SUSTAINABLE HEATING AND COOLING IN CASTING INDUSTRY
SUSPIRE PROJECT CASE STUDY

ISEC INTERNATIONAL SUSTAINABLE ENERGY CONFERENCE 2018

5/10/2018

Sustainable Production of Industrial Recovered Energy using Energy Dissipative and Storage Technologies.

PARTNERS (9):

• PCB. PreciCast Bilbao (SPAIN)
• DOW-CORNING (BELGIUM)
• IK-4 AZTERLAN (SPAIN)
• IK-4 TEKNIKER (SPAIN)
• MET (LITHUANIA)
• QPUNKT (AUSTRIA)
• TECNODELTA (ITALY)
• TELUR (SPAIN)
• ZAE-BAYERN (GERMANY)

1st of October 2015 to 30th of September 2019
Keys & Goals

CASTING FACTORY IN BARAKALDO, SPAIN

- Excess Heat Recovery in Casting Plant
- High and Low Temperature Subsystems
- Energy Storage at Medium Temperature (PCM) & Low Temperature (UTES)
- Space Conditioning of Process Rooms and Offices
- Heat Exportation to Council Sport Centre (Swimming Pool)

**EXCESS HEAT RECOVER**

70%

**PRIMARY ENERGY SAVINGS**

20%

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Waste Heat Sources

- WAX MODEL
- CERAMIC COATING
- WAX MELTING
- MOULD CLEANING
- MOULD PREHEATING
- CASTING
- MACHINING
- THERMAL TREATMENT
- QUALITY CONTROL

- Cooled water
- Outlet steam
- Exhaust gas
- Process cooled water
Excess Heat Recovering System

**LOW-TEMPERATURE SUB-SYSTEM**
- **WASTE HEAT INDUCTION FURNACES**
- **BTES**
  - Borehole Thermal Energy Storage
  - 3,750 m
- **W/W HEAT PUMP**
  - Ht = 550 kW
  - Co = 500 kW
- **COOLING**
  - Process room conditioning

**HIGH-TEMPERATURE SUB-SYSTEM**
- **WASTE HEAT EXHAUST GASSES PRE-HEATING FURNACE**
- **INORGANIC PCM**
- **HEATING**
  - Steam production,

**WASTE HEAT EXHAUST STEAM BOILERCLAVE**
- **ORGANIC PCM**
- **HEATING**
  - Indoor heating of the Factory, SHW production, Exportation production,
## Excess Heat Sources

<table>
<thead>
<tr>
<th>FROM:</th>
<th>WASTE HEAT CONSIDERED MWh/year</th>
<th>RECOVERED HEAT MWh/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>preheating furnaces (exhaust gasses from 1 furnaces)</td>
<td>820</td>
<td>512</td>
</tr>
<tr>
<td>office cooling</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>ceramyc/wax rooms cooling</td>
<td>1338</td>
<td>1331</td>
</tr>
<tr>
<td>melting furnaces cooling</td>
<td>968</td>
<td>968</td>
</tr>
<tr>
<td>boilerclave</td>
<td>150</td>
<td>17</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>3331</strong></td>
<td><strong>2883</strong></td>
</tr>
<tr>
<td>Recovered heat ratio</td>
<td></td>
<td><strong>87%</strong></td>
</tr>
</tbody>
</table>
Energy Balance Low Temperature Subsystem

HT SYSTEM EXCESS HEAT

61 MWh/y
1736 MWh/y
1797 MWh/y

3rd PARTS. SPORT CENTER

HSW

PROCESS ROOMS

PLANT

OFFICES

LT BTES

FURNACES COOLING

PROCESS ROOMS

W/W SCREW CHILLER
550 kW Ht
500 kW Co

Electricity
718 MWh/y

HOT WATER BUFFER

3072 MWh/y

80 MWh/y
474 MWh/y

COLD WATER BUFFER

2354 MWh/y
240 MWh/y
55 MWh/y
1331 MWh/y
728 MWh/y

616 MWh/y
## Covered Demand and Environmental Savings

<table>
<thead>
<tr>
<th></th>
<th>Heating and Cooling</th>
<th>Heating</th>
<th>Cooling</th>
<th>Total H&amp;C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Offices Conditioning</td>
<td>Plant Space Conditioning</td>
<td>SHW</td>
<td>Sport Centre</td>
</tr>
<tr>
<td>Conventional</td>
<td>MWh_t</td>
<td>80</td>
<td>774</td>
<td>23</td>
</tr>
<tr>
<td>Primary Energy Consumption</td>
<td>MWh</td>
<td>94</td>
<td>1,209</td>
<td>35</td>
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<tr>
<td>Emissions</td>
<td>tCO2</td>
<td>13.2</td>
<td>255</td>
<td>7.5</td>
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<tr>
<td>Conventional</td>
<td>MWh_t</td>
<td>0</td>
<td>3.0</td>
<td>11.4</td>
</tr>
<tr>
<td>500 kW GeoExchange BTES</td>
<td>MWh_t</td>
<td>80</td>
<td>771</td>
<td>11.4</td>
</tr>
<tr>
<td>Primary Energy Consumption</td>
<td>MWh</td>
<td>47</td>
<td>479</td>
<td>6.7</td>
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<tr>
<td>Emissions</td>
<td>tCO2</td>
<td>6.6</td>
<td>64</td>
<td>0.9</td>
</tr>
<tr>
<td>Environmental Savings</td>
<td>%</td>
<td>50%</td>
<td>60%</td>
<td>81%</td>
</tr>
<tr>
<td>Emissions</td>
<td>tCO2</td>
<td>6.6</td>
<td>191</td>
<td>6.5</td>
</tr>
<tr>
<td>Environmental Savings</td>
<td>%</td>
<td>50%</td>
<td>75%</td>
<td>87%</td>
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</tbody>
</table>

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Geoexchange Technologies

SEASONAL THERMAL ENERGY STORAGE

GSHP

60-100 mW/m²
Geothermal flow

100-200 W/m²
Solar Radiation

>1000 W/m²
Advective flow

UTES

Cooling Demand
Solar Heat
Waste Heat
Winter Re-Cooling
Absorption Re-Cooling

PURE ADVECTIVE

ATES

BTES

GROUND WATER FLOW

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Borehole Field Layout

30 Boreholes
125 M
3.750

Coaxial Heat Exchanger
PE-RT
Ø 63 PN16 EXT
Ø 40 PN16 INT

4 MANIFOLDS

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Drilling Works
Loop Construction
Symbiosis. Lasesarre Sport Center

CURRENT CONSUMPTION
Natural gas
3,2 GWh hcv/y

SUSPIRE

ENERGY PROVIDED FROM PCB
1,7 GWh HEATING
2,3 GWh hcv

- 72 %

LASESARRE SPORT CENTRE
Swimming pool heating
SHW

Connection pipe

PCB

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**Expected Results**

**NOWADAYS CONSUMPTION**

**POWER (ELECTRICITY)**

**NATURAL GAS**

**PRIMARY ENERGY**

26 GWh

**CO2 EMISSIONS**

4,400 t CO2

**SUSPIRE**

- 22%

- 30%

- 5,5 GWh

- 1,340 GWh
Thank you for your attention