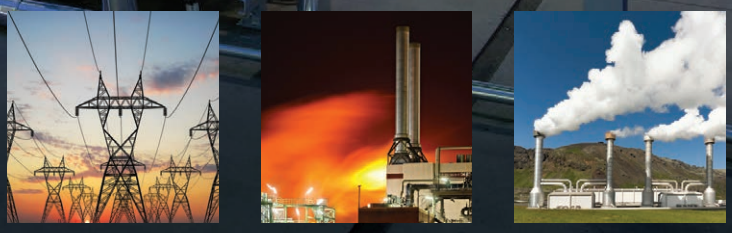
Access Energy® Prepackaged Thermapower® Organic Rankine Cycle (ORC) 125MT

The Heat-to-Power Solution for Industrial Applications



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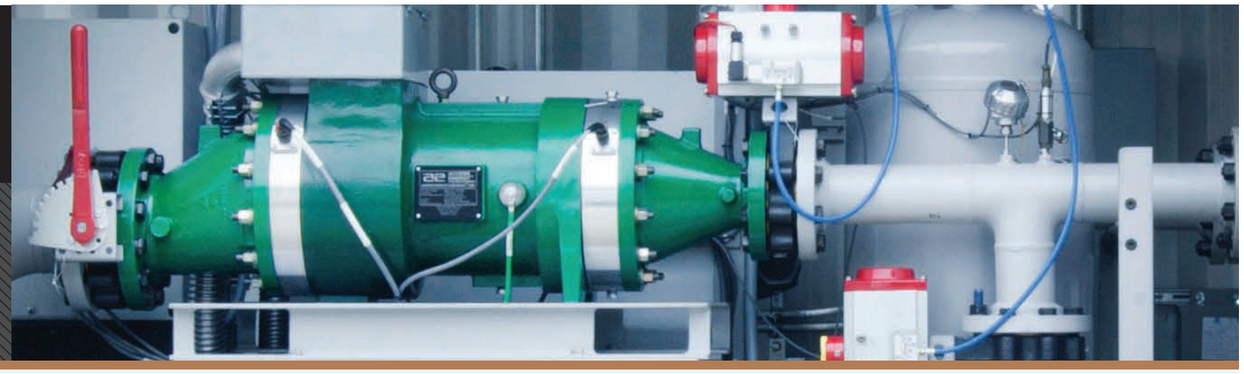
Compact, Efficient and Reliable Heat Recovery



With over 45 MW of capacity installed and operating around the world, Access Energy has the technology, knowledge and experience to make your heat recovery project a success.

If your process vents heat greater than 130°C, and you are operating 6,000 hours or more, Access Energy's Prepackaged Thermapower® ORC 125MT can help turn your waste heat into profit.

Engineered for Dependability

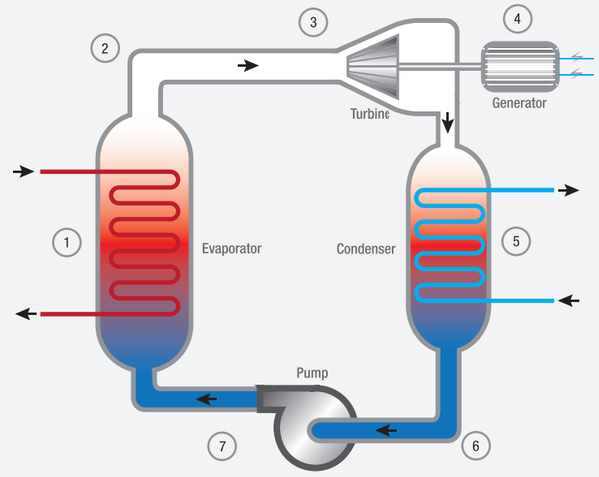
The Prepackaged Thermapower ORC 125MT uses cutting edge technology to produce reliable, clean electricity. Our patented Carefree® Integrated Power Module (IPM) operates on magnetic bearings and removes the hassle of maintenance with its innovative fully encapsulated design. With its advanced Vericycle™ power electronics and state-of-the-art computer control system, the Thermapower 125MT is the premier ORC system in the world, offering numerous benefits over competitive technologies, including:

