CHPM2030

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Combined heat, power and metal extraction

Project outcomes

The European economy is heavily dependent upon energy and mineral supply for industry and society. Therefore, key challenges are: lowering the costs and the environmental impact of energy production, and decreasing the dependence on imported strategic raw materials. Responding to these challenges, the CHPM2030 project was set up to develop a novel technology, which combines deep geothermal energy production with metals extraction from the geothermal fluid in a single interlinked process (Combined Heat Power and Metals – CHPM). In order to improve the economics of deep geothermal energy development, the project has investigated possible technologies for mobilising metals from metal-bearing geological formations with geothermal potential at a depth of 3 to 4 km, and potentially even deeper, and recovering metals from the geothermal fluid at surface. Thanks to the research by the CHPM2030 Team, the co-production of energy and metals might become possible and may be optimised according to market demands in the future.

2016/2017:

- Europe's mineralised regions were screened in terms of their EGS potential. I Read more: D1.1 EGS-relevant review of metallogenesis
- The mineralisation and the geothermal potential of the four study sites in Portugal, Romania, Sweden and the UK were studied in details. I Read more: D1.2 Report on data availability – compiled from 5 reports
- The EGS-relevant geochemical and rock mechanical properties of the ore bodies were defined. I Read more: D1.3 EGS-relevant review of orebody structures
- A conceptual framework for the orebody-EGS was formulated. I Read more: D1.4 Conceptual framework for orebody-EGS

2017/2018:

- A 3D stochastic fracture model was built and the extractable amount of heat and metallic minerals in different scenarios were defined. Recommendations were provided for the integrated reservoir management. I Read more: D2.1 Recommendations for integrated reservoir management
- It was proved that relatively 'mild' leaching agents were capable of liberating metals into the recirculating fluid within an EGS. I Read more: D2.2 Report on metal content mobilisation using mild leaching
- It was proved that surface modification of nanocarbon particles allowed metals to be adsorbed, both in acid and alkaline pH regions. I Read more: D2.3 Report on metal content mobilisation with nanoparticles
- The overall system dynamics were defined and data for environmental assessment were provided. I Read more: D2.4 Report on overall systems dynamics

2018/2019:

- It was proved that metals can be successfully electrodeposited at elevated pressure and temperature (up to 300 °C and 238 bar); higher pressures and temperatures lead to higher recovery rates. I Read more: D3.1 Report on performance and design criteria for high-temperature, high- pressure electrolysis
- It was proved that gas-diffusion electroprecipitation and electrocrystallization (GDEx) is a novel way to recover metals from dilute solutions. The patent of this process has been granted in Europe. I Read more: D3.2 Report on performance, mass and energy balances and design criteria for gas-diffusion electroprecipitation and electrocrystallization
- It was proved that GDEx allows nearly full recovery of the relevant metals present, and selectivity can be achieved. The GDEx experiments are up-scalable

and work for most of the critical raw materials. Preliminary economic feasibility calculations show positive results. I Read more: D3.2 Report on performance, mass and energy balances and design criteria for gas-diffusion electroprecipitation and electrocrystallization

- It was proved that the presence of multivalent ions in the geothermal brine does not eliminate the potential for salinity gradient power generation by reverse electrodialysis (SGP-RE), though a reduction in power was noted. However, the extraction of electrical energy was enhanced significantly by increasing the brine temperature. I Read more: D3.3 Report on performance, energy balances and design criteria for salt gradient power reverse electrodialysis
- A mathematical model framework was created based on the technology component-level models, which enables linking downstream and upstream geothermal engineering subsystems. I Read more: D4.2 Report on CHPM process optimisation
- The overall model can be used to study different scenarios, perform simulations, and develop optimisation and other kinds of system analysis. I Read more: D4.2 Report on CHPM process optimisation
- A decision support tool has been developed for the economic feasibility assessment allowing users to simulate revenue streams from both energy and metal extraction levels. The tool will remain accessible after the project lifetime through the MinPol website. I Read more: D5.3 Self-Assessment Tool
- Best practices have been suggested to companies planning to run CHPM plants for minimising the social and environmental impacts of the technology. I Read more: D5.5 Environmental impact assessment framework
- A wide array of convergent technologies and relevant issues were defined (linked to CHPM exploration, development, operation and market) that can support the implementation of the technologically challenging CHPM scheme by 2030/2050. I Read more: D6.1 Report on Emerging and Converging Technologies
- Detailed studies on the potential pilot sites and European-level databases provide the foundations for the implementation of pilot CHPM projects by 2030. I Read more: D6.2 Report on pilots – compiled from 5 reports
- Roadmaps for the implementation of future CHPM projects have been provided for 2030 and 2050 time horizons, including actions, targets and milestones. I Read more: D6.3 Roadmap for 2030 and 2050

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Cover photo: Vigdís Harðardóttir, Iceland Geological Survey
Infographic: CHPM2030 consortium

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