CHPM2030 - Combined Heat, Power and Metal extraction from ultra-deep ore bodies

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University of Miskolc, Hungary
Joint Geothermal Project meeting
Utrecht, The Netherlands  March 8-9, 2016
Project data

• Call: H2020-LCE-2014-2015 two-stage, Research and Innovation action
• Topic: Developing the next generation technologies of renewable electricity and heating/cooling
• Project ID: 654100
• Implementation: 01.01.2016-30.06.2019
• Budget: 4.2 million EUR
• TRL: 4-5
## The consortium

<table>
<thead>
<tr>
<th>Partner organisation</th>
<th>Country</th>
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<tr>
<td>University of Miskolc (UNIM), coordinator</td>
<td>Hungary</td>
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<td>University of Szeged (USZ)</td>
<td>Hungary</td>
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<td>European Federation of Geologists (EFG)</td>
<td>France</td>
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<td>Iceland Geosurvey (ISOR)</td>
<td>Iceland</td>
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<td>British Geological Survey (BGS)</td>
<td>UK</td>
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<td>Laboratório Nacional de Energia e Geologia (LNEG)</td>
<td>Portugal</td>
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<td>Vlaamse Instelling voor Technologisch Onderzoek (VITO)</td>
<td>Belgium</td>
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<td>La Palma Research S.L. (LPRC)</td>
<td>Spain</td>
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<td>Agency for International Minerals Policy (MinPol)</td>
<td>Austria</td>
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<td>Geological Survey of Romania (IGR)</td>
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<td>Katholieke Universiteit Leuven (KLeuv)</td>
<td>Belgium</td>
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<td>Geological Survey of Sweden (SGU)</td>
<td>Sweden</td>
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The CHPM 2030 challenge and rationale

1) Increasing demand for green energy in the EU and worldwide

2) EU needs critical raw materials – limited mining

Developing a new technology for combining geothermal energy production and metal mining

Create a proof of concept of the technical and economic feasibility at laboratory scale
Concept

- Identifying ultra deep metalliferous formations
- Establishment of EGS
- Enhance the interconnected fracture systems within the orebody
- Leaching metals from the orebody
- Metal extraction from the geothermal brine
- Production of heat and electricity
Schematic overview of the envisioned CHPM Installation

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Project Introduction Joint Geothermal Project meeting, Utrecht, March 8-9, 2016
Work organisation

WP8
Project management

WP1
Methodology framework definition

WP2
Laboratory experiments and orebody investigations

WP3
Metal recovery and electrochemical power generation

WP5
Integrated sustainability assessment

WP4
Systems integration

WP6
Research roadmapping and preparation for pilots

WP7
Dissemination

Stakeholders — Expert audiences — Press — Broad public
WP1 - Methodology framework definition (WP leader: UNIM)

- EGS-relevant review of metallogenesis and ore deposit formation
- Collection and evaluation of unprocessed data
- Understanding the rock-mechanical characteristics of orebodies from an EGS perspective
WP2 - Laboratory experiments and orebody investigations (WP leader: BGS)

• To **develop the tools and methods** for orebody EGS reservoir management.

• **Test and validate the methods using** simulations and laboratory experiments, reaching and exceeding TRL-4.

• Hypotheses to test
  • The **composition and structure of orebodies have features that could be used to our advantage** when developing an EGS.
  • That **metals can be leached from the orebodies in high-enough concentrations and over a prolonged period of time** to substantially influence the economics of EGS.
  • That **continuous leaching (of metals) will progressively increase system performance** over time in a controlled way.
  • Bonus exotherm processes may occur during leaching (e.g. pyrite oxidation)
WP3 - Metal recovery and electrochemical power generation (WP leader: VITO)

• **Recovery of the metal** content by high-temperature, high-pressure geothermal fluid electrolysis

• **Recovery of the metal** content of geothermal fluids by **gas-diffusion electroprecipitation and electrocrystallization**

• **Salinity gradient power** from pre-treated geothermal fluids – reverse electrodialysis
WP4 – Systems integration (WP leader: ISOR)

- **Conceptual framework** for CHPM power plant
- **Process optimisation** and **simulations**
- CHPM schematics and blueprints
WP5 - Integrated sustainability assessment (WP leader: USz)

- Integrated **sustainability assessment** framework
- Baseline **economics for energy and mineral raw** materials
- **Decision support for economic feasibility** assessment
- **Social impact** assessment and policy considerations
- **Environmental impact** assessment
- **Ethics assessment**
WP6 - Roadmapping and preparation for pilots (WP leader: LPRC)

• Horizon Scanning & Visions (EU2050 Energy Roadmap, Geothermal Technology Roadmap)

• Preparation for pilots (South West England, Iberian Pyrite Belt, Romania, Sweden, European outlook)

• Roadmapping (2030, 2050)
WP7 - Dissemination and stakeholder involvement (WP leader: EFG)

• Project website
• Project image and stylebook
• Communication and dissemination plan
• Project brochures
• Press-releases and media kits related to CHPM2030 initiatives and outcomes
• Fact-sheets on the CHPM technology
WP8 – Project management (WP leader: UNIM)

- Coordination and supervision of project activities
- Administrative project management
- Administrative project reporting
- Organisation of project meetings
- Risk management and conflict resolution
- Technology exploitation, innovation management and IPR
# CHPM 2030 – Advisory Board

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<thead>
<tr>
<th>Name</th>
<th>Expertise</th>
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<tbody>
<tr>
<td>Harald Dill</td>
<td>ore geology, geochemistry</td>
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<tr>
<td>Stuart Simmons</td>
<td>metals in geothermal fluids</td>
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<tr>
<td>Ladislaus Rybach</td>
<td>geophysics, geothermics</td>
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<tr>
<td>Gioia Falcone</td>
<td>geothermics, chemical engineering</td>
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<tr>
<td>Christian Boissavy</td>
<td>geothermics</td>
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<tr>
<td>Miklos Antics</td>
<td>geothermics, reservoir engineering</td>
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On behalf of the CHPM2030 consortium wish you successful project and thank you for your attention!