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Heat-to-Power Solutions for Industrial Applications

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Since 1968 giving value to your energy

50 YEARS

Joint Workshop on Energy Saving Engineering - Effective Use of Thermal Energy
Spanish Embassy in Tokyo - JAPAN

Who We Are

INNERGY

INNERGY HEAVY INDUSTRIES

Heavy Industries, since 1968, has been one the European leading companies on the design, manufacture, commissioning and maintenance of industrial solutions for the heat and power generation. INNERGY is one of the few companies outside Japan, certified to manufacture pressure vessels according to JIS Standards

INNERGY ENGINEERING

Engineering, is the reference EPC and ESCO service provider for Biomass, Waste and Waste Heat projects in LATAM Our expertise as vertical integrator allow us to offer competitive solutions for the most specific demands.

INNERGY ELECTRIC

Electric, is the automation, control panel and electrical system provider, capable to offer Taylor-made solutions for any industrial process.

INNERSUD

INNERGY UK

INNERGY Japan

The Group Evolution

Projects in
5 CONTINENTS

Developing

PROJECTS WORLD-WIDE.

- More than 1.500 MWt
- More than 2.000 MWe on solar and biomass projects

- 50 years As the leading boiler company in Spain and LATAM
- More than 3.500 References

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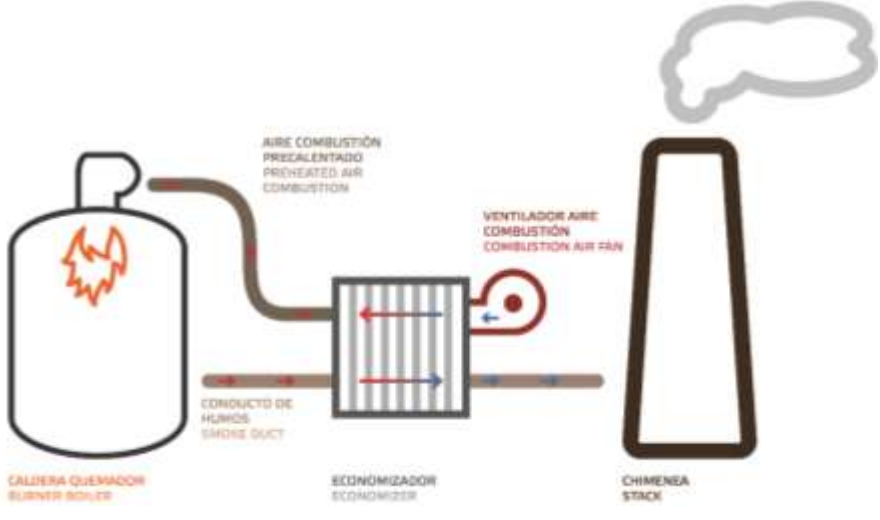
The HEAT RECOVERY Advantages

Waste heat boilers, air preheaters and boiler preheater systems are common worldwide in industrial facilities.

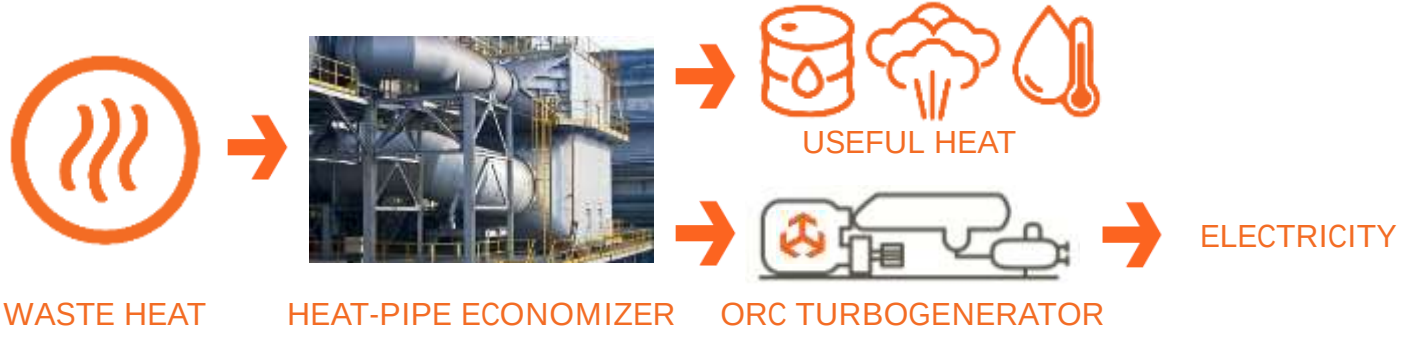
These conventional systems make the most effective use of high-quality heat (above 430°C) to generate electrical power and also use lower-quality heat (200–430°C) for air or water preheating.





