GEO ENeRGY

ENeRG community welcomes the European Green Deal

Global warming is happening and is already affecting citizens, confirming the urgent case for action that science has presented for some time. Temperatures continue to break records and climate-related extreme events are more frequent and more intense. The role of greenhouse gases produced by human activities is no more a matter of debate and the need to reduce them is a necessity fully acknowledged in the Paris Agreement, negotiated by 196 state representatives at the COP21 climate conference in 2015. Much evidence highlights that the current plans to reduce global greenhouse gas emissions are not on track to achieve the goals of the Paris Agreement to keep global warming well below 2°C, and pursuing efforts to limit the increase to 1.5°C. Due to that and in view of the COP26 in Glasgow 2021, where the parties are expected to update their Nationally Determined Contributions (NDCs) reflecting their long-term strategies for reducing emissions towards 2050, the European Council has approved a binding EU target for a net internal reduction of greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels, to secure achieving the already agreed target of net zero greenhouse gas emissions by 2050.

Moreover, these ambitious goals have to be met while preserving the environment, securing availability of energy at affordable costs, making the EU's economy sustainable.

The challenge is very very important and equally hard to win, because it will imply development, integration and application at large scale of new technologies and behavioural, social and cultural changes in all of us as citizens.

To guide all these processes, the European Commission has introduced the **European Green Deal**, a set of policy initiatives with the overarching aim of making Europe climate neutral in 2050, and a plan to boost the efficient use of resources by moving to a clean, circular economy.

ENeRG, the European Network for Research which includes members from 20 European countries, welcomes the **European Green Deal** and intends to contribute to it by pooling knowledge and competence of its members and performing joint research. The **Mission of ENeRG** is to **"promote co-operation between European R&D organisations whose main interest is to conduct basic or applied research or technological development in the field of sustainable use of the underground for the energy transition."**

Applied research, optimal use of resources, renewing the overall energy sector, are all concepts which link the ENeRG mission and its areas of activities to the concepts underlying the European Green Deal.

The subsurface should be considered as an important resource for the energy transition aimed at reaching the newly improved goals of emissions reductions. Two examples of this are **Geothermal Energy** and **Energy Storage,** both objects of research by EneRG members, over many years.

Geothermal energy is a non-intermittent renewable energy. Its underground resources range from shallow resources, through deep permeable aquifer reservoirs, hot springs, fumaroles, geysers, travertine deposits, chemically altered rocks to hot dry rocks. Their heat can be captured and used directly for heat supply, or their steam can be used to generate electricity. The main goal for geothermal energy research is to significantly enhance the exploitation of these resources, affected often by geological heterogeneity, lateral and vertical lithology variations, faults, diagenesis reducing porosity and permeability constrains.

New types of underground energy storage represent a new and important challenge opening a new research domain which will play an increasingly important role in enabling the reduction of CO_2 emissions thanks to the large use of renewable energy sources (RES) for energy production. Because RES, largely using wind and solar energy, are inherently intermittent, there is a need for massive storage of energy to balance the fluctuations. Among various options, use of the underground offers large storage capacities and discharge rates through a series of techniques, such as (i) underground pumped hydro-storage (UPHS), (ii) compressed air energy storage (CAES), (iii) storage of hydrogen produced, e.g., by power to gas conversion and (iv) thermal energy storage, including the power-to-heat conversion option. Each of these techniques requires the selection of appropriate geological environment (leached salt caverns, crystalline rocks, porous and/or fractured sedimentary rock, porous basalts, abandoned mines or natural underground cavities). To date, there are only a few energy storage facilities of these new types operating worldwide (e.g. the CAES plants located in Germany and in the USA or the hydrogen storage site in the UK) but many more will be needed in future. Research in this field can significantly contribute to accelerate the deployment of these new energy storage technologies.

Sergio Persoglia, ENeRG President
Vit Hladik, ENeRG past President

Experience and contribution of ENeRG members to projects on the above-mentioned topics can be found in the recent isssues of the ENeRG Newsletter and Position Papers, available on the ENeRG website at www.energnet.eu.

