

# SUSTAINABLE ENERGY HARVESTING SYSTEMS BASED ON INNOVATIVE MINE WASTE RECYCLING



Materials for Energy Unit



Laboratório Nacional de Energia e Geologia

## Research Area

Materials for Energy

Mineral Resources and  
Geophysics

Mineral Science and  
Technology

Resource Economics

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Project



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AÇÃO CLIMÁTICA

## Motivation

Climate change is one of the greatest challenges faced by humankind. Fighting global warming is critically dependent on the rapid implementation of a green transition to which the European Union (EU) is fully committed through the European Green Deal.

The green transition is based on a shift from a fossil fuel-intensive to a material-intensive energy system, which implies an increased need of minerals resources. This growing demand for essential minerals and the declining quality of ores is leading to a substantial increase in waste volumes from mining operations. Thus, the use of mine wastes as valuable secondary raw materials for the development of advanced energy conversion devices creates an increased economic incentive to eliminate environmentally hazardous tailings. Moreover, current commercial thermoelectric (TE) devices rely on tellurium-based thermoelements, which is an element derived or refined from minerals that are scarce in Europe, making the continent heavily import dependent.

In this context, the START project proposes a unique technological solution, based on the conversion of mining waste into materials for waste heat recovery, thus contributing to an efficient use of resources while promoting the use of green energy harvesting through thermoelectrics, in line with the strategies outlined in the European Green Deal and in the EU Action Plans on Critical Raw Materials and on Circular Economy.

## Objectives

START's primary objective is to build an European innovation ecosystem based for tellurium-free TE waste heat harvesting systems with potential applications in heavy and maritime industry or as primary power source for off-grid sensors and IoT devices.

This will be achieved by producing advanced sulphide p-type TE thermoelements that incorporates discarded waste secondary sulphides (tetrahedrite), present in many European mine wastes, to replace the tellurium-based p-type TE thermoelements.

## Partnership



## Web page

[www.start-heproject.com](http://www.start-heproject.com)

## Project Duration

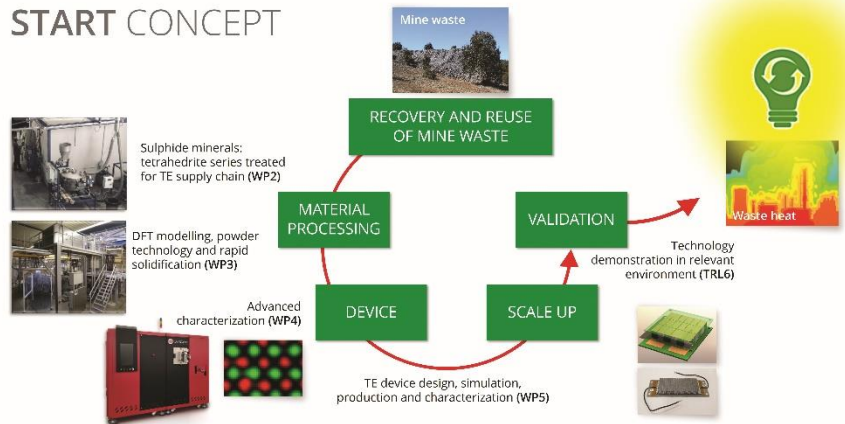
01 June 2022 - 31 May 2026

## Expected impact towards a more sustainable and resilient EU:

- Reducing EU dependence on primary critical raw materials.
- Promotion of circular economy processes.
- Production of TE energy harvesting systems to:
  - reduce fossil fuels consumption,
  - increase overall efficiency of energy production and consumption systems,
  - reduce greenhouse gas emissions.

## START concept

Transform mining waste into waste heat recovery materials.



## START Consortium

The project is coordinated by LNEG (Portugal) and aggregates 15 organisations, from 10 EU member states and 1 associated country, including 6 research organizations with strong background and knowledge on geology, materials science and renewable energies, 7 SME's companies that guarantee the entire supply chain, from production, exploitation and ecological footprint assessment, and 2 non-profit international associations with a consolidated network of partners and stakeholders.



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