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GEO ENeRGY

CGS Europe – launch of a Pan-European Coordination Action on the geological storage of CO_2

Although the European Union has already made significant progress in advancing CO_2 Capture and Storage (CCS) as a key technology for combating climate change, the situation now calls for acceleration and an even spread throughout EU Member States and Associated Countries. This means supporting the 10–12 large-scale demos in Europe from all possible angles, so as to promote commercial deployment from 2020.

The CO_2 Geological Storage (CGS) part of the CCS chain deserves special attention because of its site-specific and delicate nature (wide range of scientific aspects, regulations still being developed, necessity to guarantee safety and efficiency over at least 1000 years, not yet fully proven, local acceptance issues, etc.). In this context, a three-year Coordination Action, CGS Europe, was launched on 1st November 2010, financed by the EC FP7 programme.

Essentially based on networking, CGS Europe will promote cooperation both:

- *Internally* – between the participants with true European coverage: 24 EU Member States and 4 Associated Countries thus leading to capacity building between the 34 institutes involved all with experience and references in CO_2 storage research,
- *Externally* – reaching out to national, European and international stakeholders and initiatives within the CCS community as well as to the general public.

This cooperation will be made easier by the fact that CGS Europe will build upon existing networks and relationships, with the well-established CO_2GeoNet Association acting as a nucleus, linked to the key geoscientific institutes from the CO2NET EAST and ENeRG networks, plus a few additional institutes from EuroGeoSurveys to increase coverage.

The objective of CGS Europe is to build a credible, independent, long-lasting and representative pan-European scientific body of expertise on CO_2 geological storage that will:

1. Instigate a durable networking of research capacity on CO_2 storage in all the relevant EU Member States and Associated Countries;
2. Liaise and coordinate its activities with other stakeholders and existing initiatives in Europe to help define and coordinate CO_2 storage research roadmaps and activities at national, European and international level;
3. Help reduce the existing gap between the 'forerunner' countries, where CCS activities have been started or planned, and those countries where these actions are not yet happening;
4. Contribute to the large-scale demonstration and industrial deployment of CCS;
5. Support the implementation of the European Directive on the geological storage of CO_2 and other regulatory regimes.

To achieve these aims, CGS Europe has planned a series of mechanisms to further enhance the collection, dissemination, and homogenization of scientific knowledge on CO_2 storage. The work plan consists of five work packages (WP), with efforts concentrating on:

- **Consortium management (WP1)**
- **Integration & networking (WP2)**, both internally and externally:
- **Knowledge management** – in order to accelerate the large-scale implementation of CCS, including:
  - i) Knowledge repository **(WP3)**: to collect, structure and summarise existing CGS knowledge for easy use,
  - ii) Knowledge development **(WP4)**: to foster this knowledge by bridging the gaps between the different countries and joining forces for increased capacity, and
  - iii) Knowledge dissemination **(WP5)**: to disseminate the results to a broader audience in a clear and appropriate manner.

One major outcome of CGS Europe will be a better understanding of the current status of CO_2 geological storage throughout Europe, a sort of pan-European knowledge pool structured to provide relevant information (reports, best practices, country status, etc.) to a wide and varied audience. Through various dissemination tools (knowledge-dissemination and awareness-raising workshops, a website with an online knowledge repository, publications, spring/summer school, etc.), CGS Europe will offer access to unbiased, scientific advice to national regulatory authorities, industrial stakeholders, the scientific community, media, the general public, etc.

The most concrete outcome of CGS Europe, at the

CALENDAR OF EVENTS

- **End January 2011:** Launch of the **CGS Europe Website** www.cgseurope.net.
- **April 2011: 1st CGS Europe Regional CCS-awareness-raising workshop**, Vilnius, Lithuania. Topics will include: Role of CCS in climate change mitigation, Global CCS perspectives, European policy and regulations; CCS status and developments in the Baltic Sea region, Research results and innovations in CGS.
- **9–12 May 2011: CO_2GeoNet 6th Open Forum, Venice**. This annual CO_2GeoNet event will be organized in 2011 through CGS Europe. It will bring together CCS stakeholders and provide them with the latest results and progress in the field of CO_2 geological storage. A European country-by-country overview will be presented, including an update on demos, FP7 results, status of the transposition of the EU CCS Directive. CGS Europe events in Venice will also include the **1st CGS Europe knowledge-sharing workshop focused on** "*Legal and regulatory issues for the implementation of the EU Directive on the geological storage of carbon dioxide* and the **2nd project General Assembly.**
- **Summer 2012**: 1st edition of a one-week CGS Europe CO_2 geological storage school for 25–30 students.

end of the EC funding period, will be **a durable European-wide scientific body on CO_2 geological storage,** forming the crossroads between national-European--Worldwide perspectives and needs in the field of CO_2 geological storage.