The INNERGY WtH Technology

Generating power from ‘waste’ heat is a particularly advantageous solution. A waste heat recovery plant based on the Organic Rankine Cycle combined with HEAT PIPE recovery systems can now work with heat at lower temperatures than ever before, thanks to the INNERGY WtH Technology.



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The **INNERGY "HEAT-PIPE"** Technology

The high performance superconducting 'heat pipe' technology, is a revolutionary system that replaces conventional exchangers, to transmit heat from gas to gas, from gas to liquid (and vice versa) or from liquid to liquid.
The 'heat pipe' can transmit up to 1000 times more thermal energy than copper, the best conductor among those commonly used, with a temperature drop lower than -17 ° C per 30 cm.

The **INNERGY "HEAT-PIPE"** Technology

Shell & tube heat exchanger

Conventional heat exchangers

Complex multi-tubular structure, vulnerable to catastrophic single tube failures

Thin metal surface effects heat transfer, vulnerable to erosion and corrosion

Thermal stress cracking due to differential expansion

Susceptible to fouling and difficult to clean
(may require de-installation)

Cold spot induced condensation corrosion and hot spot induced oil degradation

The **INNERGY "HEAT-PIPE"** Technology

Heat Pipe heat exchangers

Multiple redundancy, independent pipe operation.
Simple, compact, light.

Robust and reliable – almost failsafe
Trusted: 2.5mm or 3.5mm pipe walls

Isothermal operation, so no thermal stress.
No start-up required. Instant responsiveness.

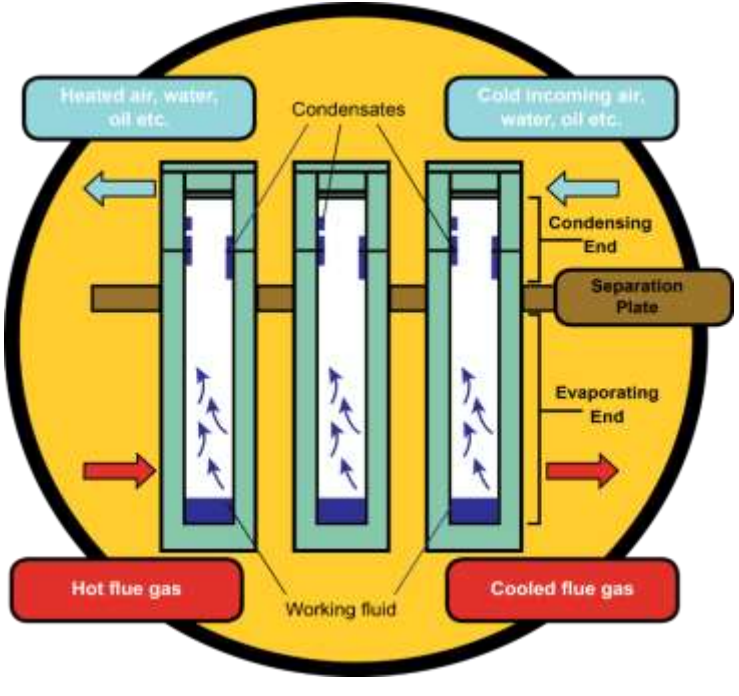
Minimal maintenance; trivial to clean;
easily handles very hot and/or dirty exhausts

Isothermal operation, no hot or cold spots

Heat pipe heat exchanger
running since 2008



The **INNERGY "HEAT-PIPE"** Technology



Multiple Redundancy

Each pipe operates independently so unit is not vulnerable to a single pipe failure preventing cross contamination

Low Fouling

Use of smooth pipes allows exchangers to be used in high particulate or oily applications

Ease of Cleaning & Maintenance

Can be maintained in situ (no uninstall)

