

ENeRG GEO ENeRGY

Horizon Europe to address disparities in R&I performance among countries

ENeRG welcomes the fact that the recently launched **Work Programme 2021-2022 of Horizon Europe**, the EU's key funding programme for research and innovation, is giving new opportunities for international collaborative research, including actions addressing the growing disparity between countries and regions in terms of R&I performance.

In the part dealing with **"Widening participation and strengthening the European Research Area"** the Work Programme includes a series of concrete instruments to allow successful participation in the R&I process and promote networking and access to excellence.

Such goals are strictly related to the main objectives of ENeRG, such as: to promote scientific and technical collaboration between Members (to function as a "broker" for international consortia); to disseminate geo-energy research results and synthesized knowledge Europe-wide; to foster interaction and exchange of information between Members and national/European stakeholders.

The EU recognizes that in the field of climate science as well as clean-tech and energy & transport technologies, disparities are meaningful between R&I leading and lagging countries, mentioned as "Widening countries". These are often faced with a relatively larger challenge in terms of decarbonization, and their Research & Innovation systems can take benefit

from a strong collaboration with leading countries which are more advanced in tackling this challenging issue.

The disparity issue has been one of the drivers of many recent activities of ENeRG which unites, among its 26 members, institutes from 15 Widening countries, all involved in basic or applied research or technological development in the field of sustainable use of the underground for the energy transition.

Within the many calls included in **"Widening participation and strengthening the European Research Area"** ENeRG considers the following ones highly interesting.

Teaming for excellence. The Teaming action is designed to support the creation of new centres of excellence or upgrading the existing ones in low R&I performing countries, building on partnerships between leading scientific institutions in Europe and the main beneficiary institutions in low R&I performing countries that display the willingness to engage together for this purpose. Leading scientific institutions are advanced and established partners that have developed an outstanding reputation in research and innovation excellence in the chosen scientific domain. The implementation of Teaming action is expected to become an influential and meaningful bridge particularly between smart specialization strategies and excellence in R&I with the

aim of strengthening the European Research Area and contributing to the Sustainable Development Goals.

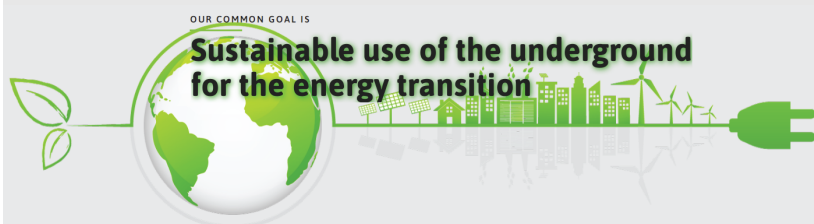
Twinning. Twinning aims to enhance networking activities between the research institutions of the Widening countries and at least two top-class research institutions from two different Member States or Associated Countries. Therefore, building on the huge potential of networking for excellence through knowledge transfer and exchange of best practice between research institutions and partners.

Twinning proposals should have to clearly outline the scientific strategy for stepping up and stimulating scientific excellence and innovation capacity in a defined area of research and should include actions such as: short-term staff exchanges, expert visits, on-site or virtual training, workshops, conference attendance, organisation of joint summer schools, dissemination and outreach activities.

Sergio Persoglia, ENeRG President

The work programmes under Horizon Europe are available at:

https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/horizon-europe-work-programmes_en



At the usual address www.energnetwork.eu you can find our renewed website, easier to navigate also on tablets and smartphones. We hope that you will enjoy its more modern aspect and enriched functionalities.

The Newsletter content

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SUCCEED: Synergetic Utilisation of CO₂ storage Coupled with geothermal EnErgy Deployment



SUCCEED is an industrial CO₂ storage and utilisation project aimed at mitigating against greenhouse gas emissions from geothermal power production. Although it is widely assumed that geothermal energy is clean, and renewable, most geothermal energy plants emit CO₂. The non-condensable gases in geothermal resources include up to 97.8% CO₂ and trace amounts of other gasses. Geothermal energy contributes significantly to some countries' energy budget, and their CO₂ emissions can be relatively significant.

