CGS Europe

Pan-European coordination action on CO_2 Geological Storage

(Coordination and support action)

SEVENTH FRAMEWORK PROGRAMME

THEME [ENERGY.2010.5.2-2]
[Trans-national cooperation and networking in the field of geological storage of CO_2]

OUTLINE

- Why CO_2 must be controlled ? Primary ways to control CO_2 in the atmosphere.
- EU Project « CGS EUROPE»
  - Goal
  - Srategy
  - Workplan
  - Work packages
  - Meetings organised
  - Publications
  - Expected internal and external impacts

Climate Change and its effect on life on earth had challenged the scientists and industry to come up with ideas to combat this problem by decreasing and / or eliminating CO_2 which results from human activities,

Reduction in CO_2 emitted to atmosphere is main target in this war.

It is accepted that in industrial applications the first route is to:

- Increase efficiency (about 50% reduction is expected),
- The next high reduction (~ 20 %) is anticipated to come from CO_2 capture and storage, CCS.

CO_2 Capture and Storage has 3 main phases:

- Application of technlogy to capture CO_2 from flue gases of industrial plants/power plants
- Transport of captured CO_2 by pipeline, road tankers, sea tankers to storage sites,
- Injection of CO_2 to underground geological storage sites , deep into earth and then monitoring for the leaks to make sure that CO2 stays underground.

Capture technology had become mature enough to be applied to power plants and other industrial sites.

The challenge is now in the geological storage, do we have enough storage capacity ? Can we couple emmision points with storage sites ?

The present project:

CGS Europe « Pan European Coordination Action on CO_2 Geological Storage»

is designed so that EU and Associate Country representatives will share knowledge and initiate new pojects on CO_2 storage.

Objective

- **To build a credible, independent and representative scientific body of expertise on CO_2 geological storage that will:**
  - Create a durable network of research capacity
  - Coordinate its activities with other stakeholders, including the ZEP Technology Platform
  - Help reduce the existing gap between the ‘forerunner’ countries, and the ‘follower’ countries
  - Contribute to the large-scale demonstration and industrial deployment of CCS
  - Support the implementation of the **EU Directive** on the geological storage of CO_2 and other regulatory regimes

European Scientific Expertise on CO_2 Geological Storage

Started with **CO_2GeoNet** in 2004

CGS Europe this pooling will enlarge to the whole of Europe through collaboration with key geoscientific institutes from:

- **CO2NET EAST** – Coordination Action on CCS (2006-2010), involving 7 R&D institutions representing 5 new EU Member States and 2 Associated Countries
- **ENeRG** – European Network for Research in Geo-Energy, created in 1993, 60 members from 28 countries
- **EuroGeoSurveys** – European Association of national geological surveys

Created as a FP6 Network of Excellence in 2004

Transformed into a non profit Scientific Association under French law in 2008

As an <u>independent</u> and <u>multidisciplinary</u> scientific body, CO_2GeoNet has the key role of building trust on CO_2 geological storage and supporting wide scale CCS implementation