Manual/automated cleaning systems

More efficient – usually smaller and/or lighter than conventional exchangers

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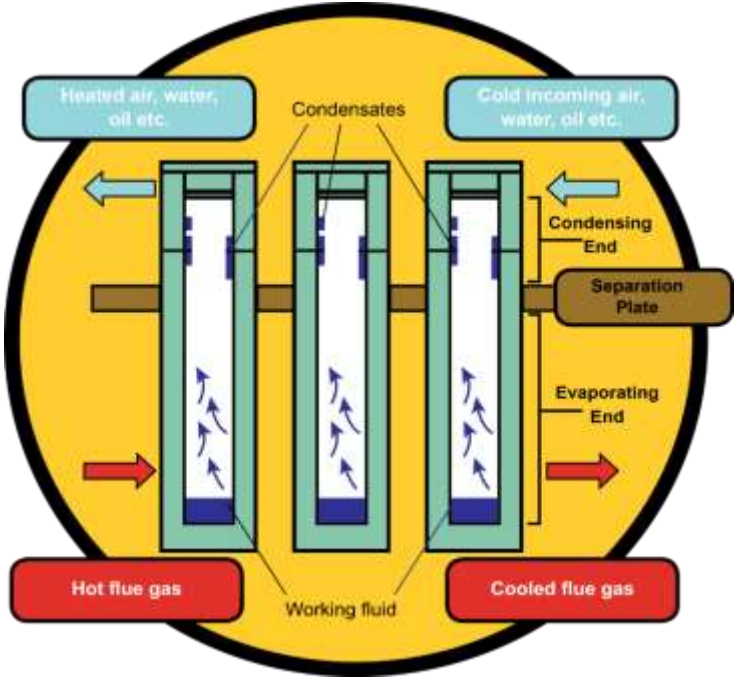
The **INNERGY "HEAT-PIPE"** Technology



Reactivity

Fast reaction time, offers different control options and suitable for sensitive apparatus: does not require preheating

Low Pressure Drop

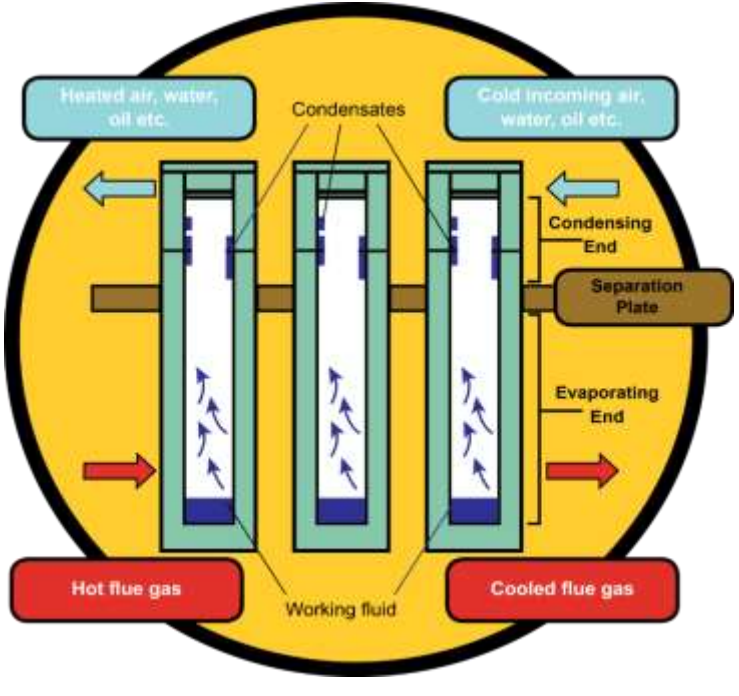
Low parasitic load means less capital and running cost on fans and greater energy recovery possibilities

Robust Materials and Long Life

Design allows pipes to freely expand and contract, thus no thermal stress on structure. Thick pipe walls resist erosion/corrosion



The **INNERGY "HEAT-PIPE"** Technology



Hot Intermediate Pipe Working Temperature

Allows higher exhaust temperature limits on some applications

Isothermal Operation – no hot or cold spots

Eliminates cold corners and condensation

Allows greater energy recovery

Better longevity for thermal oil

Highly Scalable, Customisable & Configurable

Modular design allows on site assembly

Can be designed for future expansion, to meet specific application or operational needs

