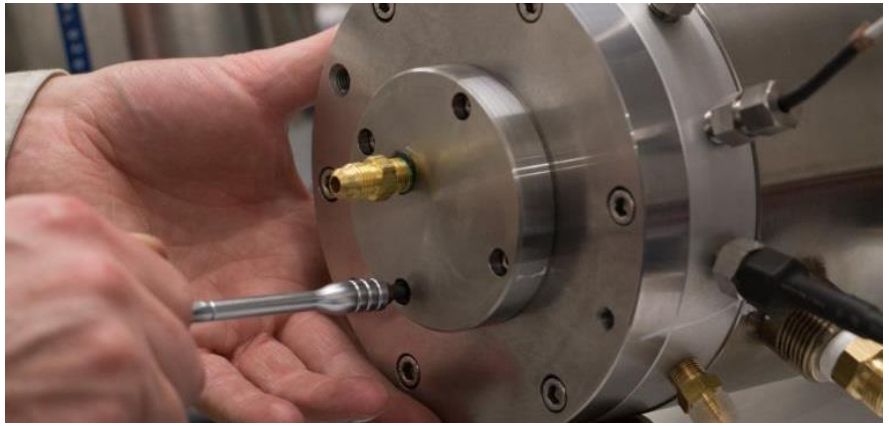
The Small Turbine ORC Company

GENERAL PRESENTATION



ENOGIA designs and produces **Organic Rankine Cycle** micro-powerplants that convert **waste heat** into **electrical power.**

- **Innovative** company founded in **2009**
  Head office and facilities in Marseilles, France
- **40 employees**
- Production with **local partners**
- More than 70 references in **22 countries**
- **Fastest growth** of turnover rate amongst all French cleantechs, winner of Deloitte Technology Fast 50
- **Strategic partnership** with the famous research group IFP Energies nouvelles
- Welcomes a **strategic shareholder** in 2018
  faurecia inspiring mobility

Awards & Recognition

ENOGIA has been rewarded by many awards, including : **«2015 Cleantech of the year»,** by the hands of Emmanuel Macron, **Energy & Greentech** fastest growing company from the Deloitte **Technology Fast50 2017**.

AWARDS

Deloitte. | In Extenso
50 Technology Fast 50 2017 FRANCE

ENERGY TRANSITION TROPHY AWARD

MINISTRY OF ECONOMICS
OVERALL GRAND WINNER

ENTREPRISE & ENVIRONNEMENT 2015
COUP DE COEUR DU JURY

ENGIE 2015
INNOVATION DAYS PRIZE

BIOGAZ D'OR 2015
INNOVATION PRIZE

TROPHEE
ARTS & METIERS
Innovation

ARTS ET MÃ©TIERS 2014
INNOVATION PRIZE

CleanTech
REPUBLIC

CLEANTECH REPUBLIC 2013
SPECIAL JURY AWARD

HENRI FABRE 2012 PRIZE
FOR SCIENCE AND TECHNOLOGY

Dependable Clean Power, Everywhere !

→ Dependable

ENOGIA's ORC can be used as **baseload power**. It is able to run 24/7, given the heat source availability. Operation is **very flexible and reliable**, start-up time is fast and it can be operated at part load