Utilising existing infrastructure at producing geothermal fields Kizildere in Turkey and the CarbFix technology site Hellisheiði in Iceland, SUCCEED aims to research and demonstrate the feasibility of using produced and vented CO₂ for re-injection into the reservoir to maintain pressure and improve geothermal performance, while



Fig. 1. Outcrop study near Kizildere, Turkey

also storing the CO₂. The project also aims at field testing and implementing a new higher signal-to-noise ratio DAS (Distributed Acoustic Sensing) system by Silixa and an innovative highly-repeatable vibratory-type electric seismic source (E-vib) by Seismic Mechatronics to provide semi-continuous monitoring capability for CCS and geothermal applications. One further objective is to develop techno-economic and life-cycle assessment methodologies for CO₂ storage in geothermal projects.

To evaluate the capabilities of surface installed Helically Wound fibre-optic Cables (HWC) for CO₂ injection monitoring, a ~1,350m long cable was deployed in a trench close to the toe of CO₂ injection well HN-16 at Hellisheiði (Figure 2). The HWC is also being tested for microseismic event detection capabilities. Test data collected from the site in July 2020 have already shown clear recordings of natural seismicity on the cable. During the seismic surveys planned, data will be recorded continuously along with the active source (E-vib) use.

The designs and deployment at Kizildere are more complex. Approximately 500 m of HWC will be deployed in a trench connecting two observation wells with 1,000 m and 1,700 m long downhole Constellation fibres. Passive and active seismic surveys will be conducted to evaluate the behaviour of injected CO₂ in the reservoir.

The project started in September 2019 and is funded through the ACT programme (Accelerating CCS Technologies, <http://www.act-ccs.eu/>).



Fig. 2. HWC installation at Hellisheiði, Iceland

SUCCEED is coordinated by Imperial College London and includes Middle East Technical University, Zorlu Energy, Delft University of Technology, Silixa Ltd., Seismic Mechatronics BV, Reykjavik Energy and Istituto Nazionale di Oceanografia e di Geofisica Sperimentale as its partners.

More information on SUCCEED can be found at: <https://www.imperial.ac.uk/en-ergy-futures-lab/succeed/>.

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Introduction of new EnErg member

Christensen CCS Consult was founded in 2019. The firm is registered in Norway and provides knowledge-based consulting related to the development of CCS, particularly on issues dealing with geological storage of CO₂. A key activity is chairing the Norwegian ISO TC/265 Mirror Committee for standardization of CCS and CCUS. So far, CCS Consult has delivered international standards on geological CO₂ and storage in associations with CO₂ EOR. Currently focus is on building an international standard for quantification and verification of CO₂ along the entire CCS value chain.

CCS Consult is also involved in a number of other international CCS activities.

For the past four years CCS Consult, as a member of the Advisory Committee, has assisted the Japanese Ministry of

Environment in developing Phase 1 of the MOE Sustainable CCS project, resulting in a capture biomass pilot plant and the first development plans for transport and offshore storage of CO₂. Phase 2 is now being defined.

CCS project, CCS Consult is contributing to the phase in which the geological storage reservoir is being developed and injector wells are being drilled at a site in Mississippi. The project aims to store up to 50 million tons of CO₂ from regional industry and power generation.

In Denmark CCS has entered the political agenda and become one of the tools to achieve a 70% GHG reduction by 2030. The Danish Energy Agency is currently building the background material and strategy for deployment of CCS by 2025 and CCS Consult is providing in-house advice on storage geology, monitoring

needs, and regulatory requirements. A study of potential types of geological storage (onshore, nearshore and offshore depleted oil fields) and the cost associated with the options has been carried out.