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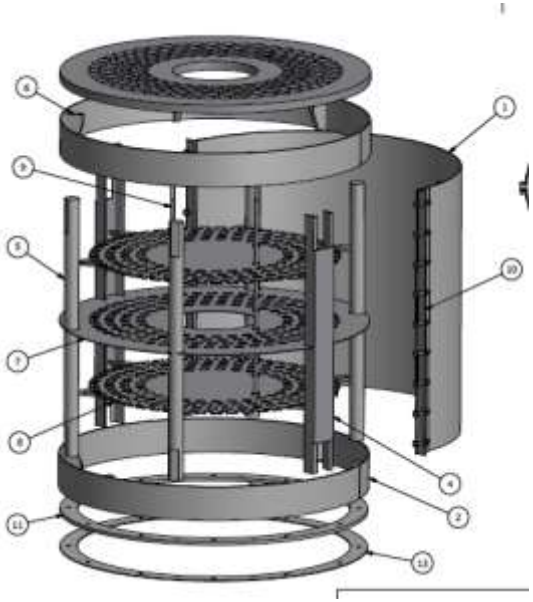
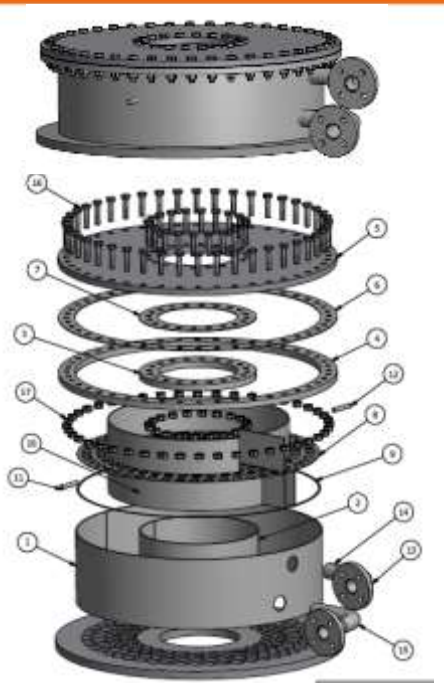
The **INNERGY "HEAT-PIPE"** Technology





Through-Flow = for exhaust temperatures above 500ºC

50 YEARS

The ORC Market

ORC systems are the industry standard for low-temperature geothermal projects, and have been successfully deployed on simple-cycle gas turbines, biomass systems, cement plants, district heating systems, solar thermal systems, sawmills, gas plants, landfill gas, glass plants and reciprocating engine exhaust.

Source: http://orc-world-map.org/



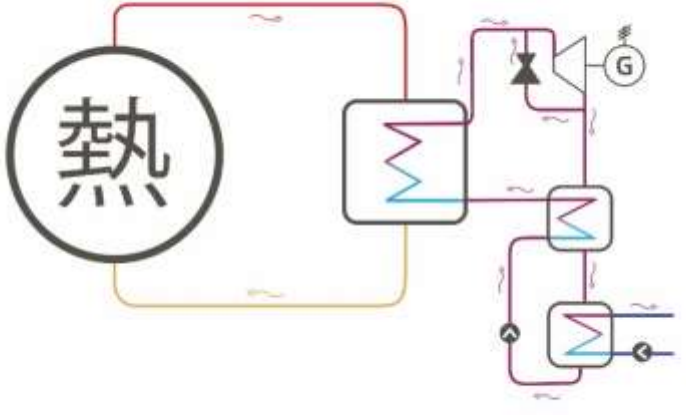
The INNERGY WtH Technology

INNERGY has developed modular ORC systems, as customized packages with precisely sized turbines, pumps boiler and related equipment's for biomass applications according to the Japanese standards, in a range between 300 kWe and 1,999 kWe. This extensive experience, allow us to develop tailored solutions also for the Heat Recovery applications.

300 kWe Prototype
BIOMASS ORC plant

The INNERGY ORC Technology

The ORC module produces electricity (and where relevant and/or needed low-temperature heat) through a closed-loop cycle that uses a low vapour-point, environmentally benign refrigerant as the working fluid instead of water.
The by-product – low-temperature heat not consumed in the electricity generation process – is discharged to the atmosphere through air- or water-based condensers.



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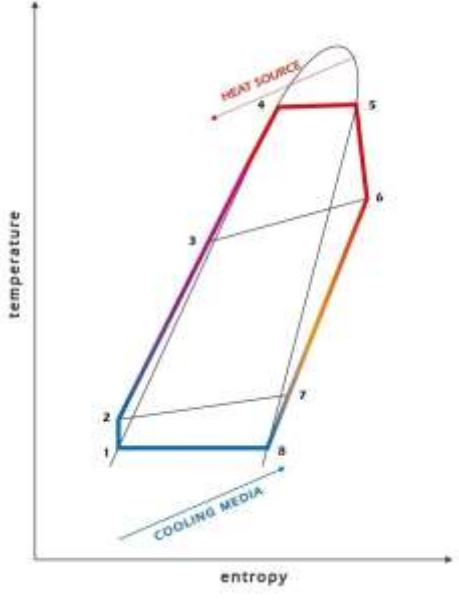
Source of Useful Waste Heat