CGS Europe

Project duration

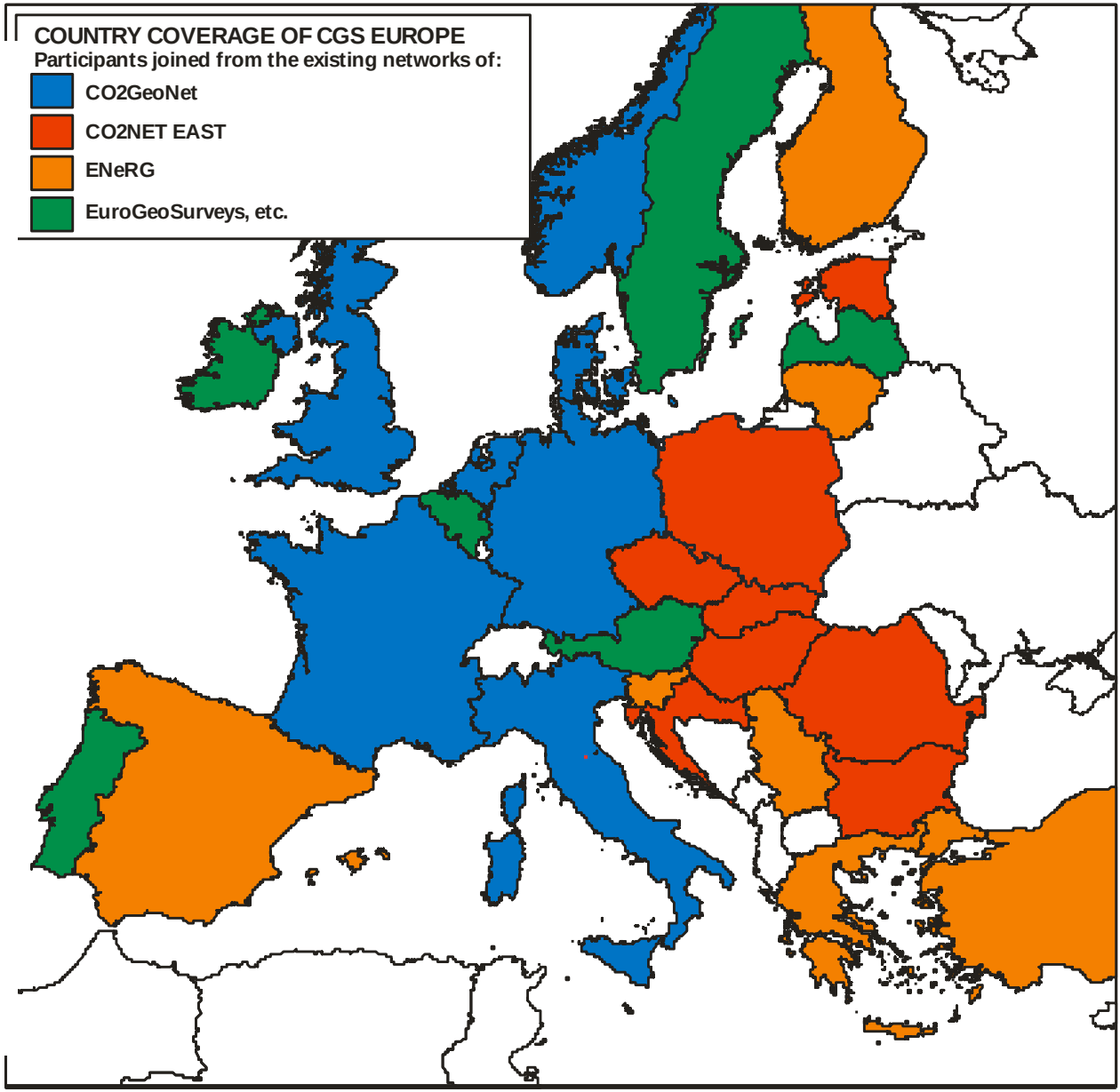
3 years (November 2010 – October 2013)

Partnership

34 research institutes from 28 countries (24 EU Member States and 4 Associated Countires)

Coordinator

BRGM – Isabelle Czernichowski Lauriol



Project Consortium – Goals for Creation:

- Provide wide geographical coverage by including most European countries
  - the consortium covers most of Europe and specifically includes those countries with the main potential for storage, although not exclusively so
- Bring together key research institutes, leaders in CO_2 storage research and newcomers, actors on national and international level
  - all the participants of the consortium are research-oriented institutions and represent in their country an independent body of expertise on CO_2 geological storage
- Pool expertise from all over Europe
  - each institute brings into the consortium both a developed knowledge of the local geology, together with the national CCS context, and a specific expertise in certain aspects of CO_2 geological storage

