ENOGIA

The Small Turbine ORC Company

ORC for Solar Applications

Company Key Facts

Prototype, 2010, Bagnols/Cèze, France

First contract, Nanjing, China

Container ORC at Treviso, Italy

ENO-10MT ORC, Marseilles, France

ENOGIA designs and produces Organic Rankine Cycle micro-powerplants that valorize waste heat by converting it into electrical power.

→ a young innovative company

→ created in 2009 by four engineers

→ head office and facilities in Marseilles, France

→ 25 employees

→ >1 M€ turnover in 2016

→ more than 25 references in more than 10 countries

Strategic backing by partner IFPEN for Rankine Cycle technological development :

Ing. Arthur Leroux
CEO
Former R&D project manager at Bertin Technologies

Ing. Antonin Pauchet
CFO
Former senior auditor at PriceWaterhouseCoopers

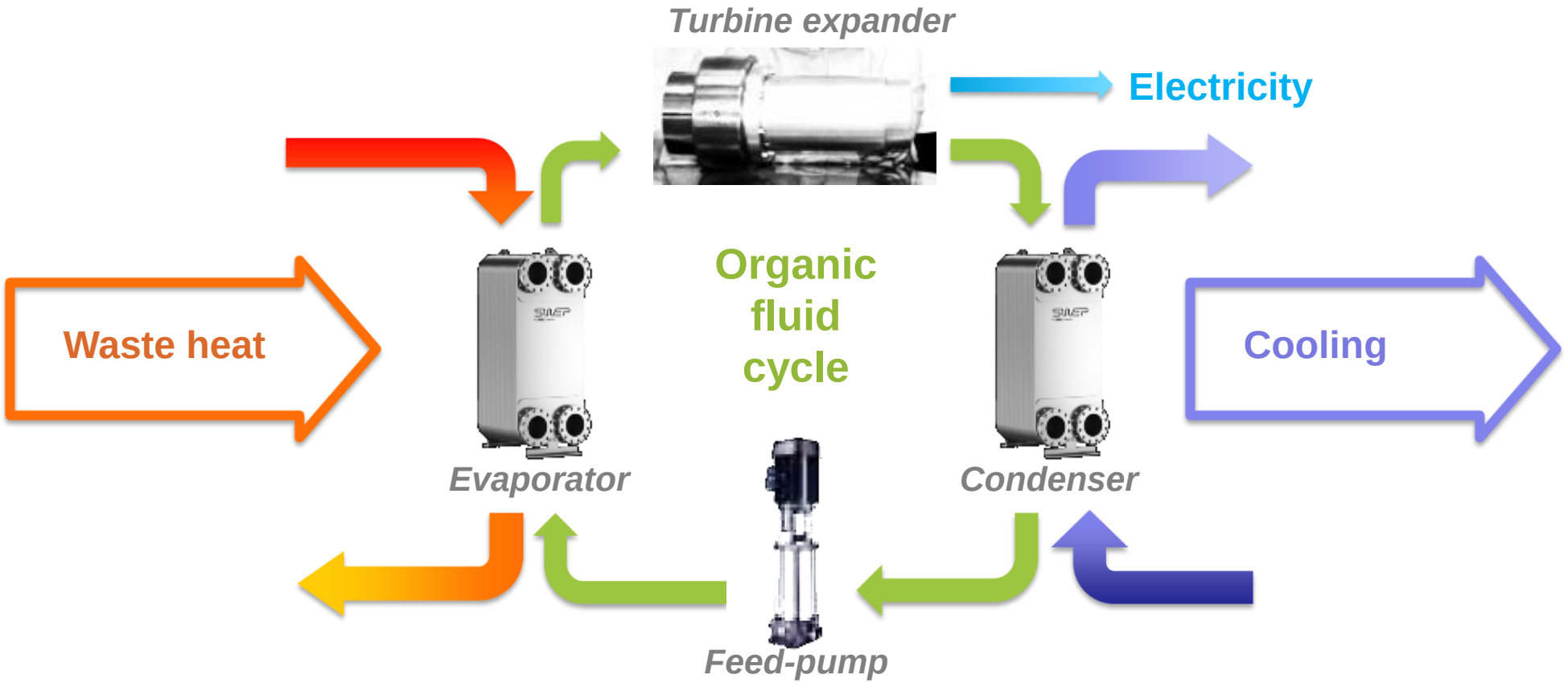
Ing. Nicolas Goubet
CTO
Former CNC machine technical designer at Forest Liné

« ORC » Technology (Organic Rankine Cycle)

