



The potential contribution of CO₂ Geological Storage to climate change mitigation, both globally and in Italy

Side event of the International Conference in Paris, July 2015:
“Our common future under climate change”

July 13, 2015; 9:30 – 13:00

Sapienza University of Rome -- Department of Earth Sciences

The presentations are available at this link:

<http://www.ceri.uniroma1.it/cn/index.do?id=166&page=88>

Video of the event: <https://youtu.be/FgOiakNtJnU>

The event was organized by **Sapienza University of Rome** (CERI Research Centre, Department of Earth Sciences, Department Civil, Construction and Environmental Engineering – DICEA) together with **CO₂GeoNet**-European Network of Excellence on the geological storage of CO₂, the **Geological Society of Italy**, **OGS** - Istituto Nazionale di Oceanografia e di Geofisica Sperimentale and **SOTACARBO**.



The goal of the event was to illustrate the potential application of Carbon dioxide Capture and Storage in Italy as a climate change mitigation technique, outlining the state-of-the-art on CCS technology to stimulate interest and debate on the potential contribution CCS can make to Italy's future GHG emission cuts.

A large number of people (about 70) took part in the various moments of the event, including young geology and environmental science students as well as members of the Geological Society of Italy, environmental scientists and engineering professionals. The participation of students was particularly encouraged and appreciated because they represent the future labour force for the spread of this technology on an industrial scale. Also dialogue with the participants was given space discussing safety concerns, feasibility and costs.



The event consisted of a series of presentations addressing the technology behind CO₂ capture and storage, modelling of fluid migration in the sub-surface, potential impacts of CO₂ leakage, and satellite monitoring. The session closed with a presentation on the social aspects of CCS and what studies have shown regarding the public's perception of this emerging technology.

After the introduction by **Professor Gabriele Scarascia Mugnozza**, Director of the Earth Sciences Department and Pro-Rector for Territorial Cultural Relations of Sapienza University of Rome, explaining the scope of that workshop, there was the screening of a short video produced by the hosts within the EC-funded ECO2 project: "**CCS – A bridging technology for the energy of the future**" https://youtu.be/RDU_PTKII_g which provides a quick and easy to grasp introduction to the CCS concept.

The first presentation was given by **Professor Salvatore Lombardi** - Sapienza University of Rome who, with his research group was a pioneer for scientific research on CCS technologies. He highlighted that CCS has the potential to greatly reduce greenhouse gas (GHG) emissions in the



short to medium term. Lombardi described the process that involves the capture of man-made CO₂ from large point sources, such as power plants or heavy industry plants, followed by its injection into porous rocks deep underground for permanent storage.

He illustrated the scientific basis for CO₂ geological storage, the importance of CCS in the world and the feasibility of geological storage of CO₂ by describing examples like Weyburn in Canada and Sleipner in Norway and the safety of CCS.

Professor Francesca Bozzano, Director of CERI, then talked about the importance of monitoring ground surface displacement during the geological storage of CO₂ to ensure site safety by using satellite-based radar interferometry. Synthetic Aperture Radar Interferometry (InSAR) is a powerful technique for the monitoring of the displacement. This technique, which can be applied by satellite, aerial or terrestrial platforms, is based on the SAR principle and the interferometric principles.

It consists of a combination of several radar images taken while the emitting and receiving antennas move along a predefined trajectory (an orbit for a satellite, a route for an airplane or a rail in the case of ground based instruments). The combination of radar images that are acquired during the movement of the antenna, by the focalization approach, allows to obtain 2D images of the sensing scenario with a high range (instrument-scenario joining direction) and cross - range resolution (direction normal to the range direction in the horizontal plane).

She finished her presentation describing an example of "success" of monitoring on deformation of the topographic surface in a real site - In Salah gas project (Algeria) obtained by a well-known Italian company: TRE.



The third presentation was by **Professor Sabina Bigi**, Sapienza University of Rome. She explained the potential link between faults and fluid migration as related to geological storage, showing how faults can be either a barrier or conduit for CO₂ movement depending on their physical characteristics. In particular she highlighted that the faults are flow paths of fluids to the surface, but in many cases they also act as barriers.

In the case of geological storage of CO₂ they are an important element to define and study. The construction of well bound mathematical models with real data allows to establish procedures to prevent reactivation processes and leakage during the storage.



The problem of safety and monitoring of geological CO₂ storage sites was addressed by **Stan Beaubien**, a researcher at Sapienza University of Rome. He explained that although a well-chosen and well-engineered site is not expected to leak, we still have to ensure that we know what the potential risks are and how to minimize them. The talk was divided in two, the first part addressing sites situated on land and the second those located off-shore at sea. The reason for this approach is that potential impacts would be very different in these two environments, as would be the types of tools needed to find a leak. He summarized some of the most recent European and nationally funded research projects addressing these items, particularly measurements and experiments conducted at sites where naturally formed CO₂ is leaking at the surface as well as sites where CO₂ was intentionally injected in the near surface to mimic what might happen should a CCS site leak. These projects include CO₂GeoNet, RISCS, ECO₂, and QICS. Impact on land has been shown to be very spatially limited, with poor growth and altered chemistry within a small area around the centre of a leak (a few metres across), but with normal conditions and values very nearby. In a marine environment recent studies have shown how rapidly CO₂ can be mixed and diluted due to the dynamic nature of ocean currents. In CO₂ release experiments both on land and off-shore, it was



found that when the CO₂ injection had stopped, the ecosystem recovered very quickly. Finally a very brief introduction to some monitoring tools, both on land and at sea have good potential to give early warning and to define the location of the leak itself.

Giuseppe Girardi, Vice President of Sotacarbo Spa, spoke about the importance of the potential for geological storage of CO₂ in Italy, how can you capture it, the realization costs, and the environmental and energy benefits that it entails. He emphasized that the potential for the use of this technique in Italy was greatly improved by a recently ratified law that will subsidize the construction of a 350 MWe coal-fired power plant and CCS demonstration plant in southern Sardinia, with the eventual injection of the recovered CO₂ into a >1000-1500 m deep saline carbonate aquifer. The Sulcis is a large scale demonstration pilot plant «ready for CCS»: a coal power plant, based on flameless oxy- combustion, that produces fumes, at ultra low emission level, represented by concentrated CO₂ delivered to the atmosphere.



The last presentation was given by **Samuela Vercelli**, Sapienza University of Rome, who addressed the public perception of CO₂ geological storage in Italy, thanks to studies conducted during the EC-funded ECO₂ project, which highlight the importance of the involvement of the citizens in the decision making processes about this technology. She illustrated how CCS is perceived as something distant from every-day life but at the same time how this topic can become an entry point for discussion on important issues that concern citizens very much, like life styles, the relationship with nature, policy and information processes. People are also uncertain as to how to evaluate CCS and both curious and interested on many aspects like costs, role of CCS in energy strategies, risks not just in terms of safety but also in relationship to implementation processes such as risks of financial speculation, criminal manipulation, etc. The relationship with the public is key in all phases of the



decision making processes, and the ECO₂ research has indicated that people involved after decisions have been made are more suspicious and less collaborative.

Finally she presented the work done to produce dissemination materials for the public and stakeholders like the report <http://www.lombardiresearchgroup.com/pagina/public-perception/the-geological-storage-of-co2:-and-what-do-you-think-518/>

The second part of the workshop was dedicated to Questions & Answers to allow the participants to interact with the presenters and to debate the technologies and themes raised during the event. At the end of the event there were the refreshments that allowed the audience to mingle with the panel members to foster additional exchange and a direct discussion of the items raised during the workshop.

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