The Kick-off meeting and 1st General Assembly took place in Paris on 29–30 November 2010 with a good turn out. In all, 46 attendees from 26 EU Member States and Associated Countries gathered together to discuss and plan immediate activities. The EC Scientific Officer, Jeroen Schuppers, was there to meet participants and offer advice on project expectations and existing CO_2-storage-based initiatives and programmes with which CGS Europe will seek collaboration.

Rowena Stead, BRGM

CGS EUROPE – SOME KEY STATISTICS

3-year Coordination Action
Funding: EC FP**7**
24 Participants, including the CO_2GeoNet Association
(**11** members as third parties)
34 institutes specialized in CO_2 storage matters
24 EU Member States and
4 Associated Countries

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Austria	Latvia
Belgium	Lithuania
Bulgaria	Netherlands
Croatia	Norway
Czech Republic	Poland
Denmark	Portugal
Estonia	Romania
Finland	Serbia
France	Slovakia
Germany	Slovenia
Greece	Spain
Hungary	Sweden
Ireland	Turkey
Italy	UK

CGS Europe participants at the kick-off meeting in Paris, 29–30 November 2010

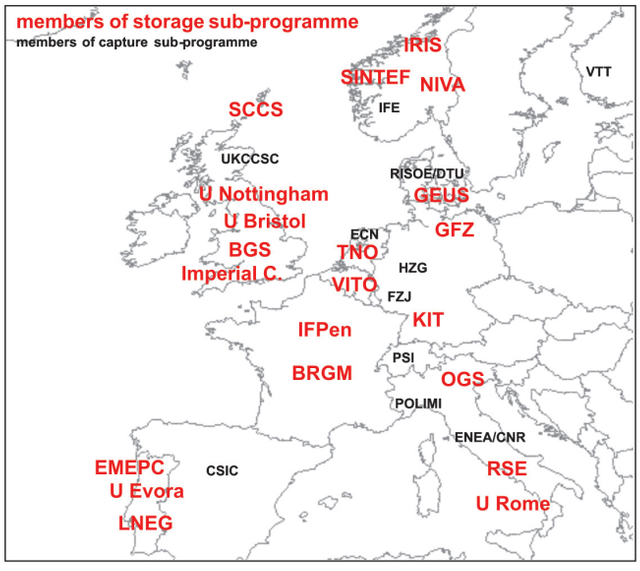
EERA Joint Programme on Carbon Capture and Storage

At the last SET-Plan conference held in Brussels on 15–16 November 2010, the European Energy Research Alliance (EERA, www.eera-set.eu) launched its Joint Programme on Carbon Capture and Storage (CCS-JP). EERA aims to strengthen, expand and optimise EU energy research capabilities through the sharing of world-class national facilities in Europe and the joint realisation of pan-European research programmes in the field of new energy technologies. The CCS-JP involves over 30 members from 12 countries who have committed more than 270 person years/year to carry out joint R&D activities.

The programme is structured in two sub-programmes: CO_2 capture and CO_2 storage. In the future, and depending on the dynamics of the programme, it is expected that other research themes, such as CO_2 transport, may also become part of the programme.

In CO_2 storage, the R&D activity will focus on static and dynamic modelling of the subsurface and its interaction with injected CO_2 and on associated monitoring methods. The general objective of this programme is to produce significant advancements on the issues that are recognised as key elements for a safe and wide deployment of CO_2 geological storage:

- identification and characterization of suitable geological complexes that may be used for storing CO_2, with no interference with other human activities, no impact on the ecosystem, having capacities that match the sources and that guarantee safe conditions for the whole period of storage operations, closure and post closure;
- development of tools that allow better understanding and evaluation of the behaviour at different time scales of the injected CO_2 and its interactions with the storage complex and the surrounding formations up to the surface;
- further development and integration of a large set of currently available monitoring techniques and the definition of recognised protocols for their use in a variety of geological, environmental and operative contexts.



The CCS-JP has been built through a series of workshops dedicated to the different R&D areas. In the next months, the programme members interested in joining forces on identified subjects will meet and set up joint projects. We will also investigate how to integrate on-going R&D work into the CCS-JP framework. Moreover, the programme will contact other initiatives and organisations in order to streamline its actions.