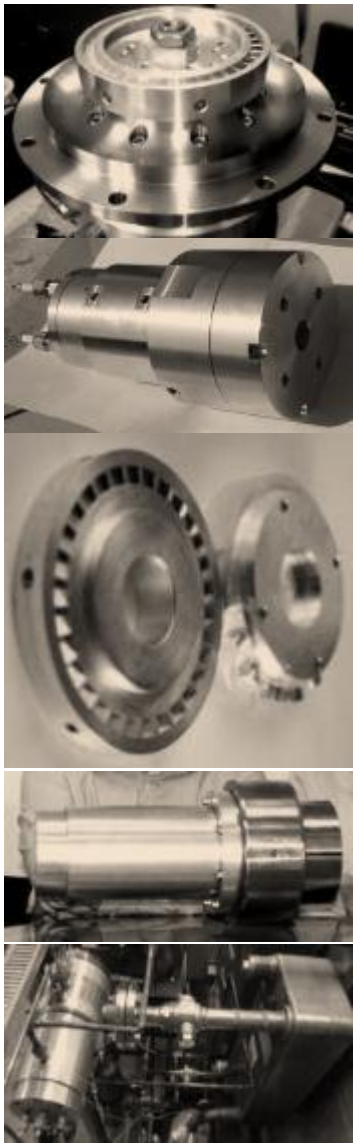
Its purpose : converts heat into useful electricity

Its strong points :

- only technology capable to convert very low temperature waste heat into electricity,
- very reliable technology because very few moving parts and low stress on components



ENOGIA's turboexpander technology



Proprietary hermetic high speed turboexpander technology

Why the kinetic turbogenerator ?

- → Proven concept on larger ORC units
- → No friction, no wear

Hermetic turbogenerator with PMG generator inside

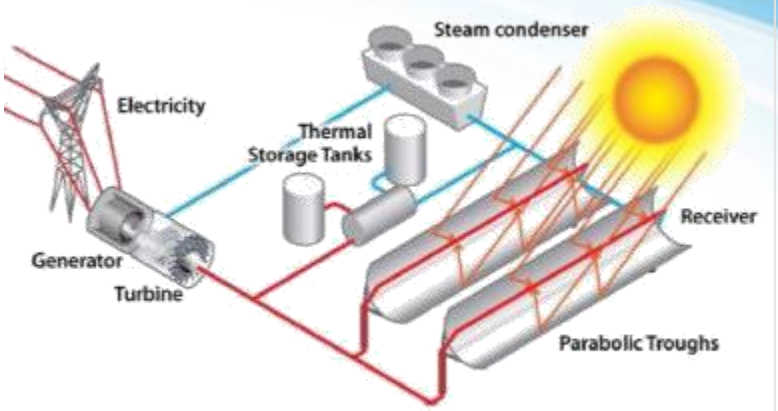
- → No fluid leaking
- → Reduced maintenance

Compact units

Made in France with EU only components, in house assembly

CSP Solar with ORC

- Use of ORC with Concentrating Solar Panels :
  - → Cylindro-Parabolic
  - → Fresnel



- Key strong points vs PV
  - → Enables thermal storage and stable electricity production
  - → Enables Combined Heat and Power operation

- Key strong points vs CSP steam turbine
  - → Lowers maintenance costs
  - → Smaller power possible with good efficiency (a few kW to a few MW)

ENOGIA CSP ORC references

CNRS PROMES, Odeillo, France

University of Thrace, Greece

UNIFEI, Itajuba, Brazil

SIREA, Burkina Faso

ELSEWEDY, Cairo, Egypt

GORD, Doha, Qatar

Product range for CSP Solar

Product range	**« MT »** (Medium Temperature)
Hot side conditions	***150 to 200℃*** ***Superheated water*** ***Steam*** ***Thermal oil***
Working fluid	***New Generation Refrigerant (GWP=1)***
10kW ***(gross electric power)***	**ENO-10MT**
20kW ***(gross electric power)***	**ENO-20MT**
40kW ***(gross electric power)***	**ENO-40MT**
100kW ***(gross electric power)***	**ENO-100MT**
N*100kW ***(gross electric power)***	***ENO-multiMT*** ***(Under development)***

ENO-10MT

ENO-20MT

ENO-100LT

Product range for low temperature solar

(flat panels or evacuated tube panels)

Product range	**« LT »** (Low Temperature)
Hot side conditions	***Full power with hot water >80 ℃***
Working fluid	***R-245fa***
10kW ***(gross electric power)***	**ENO-10LT**
20kW ***(gross electric power)***	**ENO-20LT**
40kW ***(gross electric power)***	**ENO-40LT**
100kW ***(gross electric power)***	**ENO-100LT**
N*100kW ***(gross electric power)***	***ENO-multiLT*** ***(Under development)***



