Combined Heat Power and Metal extraction from geothermal brines from ultra-deep ore bodies (CHPM2030)

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Project facts

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 – 287,500

TRL: 4-5
Members of 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>
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<td>European Federation of Geologists (EFG)</td>
<td>France</td>
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<td>Iceland Geosurvey (ISOR)</td>
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<td>British Geological Survey (BGS)</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>
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<td>Geological Survey of Sweden (SGU)</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
Schematic overview of the envisioned CHPM Installation

**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
Work organization
WP1 - Methodology framework definition

Start: M1 / End: M10  WP leader: UNIM
Participants: UNIM, USZ, EFG, ISOR, BGS, LNEG, IGR, SGU, VITO
– completed

• EGS-relevant review of metallogenies and ore deposit formation

• Collection and evaluation of unprocessed data (SW England, Iberian Pyrite Belt, Case study Romania), Fennoscandia Shield area in Sweden.)

• Understanding the rock-mechanical characteristics of orebodies from an EGS perspective

• Development of new concepts for orebody-EGS
<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Title</th>
<th>Version</th>
<th>Date</th>
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<tr>
<td>D1.1</td>
<td>EGS-relevant review of metallogenesis</td>
<td>December 2016</td>
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<tr>
<td>D1.2</td>
<td>Report on data availability</td>
<td>December 2016</td>
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<tr>
<td>D1.3</td>
<td>EGS-relevant review of orebody structures</td>
<td>December 2016</td>
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<td>D1.4</td>
<td>Conceptual framework for orebody-EGS</td>
<td>December 2016</td>
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WP2 - Laboratory experiments and orebody investigations

Start: M10 / End: M24   WP leader: BGS
Participants: BGS, ISOR, UNIM, USZ, VITO
  – completed

• Show that metals can be leached from the orebodies in high concentrations over a prolonged period of time, and thus potentially influence the economics of EGS.

• 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.
WP2 – Deliverables

Recommendations for Integrated Reservoir Management
CHPM2030 Deliverable D2.1
Version: December 2017
117 page report

Report on metal content mobilisation using mild leaching
CHPM2030 Deliverable D2.2
Version: December 2017
386 page report

Report on metal content mobilisation with nanoparticles
CHPM2030 Deliverable D2.3
Version: June 2016
69 page report

Report on overall systems dynamics
CHPM2030 Deliverable D2.4
Version: December 2017
28 page report
WP3 - Metal recovery and electrochemical power generation (VITO)

Start: M10 / End: M36  WP leader: VITO
Participants: KU Leuven
– completed

• Recovery of the metal content by high-temperature, high-pressure geothermal fluid electrolysis (Cu)

• Recovery of the metal content of geothermal fluids by gas-diffusion electroprecipitation and electrocrystallization (Li, Al - brine)

• Salinity gradient power from pre-treated geothermal fluids – reverse electrodialysis
WP3 – Deliverables

**Report on performance and design criteria for high-temperature, high-pressure electrolysis**
CHPM2030 Deliverable D3.1
Version: August 2018

**Report on performance, mass and energy balances and design criteria for gas-diffusion electroprecipitation and electrocrystallization**
CHPM2030 Deliverable D3.2
Version: August 2018

**Report on performance, energy balances and design criteria for salt gradient power reverse electrodialysis**
CHPM2030 Deliverable D3.3
Version: August 2019
WP4 – System integration

Start: M28 / End: M42  WP leader: ISOR
Participants: ISOR, VITO, KU Leuven, UNIM, USZ

Integrate downstream and upstream processes into a single system and develop optimisation strategies for energy and metals production

- Task 4.1 Conceptual framework(s) for CHPM power plant – delivered
- Task 4.2 Process optimisation and simulations
- Task 4.3: CHPM schematics and blueprints
Probabilistic model of Li extraction in the GDEx component
WP5 - Integrated sustainability assessment

Start: M18 / End: M42  WP leader: USZ
Participants: USZ, UNIM, EFG, ISOR, BGS, LNEG, LPRC, Minpol, IGR, SGU

- Task 5.1. Integrated sustainability assessment framework
- Task 5.2. Baseline economics for energy and mineral raw materials
- Task 5.3 Decision support for economic feasibility assessment
- Task 5.4 Social Impact Assessment and policy considerations
- Task 5.5 Environmental Impact Assessment
- Task 5.6 Ethics Assessment
WP6 - Road mapping and Preparation

Start: M24 / End: M42  WP leader: LPRC
Participants: LPRC, UNIM, USZ, EFG, ISOR, LNEG, BGS, VITO, LNEG, Minpol, IGR, KU Leuven, SGU

This WP will set the ground for subsequent pilot implementation, bearing in mind that CHPM2030 is a lowTRL research project, based on a novel idea that needs further nutrient and support beyond the immediate duration of the project.

To map converging technology areas and develop a research roadmap that could help bring forward the realization of the envisioned CHPM scheme.

• Tasks are 6.1 – 6.3: Horizon scanning & visions (Report on emerging and converging technologies), Preparation for pilots (subtasks - report) and Road mapping
WP7 – Dissemination and stakeholder involvement

Start: M1 / End: M42  **WP leader:** EFG

Participants: LPRC, UNIM, USZ, EFG, ISOR, LNEG, BGS, VITO, LNEG, Minpol, IGR, KU Leuven, SGU

- Tasks are 7.1 – 7.3: Dissemination and stakeholder involvement (D7.1: Basic project website), dissemination support services (D7.2: Final project website), leveraging dissemination and dialogue (D7.1-D7.14)
WP8 – Project Management

Start: M1 / End: M42

Tasks are 8.1 – 8.3: coordination and supervision of project activities, administration. D8.1-D8.5: Four public reports
Thank you for your attention

Photo: Gestur Gíslason