PLANNING SURFACE TECHNOLOGIES: ORC PLANTS AND LARGE HEAT PUMPS

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Sales and business development manager
OUR MISSION

We provide reliable, advanced, environmentally-friendly solutions that maximize the value of renewable sources and energy efficiency.

Since 1980

Turboden is an Italian firm and a global leader in the design, manufacture, and maintenance of Organic Rankine Cycle (ORC) systems, highly suitable for distributed generation, which produce electric and thermal power exploiting multiple sources.
OUR PRODUCTS

ORC SYSTEM

LARGE HEAT PUMP

GAS EXPANDER

Designed for decarbonisation.
GLOBAL AND PROVEN EXPERIENCE

50 countries

400+ power plants worldwide

19 million hours cumulative operation time

25 thousand GWh electrical energy generated

98+ % average availability

BIOMASS
320 units, 444.4 MWe

GEOTHERMAL
16 units, 119.1 MWe

HIGH TEMPERATURE COGENERATION
2 units, 2.1 MWe

WASTE HEAT
35 units, 86.4 MWe

WASTE TO ENERGY
23 units, 64.2 MWe

OIL & GAS
5 units, 37.3 MWe

GAS EXPANDER
2 units, 1.3 MWe

GLOBAL AND PROVEN EXPERIENCE
GEOTHERMAL REFERENCES IN EUROPE

Site: Dürrnhaar, Germany
Customer: SWM
ORC power: 5.6 MWe

Site: Kirchstockach, Germany
Customer: SWM
ORC power: 5.6 MWe

Site: Sauerlach, Germany
Customer: SWM
Configuration: power & heat
ORC power: 5 MWe

Site: Traunreut, Germany
Customer: GKT Traunreut
Configuration: power & heat
ORC power: 4.1 MWe

Site: Soutz-sous-Forêts, France
Customer: GEIE
ORC power: 1.7 MWe

Site: Velika Ciglena, Croatia
Customer: Geo Power Energy Development
ORC power: 17.5 MWe

Site: Holzkirchen, Germany
Customer: Holzkirchen
Configuration: power & heat
ORC power: 3.4 MWe

Site: Kirchweidach, Germany
Customer: EON
Configuration: power & heat
ORC power: 4 MWe

347 ORC PLANTS IN EUROPE
(OF WHICH THE MAJORITY IS CONNECTED TO A DISTRICT HEATING OR OTHER HEAT USER)

Country | Plants
---|---
Italy | 104
Germany | 85
Austria | 32
Other 22 EU countries | 126

...some of these projects took about 10 years to start operations... and the Powerplant construction from NTP to COD takes just 1,5 years!
ORC VS HEAT PUMP

EFFICIENCY = E / Q2

COP = Q2 / E
ORC & LARGE HEAT PUMPS FEATURES

Simplicity
- Remote monitoring and automatic operation
- No water use and treatment required
- Minimal maintenance activities

Flexibility
- Ease of integration
- Excellent part load capability down to 10% load
- Different primary energy sources

Dependability
- High availability (> 98%)
- Long life (> 25 years)
- 40 years in the design and production of turbomachinery

Sustainability
- Core system for renewable energy and energy efficiency
- Clean generation of power and heat
- Reduction of CO₂ emissions
LARGE HEAT PUMPS WITH GROUND SOURCE

- The energy contained in a shallow aquifer at low temperature can be used to feed a LHP and supply heat to a district energy network at higher temperature.
HYBRID SCHEME: LHP, ORC & CHP

- Deep geothermal source (> 100 °C) can be used for heat supply to industrial users (e.g. greenhouses) and/or to generate electricity with an ORC.
- LHP can extract further energy at lower temperature before reinjection and supply a district heating network at suitable temperature.
- A CHP (gas fired) engine can supply the electricity to the Large Heat Pump and further heat to the district heating.
### TYPICAL PROJECT TIMELINE

<table>
<thead>
<tr>
<th>Site Identification</th>
<th>Pre-feasibility</th>
<th>Feasibility</th>
<th>Resource Development</th>
<th>Detailed Design</th>
<th>Procurement &amp; Construction</th>
<th>Site Erection &amp; Commissioning</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Geophysical, Geological and Geochemical data collection and analysis</td>
<td>• Preliminary exploration</td>
<td>• Exploration Drilling</td>
<td>• Permitting</td>
<td>• Completion of drilling</td>
<td>• Civil works for erection and assembling of ORC</td>
<td>• Power plant manufacturing</td>
<td>• Power production</td>
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<td></td>
<td>• Power plant pre-feasibility Studies</td>
<td>• Confirmation wells</td>
<td>• Drilling &amp; testing of wells</td>
<td>• Final design of ORC Power Plant</td>
<td>• Start-up and commissioning</td>
<td></td>
<td>• Maintenance, technical assistance</td>
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<td></td>
<td>• Reserve estimates</td>
<td>• Civil works for drilling activities</td>
<td>• Power plant Upright Engineering</td>
<td>• Site activities for Power plant ORC</td>
<td></td>
<td></td>
<td>• Remote monitoring</td>
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<td>• Optimization of plant operation</td>
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</tbody>
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#### Turboden Activities

**High Risk phase:** Project financed with equity / risk mitigation funds

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<thead>
<tr>
<th>1 – 3 years</th>
<th>1 – 2 years</th>
<th>&lt;2 years</th>
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**Lower Risk phase:** Plant construction

Project financed with debt (banks)

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<tr>
<th>5 – 7 years</th>
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30 years generation of profit at low LCOE

1 – 3 years

1 – 2 years

<2 years

5 – 7 years
CONCLUSIONS

Turboden is typically involved in the early steps of the projects by providing engineering support to the developers on two essential aspects:

1. **Define the powerplant features** (layout, performances, environmental assessment for visual impact, noise, fluids etc.) useful for permitting procedures
2. **Validate the business plan**

We have wide experience with EU regulations for MV generation. **We contributed to the harmonization of electric regulations** in Germany with an active discussion with grid operators.

**We can be actively involved during the permitting phase** with a commitment to deliver on time the documentation required by the authorities.

A typical schedule for the completion of the ORC (or LHP) powerplant, from NTP to COD is **18 months** (12 months for the delivery at site + 6 months for the construction and commissioning).

Typically the wells are not fully completed & tested before the plant can be ordered.

**The schedule can be optimized and compressed to 14 months,** if a suitable upfront engineering is agreed to cover multiple scenarios & configurations of powerplant.
OUR EXPERIENCE. YOUR POWER.

FIND OUT MORE