- High availability and reliability
  - > Consistent and stable operation with a wide variety of source heat types and conditions
  - > Very low maintenance and operating costs
- High efficiency
  - > Variable speed generator allows for optimal speed operation
  - > Self-centering magnetic bearings eliminate friction between rotating parts and reduce product wear
- Zero emissions or risk of contamination
  - > No fuel or oil lubrication required
  - > Environmentally friendly, non-combustible and non-flammable working fluid
  - > Modular configuration
  - > Scalable to site (install 1 or 10 units)
  - > Offers opportunity for N+1 redundancy for critical applications
  - > Easy to relocate if required
- Ease of transport and installation
  - > Standard 20 ft. container
  - > Only three field connections for immediate use:
    - √ Connect heat source (hot water or steam)
    - √ Connect cooling water (from cooling tower or other supply)
    - √ Connect utility grid
  - > Simple setup and commissioning
- Fully automated
  - > Auto start/stop
  - > Load control
  - > Advanced power electronics automatically match grid voltage and frequency
- Options support
  - > High pressure hot water (HPHW) controls
  - > Steam valve control

Organic Rankine Cycle Process

The Organic Rankine Cycle (ORC) converts thermal energy into electricity. It does this using a process similar to a steam turbine, but it uses refrigerant instead of water. This allows the ORC to extract energy from low temperature sources.

1. The heat source transfers thermal energy into the refrigerant causing it to vaporize.
2. High pressure refrigerant vapor flows into the turbine.
3. The refrigerant vapor pushes against the turbine and causes it to spin.
4. The turbine turns the generator producing electrical power.
5. Cooling water extracts thermal energy from the low pressure refrigerant vapor.
6. The refrigerant is condensed back into liquid.
7. Liquid refrigerant is pumped into the evaporator.



Applications

USA Oil and Gas Well

Ship Engine Jacket Water

Japan- Trash Incineration

Italy- Boiler

Japan- Geothermal Well

South Korea- Fuel Cell

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Prepackaged Thermapower® ORC 125MT

Access Energy's new Prepackaged Thermapower ORC 125MT is configured to fit within a standard 20 foot shipping container. The new design is easier than ever to install. The system is ready for immediate use after connecting the heat source, cooling source and electricity.

Included In The Container:

- Thermapower 125MT IPM
- High Grade 316 SS Evaporator and Condenser
- Power Delivery Unit
- Power Electronics Cooler
- Refrigerant Leak Detector
- Air Compressor
- Space Heater
- Exhaust Fan
- Lights

Customer To Provide:

- Heat Source (Hot Water or Steam)
- Heat Source Control Valve
- Cooling Water (i.e. Cooling Tower)
- Grid Connection
- Pumps, Valves and Other Ancillary Balance of Plant Equipment

• Programmable Logic Controller (PLC)

> Controls operation of ORC components
> Remote operation with Modbus TCP/IP or Web interface

• Insight™ Magnetic Bearing Controller (MBC)

> Non-contact, no lubrication and low maintenance
> Controls magnetic bearings, which levitate the turbine wheel/rotor assembly

• Power Delivery Unit (PDU)