→ Clean Power

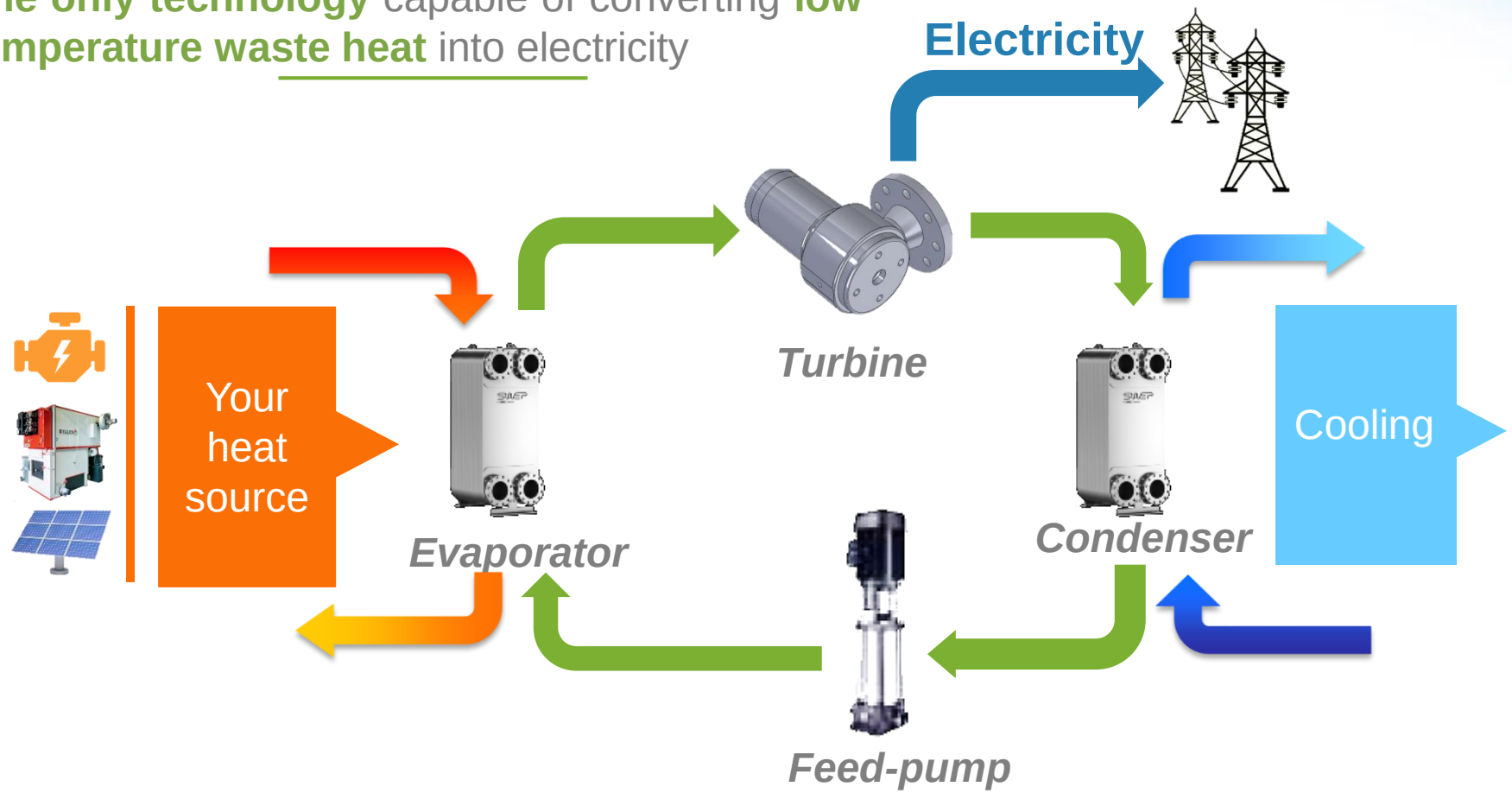
ENOGIA's ORC use **renewable heat sources** like geothermal energy, biomass, biogas, solar and even waste heat streams

→ Anywhere

ENOGIA's ORC units are the smallest available in terms of power, as well as the **most compact units**. They can be used in difficult environments but also for large to small heat streams, virtually **anywhere in the world**

« ORC » Technology (Organic Rankine Cycle)

The only technology capable of converting **low temperature waste heat** into electricity



Very reliable technology because very few moving parts and **low stress on components**

