

GEO ENeRGY

ENeRG Partners Involved in the European CCS Demonstration Programme (part 2)

In the previous issue of GEO ENeRGY (No 23), the title page article introduced the involvement of ENeRG members in the EU Demonstration Programme for CO₂ Capture and Storage (CCS). Engagement of ENeRG partners from France, the Netherlands and Poland in their national CCS demonstration projects was described. We are now continuing with this overview with information from a further three European countries.

Romania

The Romanian CCS Demo project, GETICA CCS (www.getica-ccs.ro), is a project run under the co-ordination of the Ministry of Economy, Trade



and Business Environment (METBE), with support from the Global CCS Institute. Following the completion of the feasibility study of the project, METBE submitted to the European Investment Bank the application forms for the NER 300 competition.

The project intends to store 1.5 Mt CO₂ captured (using post-combustion technology) from the unit no. 6 of Turceni power plant, into a deep saline aquifer in a major structural unit called Getic Depression, from which the name of the project has been derived. Turceni is a local-lignite fired plant located in the Oltenia Region, which is responsible for 40% of the CO₂ emissions at national level. Turceni was selected from several large emission sources in the area in the context of retrofitting and extending the operational life of unit no. 6 and



from a social point of view of maintaining existing jobs in the lignite power industry, including mining exploitation. The transport of CO₂ from Turceni power plant to the storage site will be made through onshore pipelines of approximately 40 km in length.

As for the storage site, the feasibility study led to the selection of two possible

made at the end of the first step of the appraisal, based on the results of the 2D seismic surveys and the well analysis from the first appraisal well drilled in Zone 5. Based on the current level of knowledge, Zone 5 appears to be the best option for storage. For this reason, this zone will be fully appraised and a partial appraisal will be made in Zone 1 as a back-up.

The Technical Consortium of the project is comprised of GeoEcoMar, ISPE, Alstom and Schlumberger. GeoEcoMar, the Romanian partner in ENeRG, has been so far in charge of the co-ordination of the storage part of the feasibility study. With the advice and consultation of Schlumberger, GeoEcoMar team made the selection of the two possible storage areas to be appraised.

Spain

In 2006, the Spanish Government created a Research Foundation called "Fundación Ciudad de la Energía (CIUDEN)" with the goal of becoming an international reference on Clean Coal research.



Fig. 1 The Turceni power plant

storage areas, named Zone 5 and Zone1, both within an area of 50 km radius from the power plant. Preliminary performance assessment studies and risk analysis were made on these two zones. The final selection of a single storage site will be

The project will be implemented by the Project Company composed from Turceni Energy Complex, Transgaz (National Company for Natural Gas Transportation) and Romgaz (National Company for Natural Gas Exploitation).

As a result of an agreement between this Foundation and the power company ENDESA, it was decided to launch a demonstration project on Carbon Capture and Storage, titled The Compostilla Project (www.compostillaproject.es).

The capture part of the project includes a first pilot phase of oxyfuel combustion (20 MW_e) with two lines of Pulverized Coal and Fluid Leach. If the demo project continues in the second phase, a 300 MW_e plant will be implemented by ENDESA.

The storage project is divided into two parallel activities: CIUDEN is in the early stages of an injection pilot plant in the location of Hontomin (Burgos), with the objective of developing and testing monitoring and validation strategies and technologies. This programme includes different works on the field including geology, hydrogeology, geophysics, reservoir engineering and field modelling. In 2012, it is planned that 3 wells will be drilled in order to execute injection tests. One well will be used for injection and the other two will be used for observation and monitoring tests.

ENDESA, meanwhile, is looking for storage sites with enough capacity and injectivity to be used as a final store for the industrial demonstration. At this moment, ENDESA is developing extensive field exploration campaigns of 3D seismic and deep boreholes, in order to precisely define geometric and petrophysical characteristics of the structure.

IGME, the Spanish member of ENeRG, developed site selection works for ENDESA in the frame of the CENIT CO₂ Project, which were used for the first selection of sites for

further exploration. Moreover, a geophysical team of IGME is developing micro-gravimetric techniques for future monitoring and control of the injected CO₂ at the field of Hontomin.