The founder, Niels Peter Christensen previously worked with Gassnova SF (Norway), Vattenfall Power Corp. (Sweden, Denmark, Germany, Netherlands, Poland) and the Geological Survey of Denmark and Greenland (GEUS). Before that he worked in the oil and gas sector, developing hydrocarbon fields in the North Sea. He was appointed honorary professor at Heriot Watt University (Edinburgh Scotland) 2006-2011, and a member of the Scientific Board of the national Italian Institute OGS, 2012-2020.

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Hydrogen Storage In European Subsurface (Hystories)

Large-scale underground storage of renewable hydrogen is very important for the development of a low emission hydrogen economy and to balance the intermittency of renewable energy production for the transportation grids. Until now, underground hydrogen storage was conducted in salt caverns (starting from 1970's in Europe) and a broader range of geological storage solutions need validation.

In this context, the Hydrogen Storage In European Subsurface (Hystories) project, a two year project funded under the Horizon 2020 programme, aims to provide the needed technical developments and techno-economic assessments for the implementation of large-scale storage of renewable hydrogen in depleted hydrocarbon fields or aquifers (Figure 3).

The Hystories consortium is coordinated by GEOSTOCK SAS and includes Ludwig-Boelkow-Systemtechnik GmbH - LBST and MICRO PRO GMBH (Germany), MONTANUNIVERSITAET LEOBEN (Austria), FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON - FHA (Spain), INSTYTUT GOSPODARKI SUROWCAMI MINERALNYMI I ENERGIA PAN – MEERI PAS (Poland) and the CO2GeoNet Association as partners. Under the CO2GeoNet association, 9 ENeRG Members are involved in the project.

Within the Hystories project, each of the technical challenges related to storage of hydrogen in depleted fields and aquifers, will be addressed using different strategies:

- Advancing a European database of geological storage opportunities through addition of data with specific relevance to geological storage of hydrogen for 19 European countries;
- Answering reservoir engineering questions through modelling and comparisons with geological models of natural gas storage sites in operation;
- Assessing impacts of geochemical interactions between hydrogen and rocks of porous media, based upon relevant rock compositions and accounting for the associated uncertainties;
- Determining expected microbial activity and impacts through experimental microbiological investigation on a dozen different brines and rocks (cores or cuttings) from gas storage sites;
- Developing strategies for longer-lasting infrastructure; materials and corrosion to enable long lasting wells in the potentially aggressive environment of hydrogen storage will be investigated, using several possible materials.

In addition to the technical challenges addressed, Hystories will provide insights

into underground hydrogen storage for decision makers in government and industry through techno-economic feasibility studies. These studies include:

- Modelling of the European energy system in various scenarios and time horizons in order to analyse its optimal sizing and operation, and thus to define a demand for underground renewable hydrogen storage;
- Impact studies, such as Environmental and Social Life Cycle Assessment will be conducted, each relying on an ISO framework;
- Cost estimates and ranking of the sites based on techno-economic criteria for a given location and a hydrogen storage demand;
- Analysis of several case studies to enable a more detailed look on the implementation of potential projects, notably by assessing economic opportunities for a large-scale storage of renewable hydrogen.

The main outcome of the project will be assessments of techno-economic feasibility for the implementation of hydrogen storage in preferred locations to support informed decision making on, for example, whether to proceed to field pilot demonstration ahead of larger scale developments anticipated in Europe. The results of Hystories will provide substantial insights into the suitability for implementing such storage across the EU and enable the development of positive business cases for future storage sites.

Public results will be made available over the next two years on the project website www.hystories.eu.