ENOGIA turbine technology

Hermetic **high speed turbine** technology, patented by ENOGIA

Why the **kinetic turbo-generator ?**

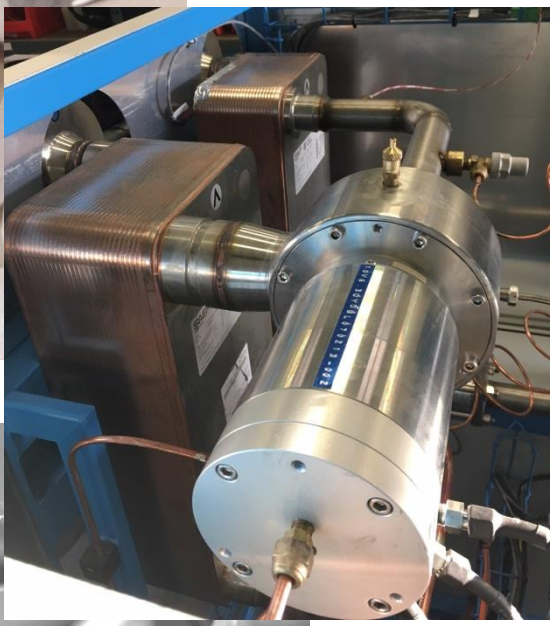
- → **Proven concept** on larger volumetric ORC units
- → **No friction,** no wear

Hermetic turbo-generator with a **PMG generator**

- → No **fluid leaking**
- → **Reduced** maintenance

Extremely **compact** units

Made in France with EU components only, **in-house assembly**



Our product range

From 10 to 200 kW of Electrical power from Hot Water, with extremely compact plug and play ORC modules

ENO-10LT


ENO-20LT

ENO-40LT


ENO-100LT


ENO-200LT

Our ORC applications

Renewable energies

Biogas, Landfill gas

- Enhancement of biogas engine via exhaust, water jacket or both
- Direct biogas to electricity conversion with boiler

Solar

- Solar CHP with CSP field

Biomass

- Biomass to electricity
- Biomass CHP
- Isolated site

Geothermal

- Natural hot sources
- Medium temperature wells (from 80°C)