Italy
ZEPT – Zero Emission Porto Tolle (www.portotolleproject.com) – is one of the CCS projects co-financed by the EU under the EEPR (European Energy Programme for Recovery). Recently, Porto Tolle has been proposed by Italy in the first run of the NER300 competition. The goal of this project, which is under development, is to retrofit one 660 MW_e coal fired unit in the Porto Tolle power plant with CO₂ post combustion capture equipment and start CO₂ underground storage (over 10 years with an injection rate of 1 Mt/year) in an offshore saline aquifer by 2015.

OGS, the Italian ENeRG partner, has been involved for over a decade in a series of EU projects dealing with CO₂ storage site characterisation, deep and surface monitoring and offshore impact assessment. Based on this experience, OGS has been



involved in the Porto Tolle project since its early stages, when a basin-scale evaluation of potential sites for CO₂ geological storage had been performed. OGS' activity has since been focused on a detailed analysis of some of the most promising geological structures and the definition of static models for them. Dynamic modelling has then assessed the long-term behaviour of these potential reservoirs, located offshore. Moreover, as required by the European Directive on the geological storage of carbon dioxide, OGS has been required, together with La Sapienza – University of Rome, to determine the baseline conditions on the sites before CO₂ injection. The studied area has an extension of ~ 400 km² around the most probable injection points, in water depths ranging from 13 to 50 m. Chemical and biological samplings of sea sediments and of the water column were performed over a grid of 20 stations, for a one-year period. These discontinuous measurements were integrated with continuous oceanographic



Fig. 2 The Porto Tolle project – site location and model of the power plant block with CO₂ capture facility

measurements which used 2 fixed sea-bottom stations with instruments to measure temperature, conductivity, pressure, dissolved oxygen, pH, dissolved CO₂ and sea currents every 0.5 m of the water column and to estimate waves height and direction. Moreover, approximately 40 sea-bottom stations have been used in about 15 grid nodes to continuously monitor dissolved CO₂ and CH₄, as well as temperature and pressure. These offshore activities are complemented by onshore baseline surveys (mainly geochemical and hydrogeological) performed by INGV.

OGS is also involved in the design of a suitable monitoring plan for the Porto Tolle project. It consists of a chain of actions involving:

- building a model of the physical properties in the rock formations from the surface to the storage reservoir;
- evaluating changes in the seismic properties, due to the injected CO₂;
- producing synthetic seismograms and tomographic modelling;
- evaluating the detectability of the CO₂, both in the hosting (CO₂ plume) and in the overlying formations (possible leakages);
- planning the most effective seismic acquisition patterns in terms of cost/benefits and lower impact on the investigated areas.

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Introduction of New ENeRG Members



IZIIS (FYR Macedonia)
www.iziis.edu.mk

The Institute of Earthquake Engineering and Engineering Seismology, IZIS, University "Ss. Cyril and Methodius" in Skopje was established in 1965, based on the recommendation of the International Consultative Board, by the decisions of the Government of Republic of Macedonia and the Authorities of the City of Skopje, with extensive support of UNESCO.

The scientific research activities of the Institute are aimed at

defining the technical basis for earthquake reduction. Throughout the development of the Institute, particular attention has been paid to the increasing and training of personnel, as one of the major factors determining the quality of the research.

The Institute carries out a large number of applied development and research projects and provides consulting services. In addition to direct co-operation of the Institute with universities, institutions and the economic sector, within the framework of the above mentioned activities, a permanent and intensive international co-operation has been developed and maintained. Such international collaboration is a prerequisite for more efficient and more complex scientific research within the Institute.

The different engineering, scientific and technical staff, the knowledge, the valuable equipment, the software tools, as well as the practical experience that has been gathered since 1965 through realization of many projects makes the Institute capable of the realization of complex tasks and these are a guarantee for the quality of service we can offer.

Recently, IZIS has been increasing research interests by geological exploration and modelling & geoinformatics activities, with the following main subjects of research and exploration:

- geological structures, including modelling of sedimentary basins;
- seismotectonic and seismogeological structures;
- engineering geology exploration;



- hydrogeological structures with groundwater and thermal water resources;
- geological surveys for the protection of the environment;
- geological potential of the land and groundwater pollution;
- geologic suitability of locations for waste landfills;
- natural resources of the country, including geothermal energy, hydrothermal systems and gas shales.

