Transformation of old collieries into geothermal districts heating

HUNOSA
Noel Canto Toimil
Head of Department of Innovation
Where are we?

- HUNOSA. Founded in 1967
- Integration of coal mining private companies
- Coal extraction (underground and open pit) and energy production
- More than 70 collieries and more than 2.000 mountain mines
- Maximum number of employees: 26.590

HUNOSA nowadays

- One underground mine in operation
- Power station (50 MW\(_e\)) + CO\(_2\) capture plant
- Washery
- Diversification activities
Mine water: our resource

- Flooding after mine closure
- Keeping a safety water level to avoid damaging buildings, infrastructures, etc.
- Permanent pumping costs.
- Geothermal energy:
  - source of income to offset pumping expenses
  - renewable resource with mine water (from being considered a waste product to being a resource)
Geothermal energy. Our facilities

El Fondón District Heating (under construction)
- Residential building
- Public Health Centre
- Hotel
- Geriatric Centre
- Sport Centre

Barredo Colliery

INITIAL FACILITIES (in operation since 2014 - 2016)
- Hospital of Mieres
- Research Building (University of Oviedo)
- Asturian Energy Foundation (FAEN)
- High School “Bernaldo de Quirós”
- Residential buildings (M9 and M10)
- Main building University of Oviedo (in Mieres)

BARREDO COLLIERY DH (in operation since 2020)

(heating and cooling)

(heating and pre-heating of domestic hot water)

Plan to develop geothermal projects in other mines
Geothermal facilities linked to Barredo Colliery

- Mine connected hydraulically with other mines
- In operation from 1937 to 1995
- Depth: 355 m
- Number of levels: 5
- Annual pumped water from Barredo Colliery ≈ 4 Hm$^3$
  (Total HUNOSA = 35 Hm$^3$ per year)
- Water temperature: 23 ºC (constant)
Geothermal energy. Barredo Colliery initial facilities

Research Building of the University of Oviedo (Campus of Mieres)

- Safety water level: 35 m
- 4 pumps: 75 kW - 215 m³/h each
- 85 m – 100 m depth (1,2,4) 130 m depth (3)

To the river

18 ºC

Headquarters of Energy Asturian Foundation

To the river

18 ºC

Hospital of Mieres

- 15 ºC
- 20 ºC

To the river

18 ºC

HP 1  HP 2  HP 3
Geothermal energy. Barredo Colliery DH

Condenser circuit

- T_a = 75 °C
- T_a = 80 °C
- T_a = 50 °C
- T_a = 40 °C
- T_a = 65 °C
- T_a = 60 °C

Evaporator circuit

- To the river 18 °C

Safety water level: 37 m

2 pumps: 90 kW - 330 m³/h each

85 m – 95 m depth

Barredo District Heating generation room

Secondary School

Main building Univ. Oviedo

M10 131 dwellings

M9 117 dwellings

Barredo District Heating heat pumps

Barredo District Heating pumping system

Barredo District Heating generation room
Mine connected hydraulically with another colliery

In operation from 1905 to 1995

Depth: 482 m

Number of levels: 12

Annual pumped water from El Fondón Colliery ≈ 1.7 Hm$^3$

(Total HUNOSA ≈ 35 Hm$^3$ per year)

Water temperature: 23 ºC (constant)
Geothermal energy. El Fondón Colliery DH

Condenser circuit

- HP 1 C
- HP 2 C

Evaporator circuit

- HP 1 E
- HP 2 E

Safety water level: 43 m

4 pumps:
- 30 kW - 180 m³/h each
- 95 m – 110 m depth

To the river 18 ºC

Tª = 80 ºC

Tª = 65 ºC

Different facilities
Geothermal energy. Technical data

<table>
<thead>
<tr>
<th>Facility</th>
<th>Installed power (kW)</th>
<th>Thermal energy supplied (MWh)</th>
<th>CO₂ Emission reduction (t)</th>
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</thead>
<tbody>
<tr>
<td><strong>Hospital of Mieres</strong></td>
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<tr>
<td>Heating</td>
<td>3.800</td>
<td>4.500</td>
<td>1.394</td>
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<tr>
<td>Cooling</td>
<td>3.000</td>
<td>2.575</td>
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<td><strong>Research building UO</strong></td>
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<td>Heating</td>
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<td>255</td>
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<td>Cooling</td>
<td>530</td>
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<td><strong>Asturian Energy Foundation</strong></td>
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<tr>
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<tr>
<td>Cooling</td>
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<td><strong>Total heating</strong></td>
<td>4.650</td>
<td>4.812</td>
<td>1.494</td>
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<tr>
<td><strong>Total cooling</strong></td>
<td>3.630</td>
<td>2.583</td>
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<tbody>
<tr>
<td><strong>Main building UO</strong></td>
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<tr>
<td>Heating</td>
<td>2.000</td>
<td>1.424</td>
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<td>Secondary School</td>
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<td>Residential building M9</td>
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<td>Residential building M10</td>
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<td>550</td>
<td>139</td>
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<tr>
<td><strong>Total heating</strong></td>
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<td>2.643</td>
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<th>Thermal energy supplied (MWh)</th>
<th>CO₂ Emission reduction (t)</th>
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<tr>
<td><strong>Sport Centre</strong></td>
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<tr>
<td>Heating</td>
<td>1.000</td>
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<td><strong>Total heating</strong></td>
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Geothermal energy. Barredo Colliery DH

- INTERNATIONAL ENERGY AGENCY - 6TH GLOBAL DISTRICT ENERGY CLIMATE AWARDS 2019

- “Integrating renewable and waste heat and cold sources into district heating and cooling systems”. 2021
  Joint Research Center – European Commission

- Selected as an endorsed nominee for:
  RUGGERO BERTANI EUROPEAN GEOTHERMAL INNOVATION AWARD 2021
Thank you very much for your attention