Real-time hydrogen-storage monitoring via energy-efficient deep learning

Fact Sheet

<table>
<thead>
<tr>
<th>Project Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GEOLEARN</strong></td>
</tr>
<tr>
<td>Grant agreement ID: 101103593</td>
</tr>
<tr>
<td><strong>DOI</strong></td>
</tr>
<tr>
<td><a href="10.3030/101103593">10.3030/101103593</a></td>
</tr>
<tr>
<td><strong>Funded under</strong></td>
</tr>
<tr>
<td>Marie Skłodowska-Curie Actions (MSCA)</td>
</tr>
<tr>
<td><strong>Total cost</strong></td>
</tr>
<tr>
<td>€ 0,00</td>
</tr>
<tr>
<td><strong>EU contribution</strong></td>
</tr>
<tr>
<td>€ 181,152.96</td>
</tr>
<tr>
<td><strong>Start date</strong></td>
</tr>
<tr>
<td>29 January 2024</td>
</tr>
<tr>
<td><strong>End date</strong></td>
</tr>
<tr>
<td>28 January 2026</td>
</tr>
<tr>
<td><strong>Coordinated by</strong></td>
</tr>
<tr>
<td>BCAM - BASQUE CENTER FOR APPLIED MATHEMATICS Spain</td>
</tr>
</tbody>
</table>

Objective

The use of renewable hydrogen as green fuel and energy storage was deemed key to achieve the European Green Deal. However, its large-scale storage is still facing significant challenges. Measurement inversion via deep learning (DL) is a state-of-the-art approach used for underground storage-site detection and monitoring. However: 1) It requires a huge amount of training data; 2) DL training is expensive, and 3) There are no efficient and reliable DL techniques for multiscale electromagnetic measurement inversion.

The goal of GEOLEARN is to guide hydrogen storage technologies by inverting subsurface multiscale electromagnetic measurements in real time using energy-efficient DL methods. For this purpose, GEOLEARN will leverage mixed-precision...
(MP) computations to maximise energy- and cost-efficiency, and ensure scalability. GEOLEARN proposes to address the above challenges as follows: 1) Develop MP finite element methods (FEMs) that can rapidly generate large training data; 2) Design MP DL algorithms that can efficiently process huge databases during training and invert measurements in real time, and 3) Apply the new techniques to invert multiscale geophysical electromagnetic measurements and guide hydrogen storage.

We will collaborate with industry to disseminate the project results and maximise exploitation, and the new methods will lead to high impacts in and outside academia.

The host has extensive experience in DL methods for inverse problems in geophysics and FEMs, and already collaborates with relevant companies. The secondment host is expert in high-performance computing and FEMs, and the applicant is expert in MP methods for scientific computing. This multidisciplinary research team is essential for the success of GEOLEARN, and will enhance the applicant's knowledge, network and skills, promoting his future career in research in Europe. The hosts and applicant will mutually benefit from the project outcomes and the industrial and academic collaborations.

**Fields of science**

natural sciences > computer and information sciences > databases
natural sciences > computer and information sciences > computational science
natural sciences > computer and information sciences > artificial intelligence > machine learning > deep learning
natural sciences > earth and related environmental sciences > geophysics
social sciences > economics and business > economics > sustainable economy

**Keywords**

- underground hydrogen storage
- subsurface characterisation
- deep learning for inverse problems
- multiscale inverse problems
- reduced- and mixed-precision computing
- finite element method

**Programme(s)**
Topic(s)

HORIZON-MSCA-2022-PF-01-01 - MSCA Postdoctoral Fellowships 2022

Call for proposal

HORIZON-MSCA-2022-PF-01

See other projects for this call

Funding Scheme

HORIZON-TMA-MSCA-PF-EF - HORIZON TMA MSCA Postdoctoral Fellowships - European Fellowships

Coordinator

BCAM - BASQUE CENTER FOR APPLIED MATHEMATICS

Net EU contribution

€ 181 152,96

Address

Al mazarredo 14
48009 Bilbao
Spain

Region

Noreste > País Vasco > Bizkaia

Activity type

Research Organisations

Links

Contact the organisation
Website
Participation in EU R&I programmes
HORIZON collaboration network

Other funding

€ 0,00
THE CHANCELLOR MASTERS AND SCHOLARS OF THE UNIVERSITY OF CAMBRIDGE

United Kingdom

Net EU contribution € 0,00

Address
Trinity lane the old schools
CB2 1TN Cambridge

Region
East of England > East Anglia > Cambridgeshire CC

Links
Contact the organisation Website Participation in EU R&I programmes HORIZON collaboration network

Other funding € 0,00

EC signature date 13 March 2023
Last update: 29 June 2023

Permalink: https://cordis.europa.eu/project/id/101103593

European Union, 2023