Relying on the same thermodynamic principles that govern traditional waste heat recovery analysis, ORC-based waste heat recovery projects convert as much as 25% of the incoming energy they receive into usable electricity. The quantity of energy such a system receives is as important as the quality of energy it receives in determining a project's feasibility and financial rate of return. But the definition of 'high-quality' heat to an ORC can be as low as 200°C whereas 'high-quality' heat to a traditional Rankine cycle system is 430°C.

50 YEARS

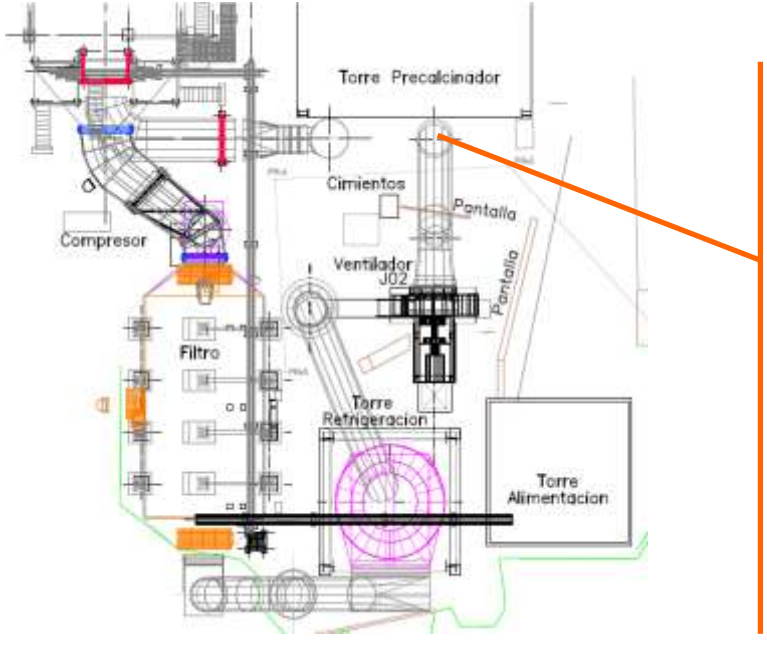


Study Case

Cement Plant in Chile (Final engineering stage)

- Gas Flow: 252.700 Kg/h at 370-380ºC
- Origin: Cement Plant
- Particle content: 0,0017%
- Moisture: 11%
- Operation time: 24 h/day – 335 days/year

Study Case



The economizer Will be installed after the Pre-calcination Tower

Study Case

Cement Plant in Chile (Final engineering stage)

	ELECTROTERM SOLUTION ET-RC-ACC 35
MAIN DATA	
Heat Medium	Thermal Oil
Nominal temperature from the Heat Recovery system (Inlet/Outlet from the ORC Module)	300 / 140 ° C
Thermal Power from the heat recovery system	16.000 KWt
Gross / Net Power from the ORC Module	3.910 KWe / 3.485 KWe
ORC Installed power self-consumption	165 KWe
Electrical Self-consumption from the ACC (Direct condensation of the ORC Fluid) (*Variable)	110 KWe
Electrical Self-consumption from the thermal oil Heat Recovery system	150 KWe
ORC REFRIGERATION CONDENSER	
Inlet temperatura of refrigeration air/ Air flow	21° C / 775 kg/s
CONSUMOS ELÉCTRICOS	
Self Consumption Electroterm ET-RC-ACC (% Gross Electric Power)	10,869% Aprox.
WATER CONSUMPTION	
Average water consumption	No Consumption
OPERTION TIME	
Operation time a year (hours)	8.040 hours/year

Study Case

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IRR ANALISYS

Electricity price variation in $/KWh, maintaining an investment and technical conditions for a lifetime of 15 years

Electricity Price	Electricity price variation	PAYBACK	PROJECT IRR
6,22 c$/kWh	-20%	5,24	14,37%
7,00 c$/kWh	-10%	4,14	16,93%
7,78 c$/kWh	**0%**	**3,21**	**19,38%**
8,56 c$/kWh	10%	2,46	21,75%
9,33 c$/kWh	20%	2,28	24,02%



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THANKS FOR YOUR ATTENTION

ありがとうございました

50 YEARS

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