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SiteChar – FP7 project dedicated to set the criterion for site characterisation for the geological storage of CO₂

Launched in January 2011, the European SiteChar project (<http://www.sitechar-co2.eu>) aims to provide a valuable tool for the roll-out of geological storage on an industrial scale in Europe by developing a methodology for the preparation of storage license applications, incorporating all the technical and economic data, as well as the social dimension. SiteChar will examine the entire site characterisation work flow, from the initial feasibility studies up to the final stage of licensing, on the basis of criteria defined by the relevant European legislation: storage capacities, modelling of aquifers at basin or reservoir scale, injection scenarios, risk assessment, development of the site monitoring plan, technical and economic analysis, and public awareness.

The technical core of the project is dedicated to testing specific aspects of the developing site characterisation methodologies at five European potential storage sites, representative of various geological contexts: a North Sea offshore multi-store site (hydrocarbon field and aquifer) in the United Kingdom, an onshore aquifer in Denmark, a pair of onshore gas fields in Poland, an offshore aquifer in Norway and a carbonate aquifer in the Southern Adriatic Sea in Italy.

A key innovation will be the development of internal 'dry-run' licence applications at two sites that will be evaluated by a regulatory advisory panel. This iterative process will refine the storage site characterisation workflow and identify gaps in site-specific characterisation needed to secure storage licences under the EU CCS Directive, as implemented in the 'host' Member States.

Parallel to technical site characterisation, SiteChar will perform social site characterisation and public



engagement activities via the internet and information meetings. Site-specific information will be made available, tailored to the assessed levels of public awareness, knowledge, and information needs.

Results of public engagement will be evaluated to contribute to the evidence base of effective public engagement strategies.

SiteChar outcomes will be practical guidelines for technical and social site characterisation for use by storage site operators, regulatory bodies and the communication teams of the relevant stakeholders.

SiteChar will advance a portfolio of sites to a (near-) completed feasibility stage, ready for detailed front-end engineering and design.

Coordinated by IFP Energies nouvelles, the project gathers another sixteen partners from research and industry, as well as the consultancy sector, from ten EU countries: AGH, ECN, ENEL, GEUS, GFZ, IMPERIAL, BGS, OGS, PGNiG, Statoil, TNO, SINTEF-PR, UniRoma1-CERI, UfU, Vattenfall and the Scottish Government. The SiteChar project is also supported by Veolia Environment and Gassnova.

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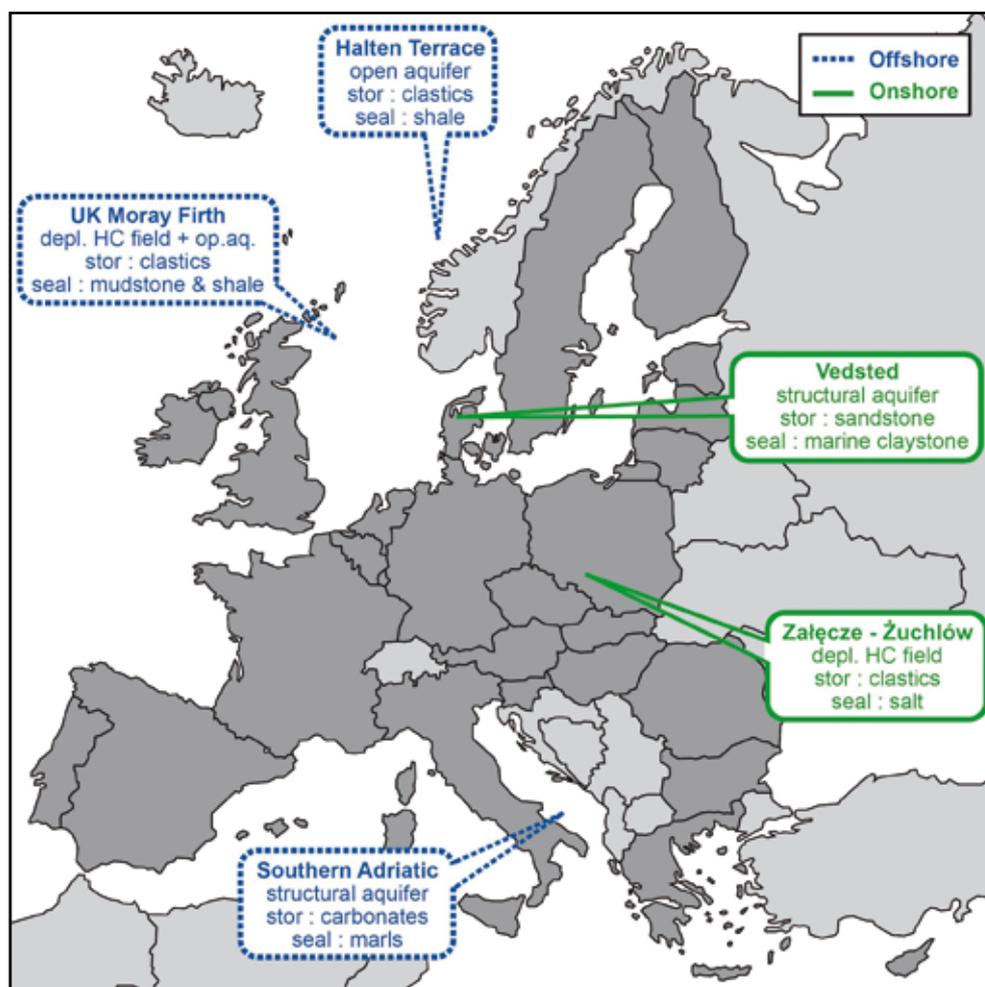