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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 related to the exploration and production of energy sources derived from the Earth's crust.
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EERA Joint Programme on Geothermal Energy

Although the geothermal energy stored in the Earth is huge (over 12 Petajoules), only a limited amount is accessible and usable with the mature technology that has been developed in the last 50 years. At present, the worldwide geothermal energy production provides less than 1% of the world's energy needs, but the geothermal resources confined in the first 6 km of the Earth's crust are estimated to be above 200 GW, of which 50–80 GW are in Europe .

The vast majority of geothermal energy is commercially produced from hydrothermal systems, where hot fluids (water, brine or steam) are extracted from natural high-permeability reservoir rocks. A small amount is derived from enhanced or engineered geothermal systems (EGS), where the heat stored in very deep (4–6 km) low-permeability rocks is transported to the surface through man-made water loops. Geothermal energy can be transformed into electric energy using different conversion technologies and/or directly used as thermal energy in district heating, agriculture and industrial processes, and in spas.

In Europe, the installed geothermal electricity power is about 850 MW in the EU 27, (810 MW in Italy alone), 574 MW in Iceland and 79 MW in Russia. The European installed power capacity is expected to increase and some scenarios foresee about 6000 MW of installed capacity by 2020.

The EERA Joint Programme on Geothermal Energy (JPGE) aims for an outstanding contribution to meet the EU's climate and energy policy targets for 2020 and beyond, through the large-scale deployment of the clean and efficient base-load power supplied by the indigenous geothermal resources.
The overall goal of JPGE is to develop and apply in pilot projects innovative and cost-effective technology viable to:

- significantly enhance the production from already identified and utilized resources;
- explore at large scale new untapped deep-seated (up to 6 km) hydrothermal systems;
- make the Engineered Geothermal Systems technology ready for large-scale deployment;
- access new "high-potential" resources such as Supercritical fluids and Magmatic systems;
- improve the environmental sustainability and social acceptability of geothermal projects.

The JPGE will be developed over 10 years and currently brings together over 250 scientists from 12 different European Research organizations in a strategically oriented endeavour. Research infrastructure such as laboratories and computer facilities will be used and opened to other participants for the specific research activities included in the following Sub Programmes:
(1) Resource assessment
(2) Accessing and Engineering of the Reservoir
(3) Process Engineering and Design of Geothermal Systems
(4) Operation and Management of Geothermal systems
(5) Sustainability, Environment and Regulatory Framework

The main milestones of the JPGE are:
Within two years: to demonstrate the potential for a coherent geothermal energy development of the major European players, strengthen the R&D capacity by intensified collaboration whilst creating a substantial synergy sharing experience and infrastructures including "natural laboratories" such as Soultz, Groß-Schönebeck, Icelandic IDDP, Larderello, etc.

Within five years: to achieve proof-of-principle technological milestones for the development of all technical elements needed for the deployment of geothermal systems for large-scale electricity and heat/chill production.

Within 10 years: to develop demonstration projects that will permit the testing of new technological solutions in preparation for their transfer into industry.

JPGE will promote education and training initiatives in the geothermal sector and will be open to Research Organizations that can bring significant contribution of resources and infrastructures.

JPGE has been conceived in close collaboration with the Services of the European Commission and geothermal organizations such as EGEC, aiming to form a unique European Geothermal Energy programme, which is capable of attracting significant R&D funds, streamlining and harmonizing R&D programmes.

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Introduction of new ENeRG members

EMSI (Turkey)
http://www.mam.gov.tr/english/YDBE/index.html

The Earth and Marine Sciences Institute (EMSI) of the TUBITAK Marmara Research Center (MRC) is a research and technology center specialized in strategic research in the areas of Natural Resources and Geo-hazards of Geological Origin, using advanced technology based on measurements, monitoring and computer-aided modeling. In terms of earthquake monitoring, EMSI has broad experience in running networks of seismology, GPS and geochemistry in different tectonic regimes of Turkey. EMSI has been a strong partner in international earthquake research projects, owing to its capabilities in generation of in-situ earthquake precursor data and the current technology it uses in its processing.