The Newsletter content

New members of ENeRG

C.E.R.I. Research Centre on Geological Risks

With 21 faculties and over 4500 teaching and research staff, Sapienza University of Rome is an internationally recognised centre of excellence for education and cutting-edge research.

The C.E.R.I. Research Centre on Geological Risks was founded under the Rector Decree no. 00353 on July 2003. The Centre promotes, coordinates and implements research on geological risks, innovative monitoring methodologies, geological modelling and CO_2 geological storage.

The Tectonic and Fluid Geochemistry Laboratory (TFC Lab), affiliated with CERI, has specialised in near-surface gas and water geochemistry since 1980, applying it to basic geology (tectonics, fault mapping, volcanic processes), resource exploration (geothermal, oil and gas, mineral), pollution mapping (garbage dumps, gasoline spills), and geological disposal (nuclear waste, CO_2 geological storage). Collaboration with social science researchers started in 1999, and it is now consolidated into a teamwork approach to public perception and social dialogue. From 2006 the group included structural geologists and developed expertise in 3D geological modelling, seismic interpretation, fault analysis and fluid flow modelling.

The TFC Lab of CERI has participated in over 20 European Union funded projects. Since 2000, 10 of these projects were focused directly on the geological storage of CO_2 (Weyburn, Nascent, CO2ReMoVe, MOVECBM, CO2GeoNet, CGS Europe, ECO2, SiteChar, RISCS, R&Dialogue and ENOS). The TFC Lab is also project leader of the LIFE-RESPIRE project and founding member of CO_2GeoNet – European Network of Excellence on the Geological Storage of CO_2 and CO_2Club Italy.

More information can be found at http://www.ceri.uniroma1.it/index.php/homeen/

Sabina Bigi
Asociate Professor, member of CERI-Sapienza

Institute of Geological Sciences of the Armenian National Academy of Sciences

Institute of Geological Sciences of the Armenian National Academy of Sciences (IGS), established in 1935, is the largest Earth Sciences institution in Armenia. The main field of activities led by IGS are: general and regional geology, geodynamics, seismotectonics, volcanology, seismology, assessment of seismic and volcanic hazards, assessment of exogenic hazardous geological effects, geothermal energy, geological informatics, efficient use and protection of the geological environment, mapping and assessment of geological systems. In the recent decades, the IGS is applying digital mapping, remote sensing, GIS technologies, seismic tomography and geophysics in many areas of its activity. Currently, the Institute operates the largest seismic network in Armenia that consists of 14 permanent stations installed in collaboration with Academia Sinica, Taiwan and the Department of Geosciences of National Taiwan University and 31 temporary seismic stations installed in framework of International US funded Caucasus-Transect project.

Currently, IGS has over 140 employees, out of which more than 70 represent the scientific staff.

Apart from its basic project titled "Features of formation of lithosphere, generation and exploration of minerals in the territory of the Republic of Armenia, assessment of risks from destructive geological processes" funded by the Government of Armenia, IGS successfully completed many national and international research projects and grants in close collaboration with many national and international organizations. Currently IGS has three active international projects in close collaboration with many research institutes worldwide.
H. Karapetyan Geological Museum is a part of IGS and it is the only geological museum in Armenia.

More information on IGS can be accessed at: https://geology.am/en/

Dr.Sci. Khachatur Meliksetian
Director, Head of Laboratory of Volcanology

The Expert Council of the Ukrainian Association of Geologists

"The Expert Council of the Ukrainian Association of Geologists" (further - Expert Council) was established in 2002 by the Public Organization 'Ukrainian Association of Geologists" https://www.geologists.org/en/.

The major area of activity is effective, balanced and investment-attractive use of energy, mineral, water and land resources.

The Expert Council performs a wide range of works, the majority of which are assignment of expert opinions on geological exploration and mining projects, geo-energy research and innovation activities, creating geological-geophysical and geological-geochemical information and other geological services.