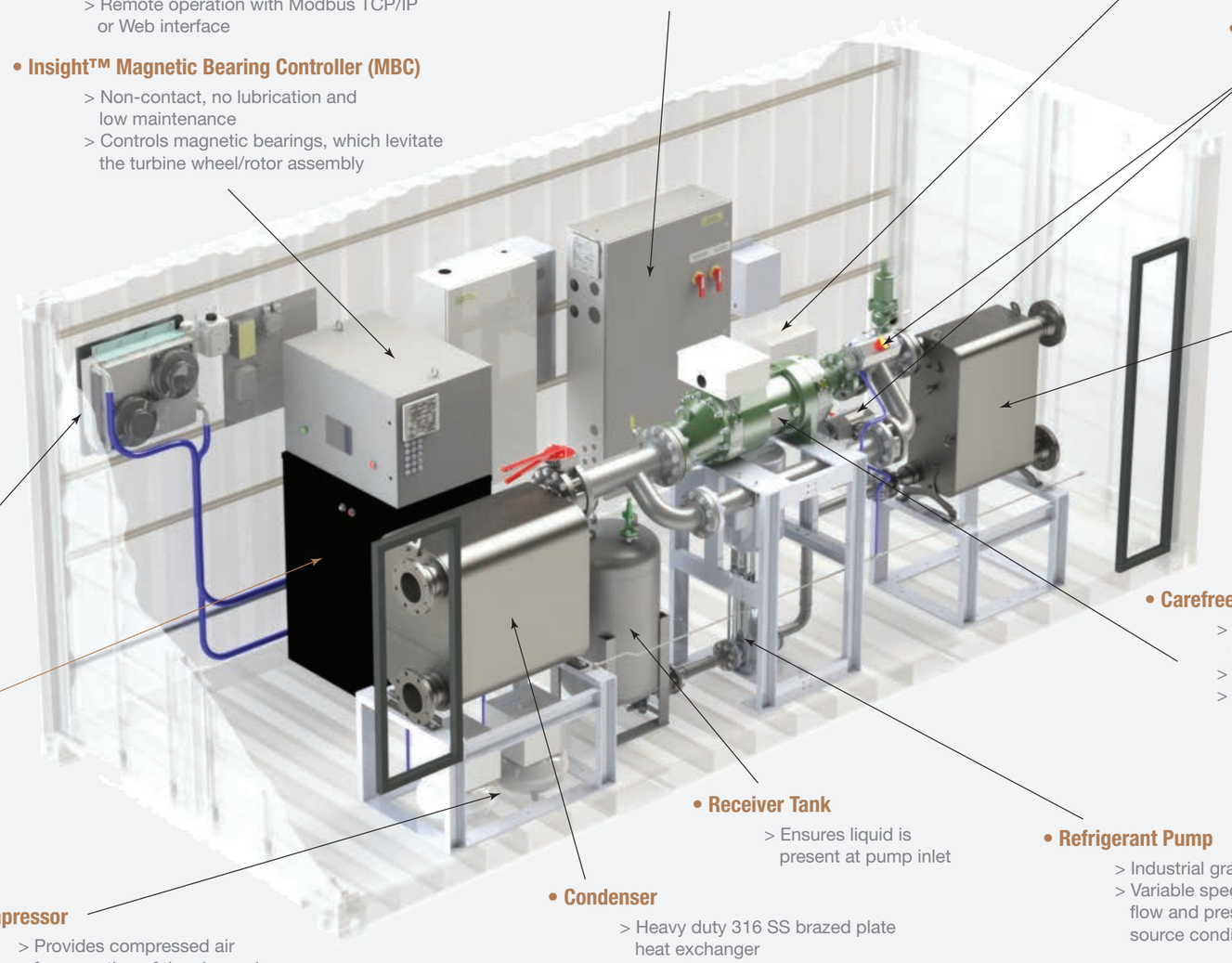
> Single point connection to the grid
> Distributes power to ORC and other ancillary equipment (i.e. PE cooler, space heater, ORC pump, etc.)

• Space Heater

> Protects unit from cold conditions, extends temperature range of operation

• Slam Valves

> Automatically re-direct refrigerant flow around IPM during a power outage or shutdown.



• Evaporator

> Heavy duty 316 SS brazed plate heat exchanger
> High effectiveness
> Small footprint
> Easy connection to process heat

• PE Cooler

> Provides cooling to the Vericycle™ Power Electronics

• Carefree® Integrated Power Module (IPM)

> Combination of turbine, generator and magnetic bearings
> Hermetically sealed
> Highly efficienct

• Vericycle™ Bi-Directional Power Electronics

> Controls the speed and power of the turbine/rotor assembly
> Automatically synchronizes turbine output with grid voltage and frequency

• Receiver Tank

> Ensures liquid is present at pump inlet

• Refrigerant Pump

> Industrial grade, high-head pump
> Variable speed motor adjusts refrigerant flow and pressure to match the heat source conditions

• Compressor

> Provides compressed air for operation of the slam valves

• Condenser

> Heavy duty 316 SS brazed plate heat exchanger
> High effectiveness
> Small footprint
> Easy connection to cooling water

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Customer Success Story

TCS1 Fuel Cell Plant in Daegu, South Korea

The TCS1 Fuel Cell Plant produces steam as a by-product. During the day, a portion of the steam is sold to a neighboring facility, and the remainder is vented to the atmosphere. When the neighboring facility is closed, all of the steam is vented. In order to beter utilize waste steam, the TCS1 plant decided to install an Access Energy ORC.