List of Participants

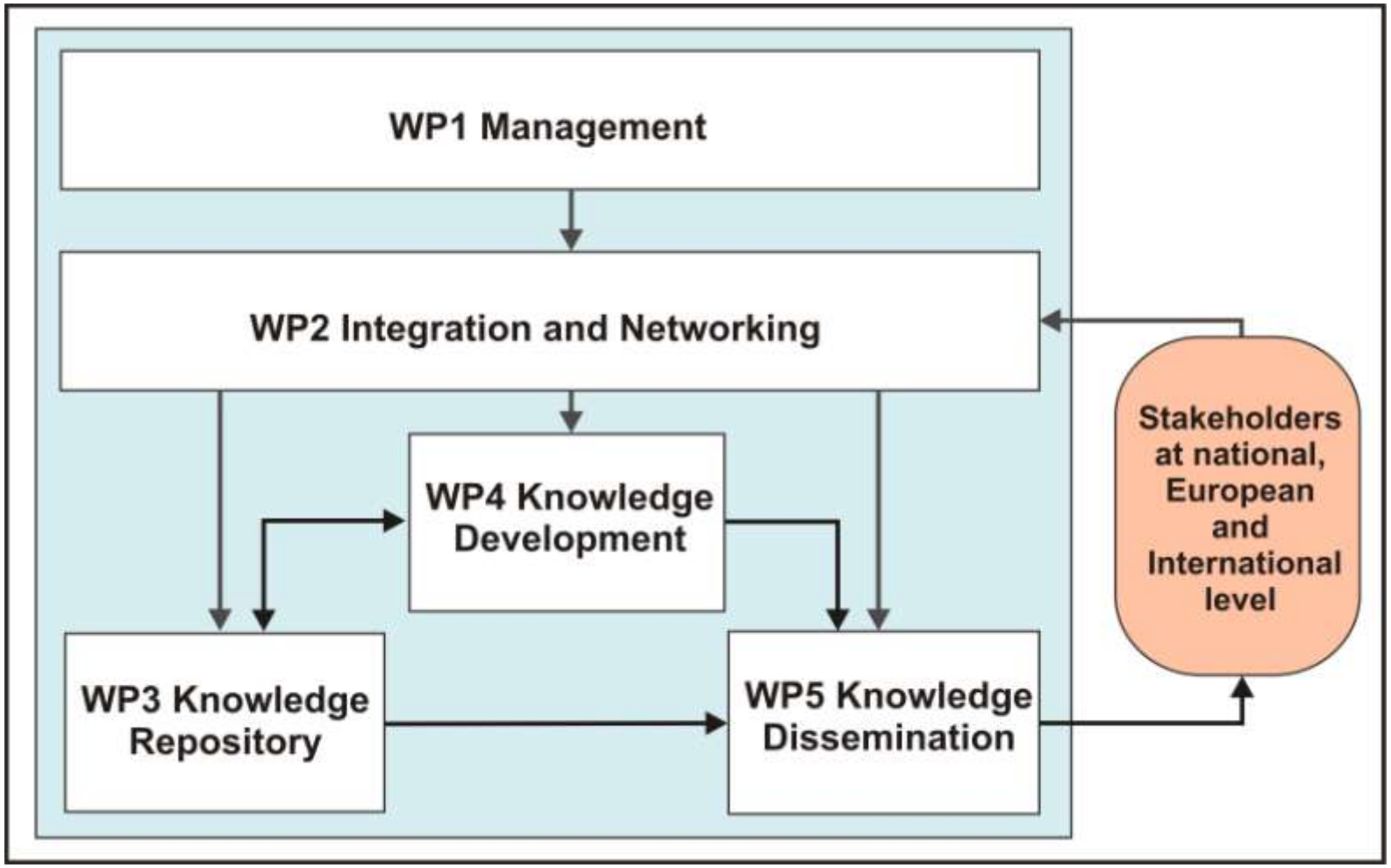
No	Name	Short name	Country
1	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES	BRGM	France
2	CO2GEONET - RESEAU D'EXCELLENCE EUROPEEN SUR LE STOCKAGE GEOLOGIQUE DE CO2	CO2GeoNet	France
3	BUNDESANSTALT FUR GEOWISSENSCHAFTENUND ROHSTOFFE	BGR	Germany
4	GEOLOGISCHE BUNDESANSTALT	GBA	Austria
5	INSTITUT ROYAL DES SCIENCES NATURELLES DE BELGIQUE	RBINS-GSB	Belgium
6	SOFIISKI UNIVERSITET SVETI KLIMENT OHRIDSKI	SU	Bulgaria
7	CESKA GEOLOGICKA SLUZBA	CzGS	Czech Republic
8	TALLINNA TEHNIKAULIKOOL	TTUGI	Estonia
9	GEOLOGIAN TUTKIMUSKESKUS	GTK	Finland
10	INSTITUTO GEOLOGIKON KAI METALLEYTIKON EREYNON	G-IGME	Greece
11	MAGYAR ALLAMI EOTVOS LORAND GEOFIZIKAI INTEZET	ELGI	Hungary
12	Department of Communications, Energy and Natural resources	GSI	Ireland
13	LATVIJAS VIDES, GEOLOGIJAS UN METEOROLOGIJAS CENTRS SIA	LEGMC	Latvia
14	Gamtos tyrimų centras	GTC	Lithuania
15	PANSTWOWY INSTYTUT GEOLOGICZNY - PANSTWOWY INSTYTUT BADAWCZY	PGI-NRI	Poland
16	Laboratorio Nacional de Energia e Geologia I.P.	LNEG	Portugal
17	INSTITUTUL NATIONAL DE CERCETARE-DEZVOLTARE PENTRU GEOLOGIE SI GEOECOLOGIE MARINA-GEOECOMAR	GEOECOMAR	Romania
18	STATNY GEOLOGICKY USTAV DIONYZA STURA	SGUDS	Slovakia
19	GEOINZENIRING DRUZBA ZA GEOLOSKI INZENIRING DOO	GEO-INZ	Slovenia
20	INSTITUTO GEOLÓGICO Y MINERO DE ESPAÑA	S-IGME	Spain
21	SVERIGES GEOLOGISKA UNDERSOKNING	SGU	Sweden
22	University of Zagreb, Faculty of Mining, Geology and Petroleum Engineering	UNIZG-RGNF	Croatia
23	**MIDDLE EAST TECHNICAL UNIVERSITY**	**METU-PAL**	**Turkey**
24	FACULTY OF ECOLOGY AND ENVIRONMENTAL SCIENCES	UB	Serbia