Crustal structure studies are carried out to determine the physical and structural characteristics of the tectonic blocks and their bounding faults. The crustal structure data produced play an important role in the understanding of the seismicity, site amplification, mechanic-dynamic characteristics of fault zones and in seismic-hazard assessment studies. The measurement of crustal deformation, both long-term (plate movements) and short-term (earthquakes, landslides and creep), leads to the determination of strain anomalies that have potential in terms of future earthquake prediction. The institute has established a continuous GPS (Global Positioning System) network in the Marmara region and has gained a sound reputation based on its background and knowledge in the use of GPS technology in the earth sciences. The institute has become an active center in mapping the deformation accumulations at cm-accuracy for regional scale by studying the interferometric analysis techniques (InSAR- Interferometric Synthetic Aperture Radar) and in measuring the vertical movements at mm-scale by microgravimetric studies. These capabilities make EMSI a strong partner in earthquake research projects, including EC-supported projects. EMSI participated in the EC 6th Framework Project FORESIGHT, where Turkey was considered as a natural laboratory to study the triggering of natural-hazard events. The success achieved in FORESIGHT initiated its participation in the sequel SCHEMA project. These are to be followed by EC 7th Framework Projects, EPOS, Pre-Earthquakes and BlackSeaHazNet projects.

EMSI is strengthening its position so as to enter the field of monitoring geothermal fields in terms of determining surface deformation as well as induced seismic activity brought about by geothermal exploitations. In such a context, EMSI can apply its expertise in micro-seismology as well as in GPS and microgravity.

Due to the environmental protection act, Turkey is now committed to reducing industrial CO_2 emissions. One of the ways is through Carbon Capture and Storage. In this respect, EMSI is actively involved in participating in EU Projects to enhance its capacity and accumulated knowledge towards CO_2 capture and underground storage.

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Introduction of new ENeRG members

NCCCS (U.K.)
www.ncccs.org.uk

The National Centre for Carbon Capture and Storage (NCCCS) is a pioneering new joint venture that brings together the combined expertise of The University of Nottingham's engineering group, one of the best in Europe, and the British Geological Survey's CO_2 storage centre of excellence. The NCCCS is one of the world's first integrated research centres in carbon capture and storage (CCS) and is well placed to take advantage of a new industry that will abate 1.5 to 4 gigatonnes CO_2/yr by 2030 and be worth £20B/yr. The Centre addresses an acknowledged vital need for cross-disciplinary research by bringing together a critical mass of expertise which is roughly double the size of any comparable institution in Britain. The Centre aims to be a world leader in both research and training and is well placed to participate in major demonstrations of CCS that are planned both in the UK and worldwide.

The NCCCS is involved in a large number of UK Government (DTI/BERR and TSB) and European Union (EU-FP and RFCS) projects involving extensive collaboration with a wide industrial base, including power generators, oil and gas companies and other stakeholders. Current R & D programmes include:

Capture:
- Development of high capacity adsorbents for more efficient capture.
- Novel high temperature sorbent systems.
- Oxyfuel cryogenic capture.

Transport:
- Development of compression technologies for transport and storage of CO_2.
- Materials for advanced CO_2 transportation.

Storage:
- Storage capacity estimation, including peer-review and due diligence of industrial proposals for CCS and storage capacity.
- Modelling and experimental studies of carbon storage in saline aquifers, oil and gas wells.
- Monitoring of CO_2 leakage.
- Influence of contaminants during CO_2 storage and effects on the host rock and cap rock.

Utilisation and recycling of CO_2:
- Decentralised CCS options, with a focus on mineralisation processes for above ground.
- Artificial photosynthesis for CO_2 conversion into chemical building blocks and fuels.

Environmental and social impacts:
- Ecosystem responses to releases of CO_2, including remote sensing technology.
- Public acceptance of CCS, exploring how lay views are conditioned.

NCCCS' activity in China includes the COACH project (Cooperation Action within CCS China-EU; 2006-2009) and China-UK NZEC project (Near Zero Emissions from Coal; 2008-2009).

The Centre has experience in providing Continuing Professional Development Courses in the UK and has recently run a short course in CCS in China at the Shanghai Expo. The courses are taught by experts at NCCCS and cover aspects of climate change, capture, pipeline engineering and CO_2 transport, and storage. The Centre will be running more courses throughout 2011 both in the UK and internationally. We are also planning to develop a Masters course in CCS, which will be run at The University of Nottingham campuses in UK and China.

The international profile and outreach activities of the NCCCS are already high as both institutions have always participated in large international conferences, international expert missions and workshops. NCCCS have experience in providing workshops and conferences and have taught on the COACH project summer schools. The Centre will continue to raise the profile of CCS by continuing to hold and attend high profile conferences and workshops and by increasing collaborations with industry, international energy advisors, government organisations, universities and other research centres.

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