ENO-10LT

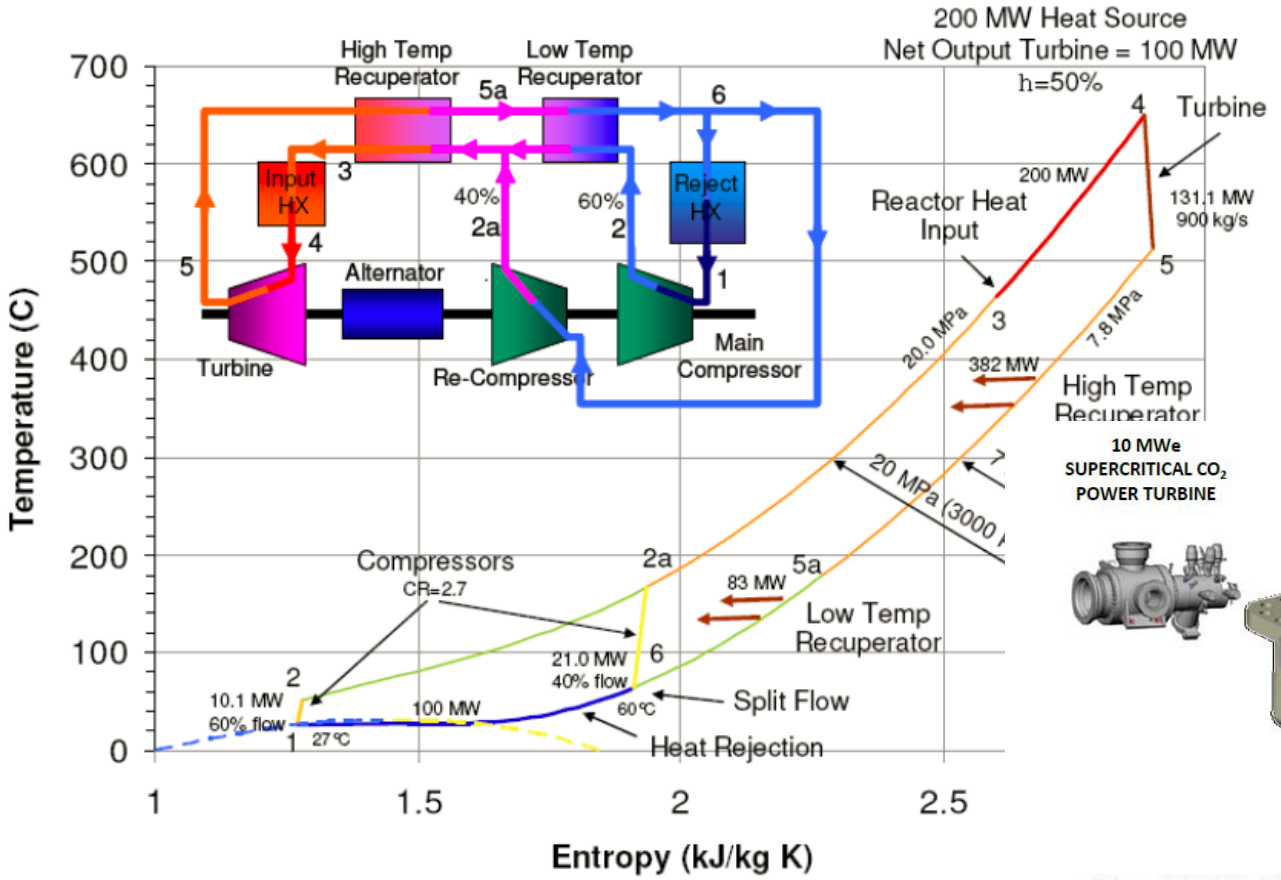
ENO-40LT

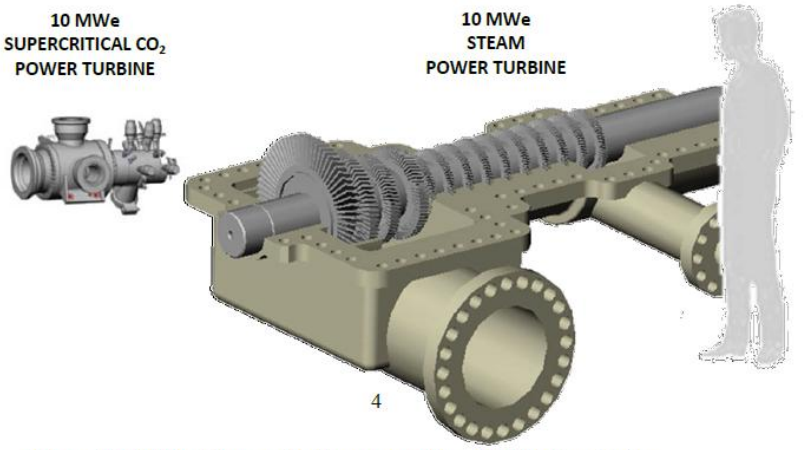


ENO-100LT

What is next ?

Supercritical CO_2 Brayton Cycle





Echogen's 10 MWe sCO_2 power turbine compared to a 10 MWe steam turbine.

Enogia works on sCO2 as a part of the I-Therm H2020 spire project

Excellent efficiency at high temperatures (ie. 400-800°C)

Contact information, thanks for your attention !

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