Energy efficiency

Industrial Waste Heat Recovery

- Process Heat
- Exhaust gases
- Waste steam

Diesel gensets

- Efficiency enhancement via exhaust, water jacket or both

Transportation

- Sea and River transportation
- Railroad
- Heavy Duty Trucks

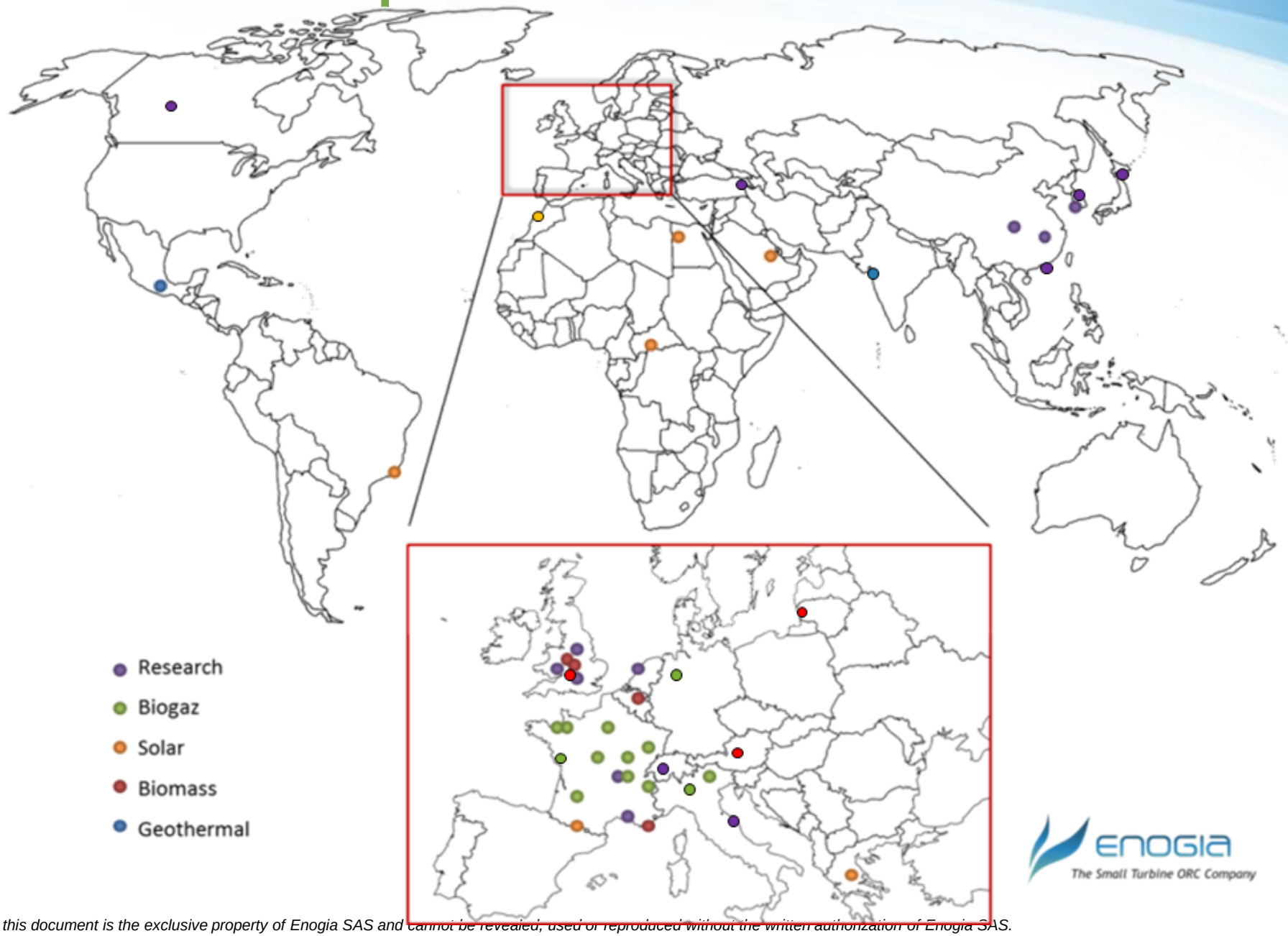
Research

Educational and Research

- With boiler simulating heat source

REFERENCES

Reference Map



ENOGIA
The Small Turbine ORC Company

ENO-40LT in container on Landfill Gas Engine

- **Hot source :** Jenbacher landfill gas engine hot water and exhaust on single heat recovery loop
- **ORC unit :** ENO-40LT gen 1 with R245fa working fluid
- **Delivery perimeter :** ORC module, container housing, hot loop piping, cold loop piping and components, dry cooler on top
- **Startup and operation :** Started in 2015, full maintenance package

ENO-40LT in container on Anaerobic Digestion Gas Engine

- **Hot source :** Jenbacher biogas engine hot water and exhaust on single heat recovery loop
- **ORC unit :** ENO-40LT gen 1 with R245fa working fluid
- **Delivery perimeter :** ORC module, container housing, hot loop piping, cold loop piping and components, dry cooler on top
- **Startup and operation :** Started in 2017, full maintenance package

4x ENO-40LT on biomass boilers

- **Hot source :** Gilles Biomass boiler
- **ORC unit :** 4x ENO-40LT gen 1 with R245fa working fluid
- **Delivery perimeter :** ORC module, site automation and control
- **Startup and operation :** Started in 2017,

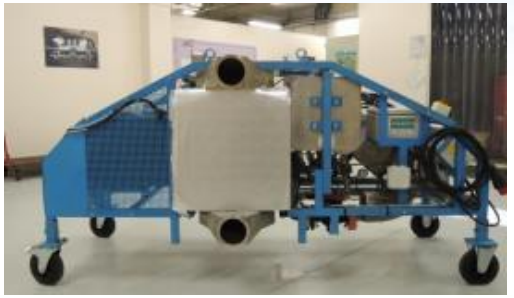
ENO-100LT on landfill gas engine

- **Hot source :** 3x MWM landfill gas engine hot water only
- **ORC unit :** ENO-100LT gen 1 with R245fa working fluid
- **Delivery perimeter :** ORC module, container housing on trailer, hot loop piping, cold loop piping and components, dry cooler on top
- **Startup and operation :** Started in 2015

TRANSPORTATION

Embedded ORC projects

- **Context :** Fuel consumption reduction of propulsion engines



- **Achievement :** Recovery of waste heat on exhaust and/or engine cooling system

- **Main technical locks**
  - **Integration and cost**
  - Achievements and ongoing projects
    - **Train Diesel Engine** (prototype delivered in 2015)
    - **Vessel Diesel Engine** (prototype installed in 2017)
    - **Truck Engine** (prototype scheduled in 2018)
    - **Automotive Engine** (prototype scheduled in 2018)