CIVIL AND ENVIRONMENTAL ENGINEERING

DIATI - Geothermal technology and geological models in the role of extraction of critical materials

Funded By	Dipartimento DIATI
Supervisor	TADDIA GLENDA - glenda.taddia@polito.it
Contact	VAGNON FEDERICO - federico.vagnon@polito.it GIZZI MARTINA - martina.gizzi@polito.it
Context of the research activity	The energy transition is and will increasingly be a main driver of demand for several critical minerals. Copper, lithium, nickel, cobalt, and rare earths, among others, are key components of many expanding green technologies that require a greater input of minerals than conventional energy. The critical minerals underlying the renewable energy revolution have very invasive extraction processes. Therefore, traditional extraction methods pose environmental and economic challenges.
Objectives	This PhD project aims to propose an innovative approach to analysing existing extraction techniques from fluids connected to high enthalpy geothermal systems, exploiting their potential as alternative sources simultaneously with the generation of clean energy. A preliminary design phase will be dedicated to the context analysis with, in detail, a framework of the critical minerals sector and the challenges linked to their traditional extraction, the state of the art of geothermal technology and existing applications, the study of environmental regulations and regulations relating to the extraction of these critical materials and geothermal projects. The objectives will be pursued through a combination of fluid analysis laboratory activities and the systems' geological-numerical modelling. The objectives of the research are: 1) Identify and characterise promising geothermal sites for the extraction of critical materials. Activities to be carried out in collaboration with Institute and Companies operating in the sector of energy production from high temperature geothermal fluids. 2) Analyze existing extraction techniques for these critical materials and develop strategies for integrating extraction with geothermal energy production for suitable geothermal sites. 3) Address the issue of environmental (geological and hydrogeological) impacts, possibly implementing mitigation measures and involving local communities. The expected results are:

	1) A better understanding of high-enthalpy geothermal systems and their associated fluid potential for the production of critical minerals, as well as clean energy. 2) A methodology for the development of site-specific models that allow evaluation in terms of the geo-hydro-thermal behavior of the system and its productivity over time.

Skills and competencies for the development of the activity	The candidate must have mastered the office package. The candidate also Knows the basics of numerical simulation (Feflow, Modflow) and data management software, data georeferencing such as a GIS.