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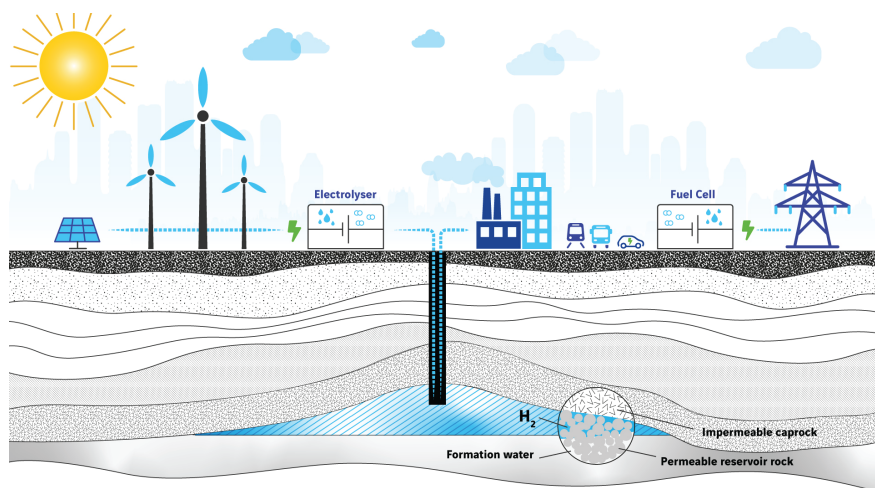


Fig. 3. Illustration of renewable hydrogen storage concept in permeable reservoir rocks

ENeRG – European Network for Research in Geo-Energy

ENeRG – European Network for Research in Geo-Energy is an informal contact network open to all European organisations with a primary mission and objective to conduct basic and applied research and technological activities in the field of sustainable use of the underground for the energy transition.

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ENeRG Newsletter – GEO ENeRGY

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International Master Course on CO₂ Geological Storage

The first session of the International Master Course on CO₂ Geological Storage (<https://www.uniroma1.it/en/offerta-formativa/master/2020/co2-geological-storage>), organized and hosted by the Sapienza and Zagreb Universities, ran in the academic year 2019 - 2020, and was provided within the EU project ENOS (Enabling Onshore CO₂ Storage in Europe) (<http://www.enos-project.eu/>). The course has the aims to prepare a new generation of young people who want to work on these topics and to develop a solid professionalism in the field of geological storage of CO₂. The course lasted one academic year (January 2020 – October 2020) with the participation of several European research institutions: GEUS (Denmark), Heriot Watt University (Scotland), University of Nottingham (England), Sotacarbo (Italy), TalTech (Estonia), NORCE (Norway).

On the 2nd of November 2020, at the Earth Science Dept. of the Sapienza University, the four students of this first session completed their studies, with the final defence of their works. The event took place partly online, with more than 35 persons connected, and partly in person (Figure 4). The first student was Pegah Soleimani Dinani who presented her work entitled "Simulation of fluid flow in a fault and nearby aquifer on the base of the SFL data", supervised by Anton Shchipanov from NORCE (Norwegian Research Centre), followed by Martina Mariani who presents her work entitled "North Italian CCS scenario for the cement industry", supervised by Kazbulat Shogenov & Alla Shogenova from TalTech (Tallinn University of Technology). The third student was Michele Conte who presented his work entitled "Fluid flow simulation in the Cornelia reservoir",

supervised by Dorian Foster & Gillian Pickup HWU (Heriot-Watt University). The last student was Gabriela Garcia, who connected from Zagreb University, to present her work entitled "Determination of Cost-Effectiveness of CO₂-EOR and CO₂ Utilization Factor as Feasibility Indicators for Permanent CO₂ Storage", supervised by Domagoj Vulin (Zagreb University). All students successfully defended their theses and received Final Diploma Awards of Professional Master in CO₂ Geological Storage.

The next session of the Master Course, which will be activated for the academic year 2021-2022, and will involve professors from Sapienza and Zagreb Universities as well as from institutions which are members of ENER. It is planned to start in January 2022, and the call for application will be announced in August 2021. The new course will be organized in 15 modules,

covering all the aspects of the geological storage of CO₂, including CO₂ injection and safety monitoring, the exploration of critical processes in laboratory studies, and reservoir numerical modelling, a week of practise and 2 months of training at several European research institutes currently involved in CCS research activities. At the end of the course, successful students will acquire a joint Diploma and will be able to understand the work of a range of specialists involved in CCS projects and to further develop their own field of specialization.

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Fig. 4. Final defence of the master course in Rome, November 2020

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