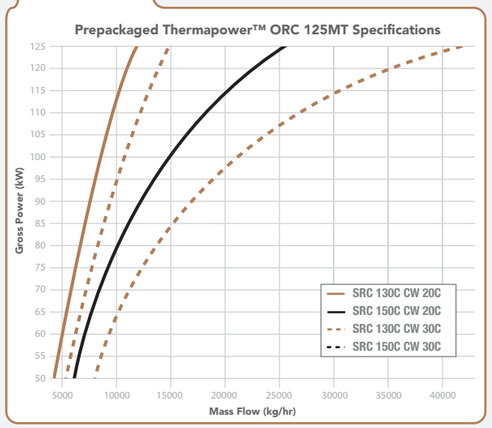
The Prepackaged Thermapower® ORC 125 MT unit was commissioned by Daesung Hi-Tech in February 2016 at TCS1, and the plant is currently benefiting from up to 125kW of power generated from the fuel cell's excess heat. Most fuel cell plants can expect a pay-back of less than 5 years when installing a Prepackaged Thermapower unit.

"We are very impressed by Access Energy's new Thermapower system and are happy with how the first unit has been performing in the fuel cell application at TCS1," said Andy Choi, Vice President of Daesung High-Tech.

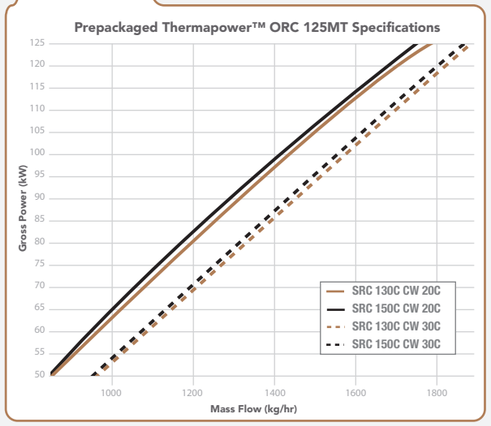
Key Benefits:

- 125 kW of gross power covers the parasitic load of the fuel cell
- Maximum site heat utilization
- Flexible operation based on customer demand
- Increased steam production due to high return water temperature
- Does not affect fuel cell operation

Pressurized Hot Water



Steam



Connection	Description
Evaporator Inlet/Outlet	4" CL300 RF ASME B16.5 Flange
Condenser Inlet/Outlet	6" CL300 RF ASME B16.5 Flange
Grid Connection	3-Phase 3 Wire with Ground
Internet Connection	Ethernet CAT-5 Cable from Customer Internet

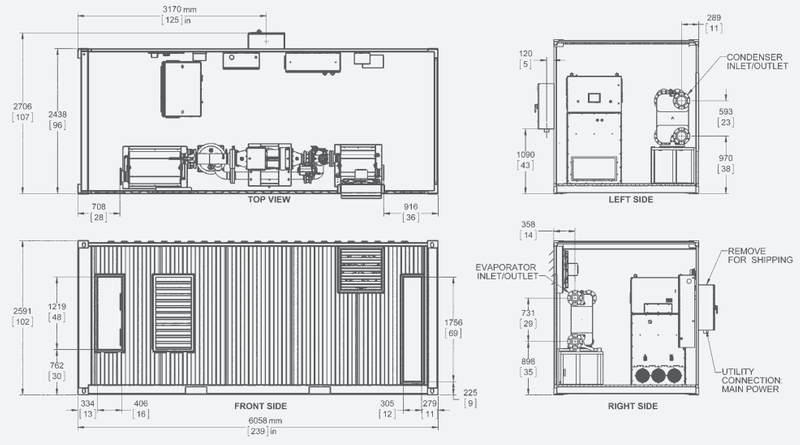
Parameter	Value
Power	125 kW Gross
Voltage/Frequency	380-480 VAC; 50/60 Hz
Input Temperature	130°C (266°F)
Parameter	**Value**
Power	R245fa
Voltage/Frequency	7,800 kg (17,200 lb)
Input Temperature	20 ft ISO Container

NOTES:

SRC is Source Heat Temperature.

CW is Cooling Water Temperature.

Dimensions



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