Since 2019, the Expert Council has been working on 2 international projects launched by the European Federation of Geologists with support of Horizon2020: CROWDTHERMAL (Community-based development schemes for geothermal energy) and REFLECT (Redefining geothermal fluid properties at extreme conditions to optimize future geothermal energy extraction). CROWDTHERMAL aims to enable the European public to participate directly in the development of geothermal projects through alternative funding schemes (crowdfunding) and social inclusion tools. REFLECT project intends to collect new, high-quality data in critical areas to be implemented in a European geothermal fluid atlas and in predictive models. REFLECT will provide recommendations on how to best operate geothermal sites sustainably and to enhance geothermal technology development.

Yuliia Demchuk
The Expert Council of the Ukrainian Association of Geologists
Head of the Council

Natural laboratories for the study of CO_2 geological storage in Romania

The natural CO_2 emissions in Romania represent a good opportunity for developing natural laboratories for the study of CO_2 geological storage. Starting from this idea, the GeoEcoMar team selected two zones, for further studies, Harghita and Banat. The studies are carried out within a new project, started in 2019, a national project financed by the Ministry of Education and Research of Romania and included in the core program of the institute. The four-year project is entitled "Study of sites with natural CO_2 emissions from Banat and Harghita for accession to the European network ECCSEL (European Carbon Dioxide Capture and Storage Laboratory Infrastructure)" (PN 19 20 05 03). Its main objective is to study from a scientifical and technical point of view the possible inclusion of two sites from the two selected zones in the European network.

Specific objectives of the project refer to defining the regional structural, geological and geophysical models for the two zones, highlighting the mechanisms of CO_2 migration to the surface; elaboration of detailed geological and geophysical models for the selected sites; geo-ecological study of the sites, checking the opportunities to join ECCSEL and financing solutions.

After an inventory of all available data and of all the potential sites, we have conducted two field campaigns, one for each zone, in September and October 2019. The objective of the campaigns was to check suitability of the sites as natural laboratories for the study of CO_2 geological storage and to select the best sites for further study. Within these campaigns, apart from identification of the sites, we also made soil gas and high precision GPS measurements for the assessment of CO_2 emissions.

In the Harghita region most of the sites that we have investigated are important touristic attractions. In these sites, the mofettes are built as dry spas where people sit and benefit from the therapeutic effects of exposure to volcanic gases. Excluding the sites highly frequented by tourists and the sites with covered mofettes, we have selected the Lăzărești site, as potential natural laboratory. Lăzărești has many dry and wet mofettes in open air which represent a good opportunity for future studies.

In the Banat region, the number of areas with natural CO_2 emissions is low. Some dry spas were built and are used for therapeutic purposes. The only potential natural laboratory for Banat, selected after the preliminary analysis and field campaign, is located south of Seceani village (north of Timișoara city). This potential laboratory extends over a large marshy area and includes several mud volcanoes and dry mofettes. During the field campaign from October 2019, the CO_2 emissions were low, due to the seasonal character of mud volcanoes activity. This activity has its peak in the spring, in April, and is strongly connected to the hydrological regime.

In 2020, the project activity focused on the study of Lăzărești site, where we conducted soil gas surveys (Figure 1) and we took samples from important CO_2 emission points. The field campaigns at this site are planned to continue also in the first half of 2021, when we intend to make geophysical surveys and repeat soil gas surveys to check seasonal variability. We will continue after this, the study of Seceani site in the Banat region.

Figure 1. Former president of ENeRG, Constantin Sava and newsletter editor, Alexandra Dudu doing field work at Lăzărești site

Dr. Alexandra Dudu
Head of CO_2 Geological Storage Department
GeoEcoMar

GeoEcoMar®

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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HyStorPor Project

HyStorPor

To meet the UK decarbonisation targets necessary to mitigate climate change, our energy mix must transition from fossil fuels. Hydrogen can support this by replacing natural gas in domestic heating, fossil fuels in transport, aviation, shipping, low carbon feedstock for manufacturing and by facilitating increased renewable energy power generation through the provision of energy storage to balance supply and demand and energy security. As hydrogen has a high energy density by mass, but a very small mass by volume, hydrogen for decarbonisation will require large-scale underground storage.