Fig. 3 The SiteChar site portfolio

ENeRG – European Network for Research in Geo-Energy

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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 related to the exploration and production of energy sources derived from the Earth's crust.

ENeRG president for 2011 is Marjeta Car from Geoinženiring, d.o.o., Ljubljana, Slovenia. Contact: m.car@geo-inz.si

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ENeRG website: <<http://www.energnet.eu>> is maintained by the Institute of Geology at Tallinn University of Technology, Estonia.

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ENeRG Newsletter – GEO ENeRGY

The Newsletter is published by the Czech Geological Survey (CGS), Prague, Czech Republic.

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ECO₂ – assessing the environmental risks of sub-seabed CO₂ storage

The EU funded project ECO₂ (www.eco2-project.eu) to evaluate potential environmental risks of carbon dioxide (CO₂) storage below the seabed was launched in May 2011. 27 project partners from nine nations will study existing sub-seabed storage sites in the Norwegian North Sea and the Barents Sea as well as natural seeps at the seafloor, to assess the safety of storage sites and the impact of potential CO₂ leakage on the marine ecosystem. The project is coordinated in Kiel, Germany by GEOMAR / Helmholtz Centre for Ocean Research.



Potential risks of sub-seabed CO₂ storage will be assessed comprehensively by a large team of geologists, biologists, chemists, economists, lawyers and social scientists from leading academic institutions and private companies. After four years they will provide not only a comprehensive

risk assessment but also guidelines for monitoring and a best environmental practice guide for preparation and management of storage sites. To meet these requirements, the scientists will study the two existing Norwegian offshore CO₂ storage sites *Sleipner* and *Snøhvit* as well as the depleting *B3 oilfield* in the Polish Baltic Sea, which could potentially be used as a storage site. They will re-assess whether or not gas is being released at these sites, how it could be transported through the different strata of the seafloor and the water

column, and which reactions are involved. Comparative data will be obtained at natural CO₂ seeps off Italy (Panarea), Japan (Okinawa Trough), Germany (Salt Dome Jüist), and Norway (Jan Mayen). Advanced instrumentation for monitoring of storage sites will be tested in the field during more than a dozen research cruises. The likelihood of leakage and the impact on marine organisms and ecosystems will be evaluated not only in the field but also by laboratory experiments and numerical modelling.

A dedicated working group will study how the public is responding to offshore CO₂ storage projects. The project results will be continually communicated to the general public and a stakeholder dialogue will be implemented with representatives from environmental NGOs, EU administrations, and operators of CCS projects. The first expeditions have already been conducted during spring and summer 2011 to monitor the seafloor and to evaluate the safety of the storage sites located in the North Sea and Barents Sea.

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The European Commission considers CCS as a potentially important technology for the reduction of greenhouse gas emissions and the mitigation of climate change. Since several European states (U.K., Norway, Netherlands, Italy) aim to store CO₂ below the seabed, more work needs to be done to evaluate the safety of these sub-seabed storage sites. The EU has thus allocated 10.5 Million to the ECO₂ project to evaluate the likelihood of leakage, the possible impacts on marine ecosystems, and the potential economic and legal consequences of leakage from sub-seabed storage sites.



Fig. 4 ECO₂ study sites in Europe

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