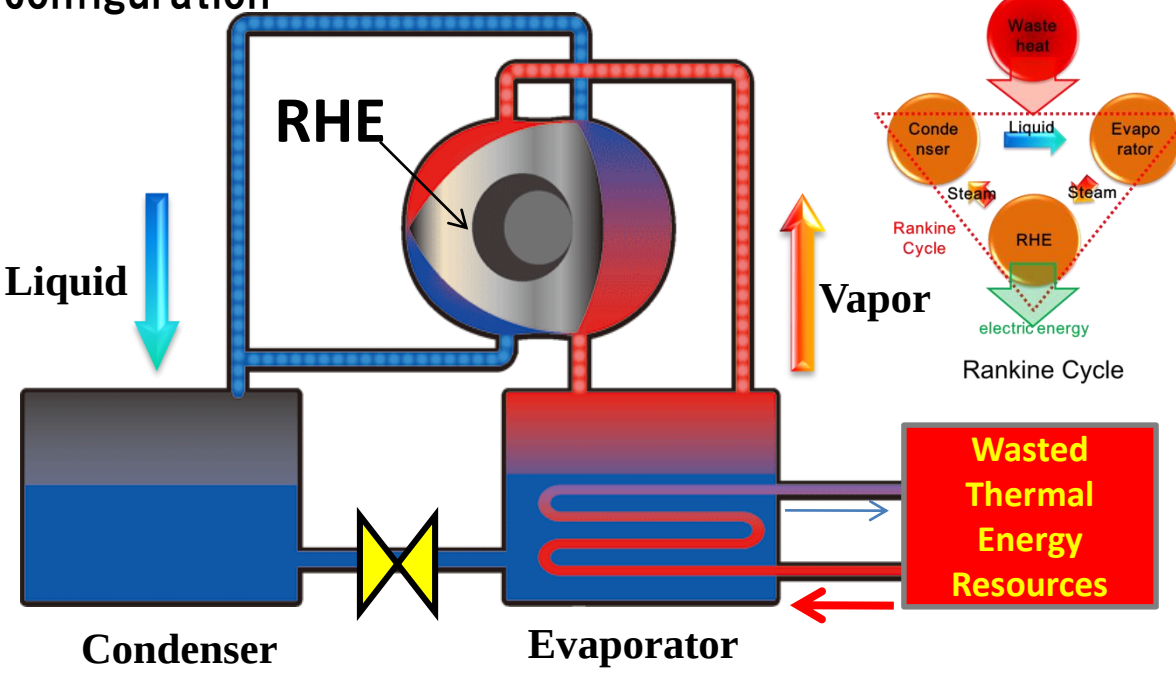
Rotary Heat Engine (RHE) system

configuration



Rankine Cycle

Rotary Heat Engine

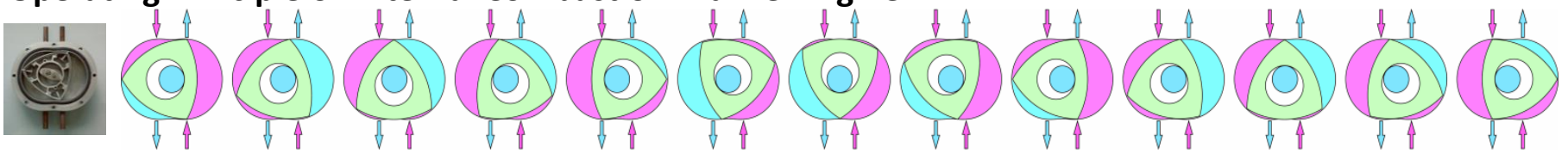
The rotary heat engine (RHE) is an external combustion Wankel rotary engine driven by Rankine cycle, developed by Da Vinci Co., Ltd.
Since displacement type engines can be operated even with relatively low pressure, they are suitable for a system recycling wasted low temperature heat.