The UK Engineering and Physics Research Council (EPSRC) has funded a project called HyStorPor (hydrogen storage in porous media). This is a collaboration between The University of Edinburgh, Heriot-Watt University, The Scottish Association for Marine Science and Imperial College. HyStorPor is supported by a number of industry partners including Equinor, Pale Blue Dot, SGN, Atkins, Quintessa, Hydrenor, EMEC, CGG, Doosan and SHFCA.

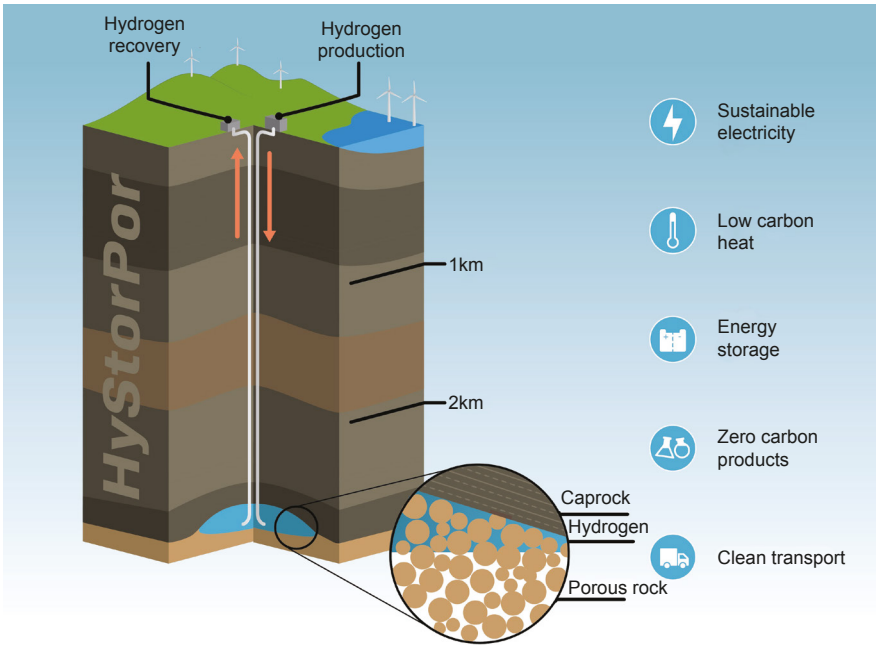

Figure 2. Hydrogen storage in porous media, and the concept of the HyStorPor Project

The main objective of the 3-year HyStorPor project which started on the 1st September 2019 is to investigate whether hydrogen storage in porous reservoir rocks is fundamentally feasible (Figure 2).

The project has four primary goals. Firstly, HyStorPor will identify if any biological and chemical reactions between the reservoir rock, sealing caprock, pore fluids, cushion gas and hydrogen could compromise storage. Secondly HyStorPor will assesses how effectively hydrogen migrates through water-filled porous media, and how much of the injected hydrogen can be recovered from the storage reservoir. Both static and dynamic laboratory experiments will be carried out in these two work packages. The third aim is to perform flow simulations, using results of laboratory data to provide estimates of storage capacity and recovery efficiency. Finally, HyStorPor will engage with society to ensure that hydrogen storage develops in a way that is both technically feasible and socially acceptable.

HyStorPor features a multidisciplinary research centre and information hub on hydrogen usage and storage based at the University of Edinburgh. More information can be found on the HyStorPor project website, where all public deliverables and open-access publications will be shared: https://blogs.ed.ac.uk/hystorpor/

Katriona Edlmann and Niklas Heinemann

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