Rankine Cycle

Phase transition of the working fluid occurs between gas-phase and liquid-phase depending on the input heat. Rankine cycle is a thermodynamic cycle which uses the pressure difference given by such phase transition.

* The pressure difference in vapor phase is converted into torque.

Operating Principle of External Combustion Wankel Engine



θ	0	45	90	135	180	225	270	315	360	405	450	495	540
Θ	0	15	30	45	60	75	90	105	120	135	150	165	180
Chamber C	constant-pressure air intake (high pressure)				constant-pressure scavenging (low pressure)				constant-pressure air intake (high pressure)				
Chamber B													
Chamber A	1	2			3	4						1	2

External pressure turns the rotor of an external combustion Wankel engine, which produces torque. On the other hand, an internal combustion engine converts internal fuel explosion into torque, but it needs a compression process. For a Wankel engine, this compression process causes back pressure, which interfere its rotation. Therefore, adapting two air supply/exhaust ports makes its loss smaller and can achieve higher output compared to another type of engine with the same volume chamber(s) since there are always two pressurized chambers out of three. In addition, the Wankel engine adopts a eccentric rotor shaft, by which the shaft turns three times at a single turn of the rotor.

RHE10 kW System

Engine closeup

Specification of 10 kW System

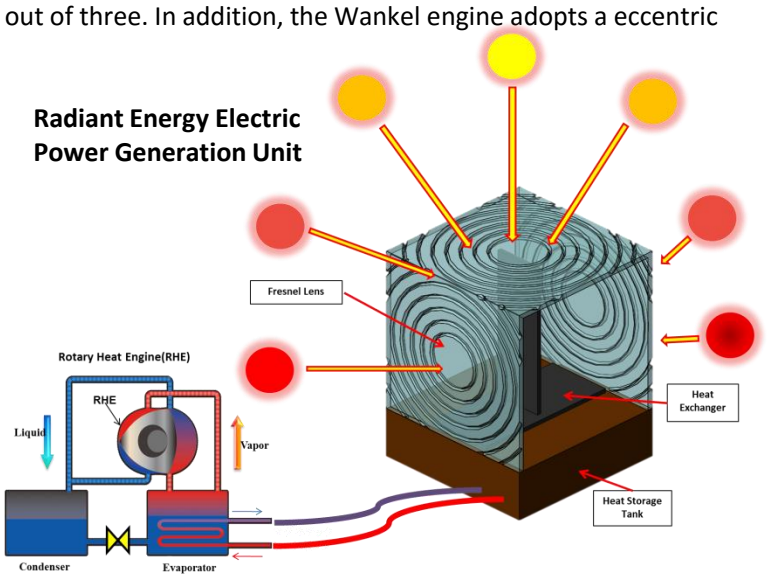
Input heat source: 85°C at 3.6 L/s
Input cooling source: 25°C at 4 L/s
Required pressure difference: 450 kPa
Generator output: 12 kW
Self power consumption: 1.8 kW
Working fluid: HFC245fa or HFO1233zd

Acceptable Heat Source

From 40℃ to 95℃
Maximum pressure: 1 MPa
Heat-work efficiency: Engine: 5.5 % (actual)

*Twin system: Generator Output 18kW
Heat-Work efficiency 8 %
(Target for SEP. 2016)
Note:
Selecting a right heat exchanger suitable for the type of input heat optimizes the system performance.

Radiant Energy Electric Power Generation Unit



This system is a combination of the heat driven RHE and the Fresnel lens unit that is comprised of the following three elements: 1) Fresnel lens for collecting solar light efficiently; 2) Heat exchanger of inverted-T shape for converting collected solar light into thermal energy ; and 3) Heat storage tank. Both two side Fresnel lenses converge the horizontal solar light such as one in the morning onto the vertical surface of the heat exchanger. As the solar elevation angle increase, the light spot moves down and reaches the bottom surface of the heat exchanger by the noon. After that, the spot moves to the other side of vertical surface. By this means, this system collects the solar light over the whole sky without any solar tracker or any moving parts.

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