CGS Europe Strategy

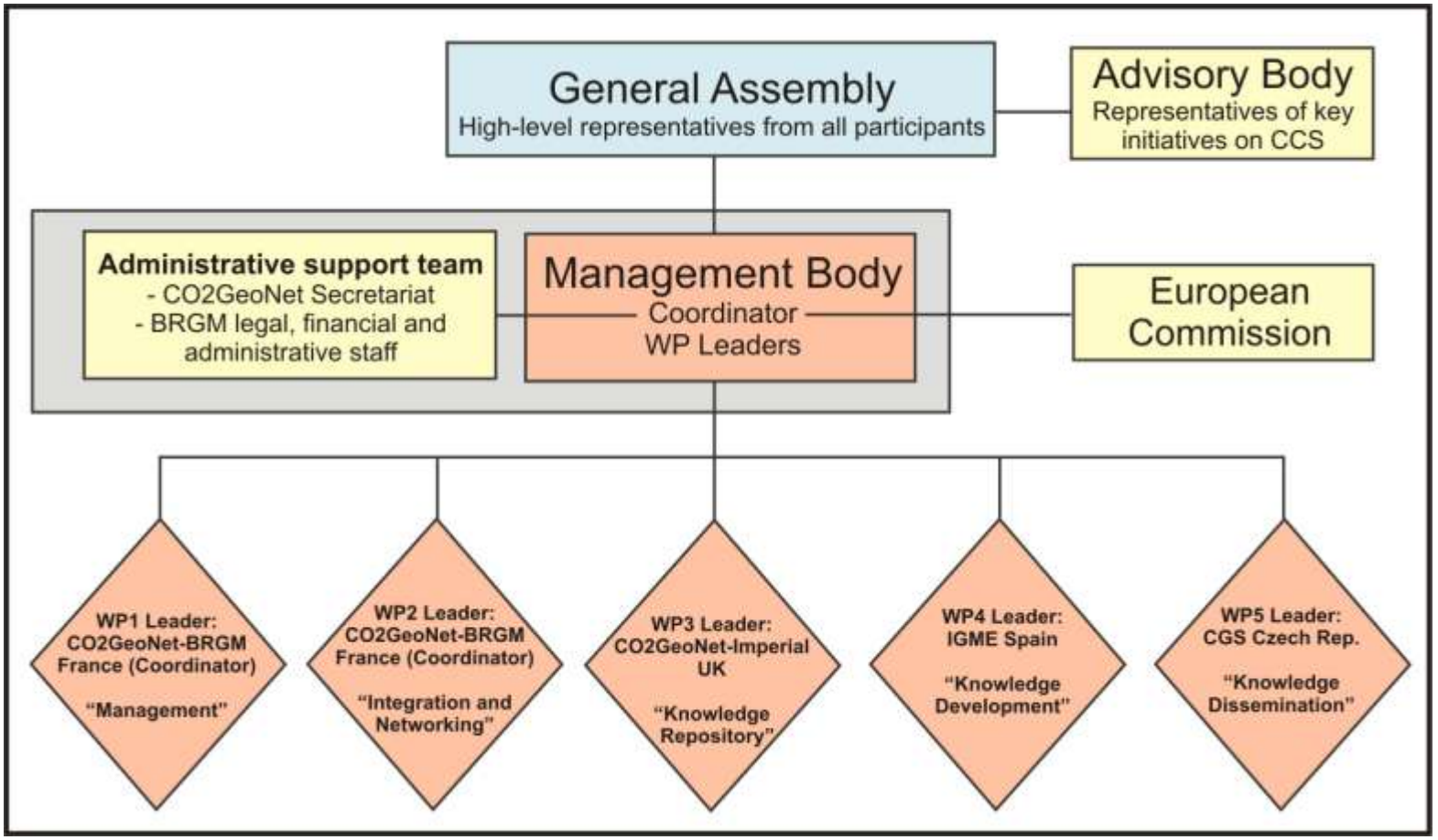
Focus on **knowledge management**:

- **Knowledge Repository**: collect, structure, summarize knowledge for easy use
- **Knowledge Development**: joint research through alignment of institutes' research programmes and external support, knowledge-sharing workshops, staff-exchange programmes
- **Knowledge Dissemination**: Annual Open Forum, CO_2 storage awareness-raising workshops, CO_2 Storage Spring Schools, Brochures, a central website with links to national websites

Work Plan Organisation



Organisational Structure



WP1 - Management

Leader: **BRGM**, France

Main objective:

- to execute the operational, legal, financial and administrative management of the CGS Europe consortium

Management Board:

- Isabelle Czernichowski-Lauriol (BRGM)
- Anna Korre (CO2GeoNet – Imperial)
- Roberto Martinez Orio (S-IGME)
- Vit Hladik (CzGS)

WP2 – Integration and Networking

Leader: **BRGM**, France

Objectives:

- to encourage and support each participant to **work together** in order to build a scientific body of expertise on CO_2 geological storage,
- to **develop networking activities between CGS Europe and external bodies** and establish initiatives that will last beyond the end of the EC contract,
- to search for external funding opportunities in order to expand activities, **prepare for self-financing** after the end of the project period .

WP3 – Knowledge Repository

Leader: **CO2GeoNet-IMPERIAL**, UK

The objective is to produce **CO_2-storage-related information**

Main activities:

- Development of **knowledge repository database**
- Produce **key summary reports** on :
  - Monitoring methods
  - Storage site selection methodologies and requirements
  - Regulatory regimes related to operational and safety risks

WP4 – Knowledge Development

Leader: **IGME**, Spain

Objectives:

- to encourage **sharing of knowledge**

  by organising:

  - workshops for geoscientists
  - workshops for other stakeholders
- to **coordinate research** activities between the CGS Europe participants **by promoting scientist exchange between partners**
- to favour the emergence of **new** targeted research **projects**

WP5 – Knowledge Dissemination

Leader: **Czech Geological Survey**, Czech Republic

Objectives:

- to stimulate **knowledge transfer** and information dissemination
- to **raise** general **awareness** of CCS as a climate change mitigation measure
- to facilitate the implementation of the **European Industrial Initiative** on CCS mentioned in the SET plan
- to support implementation of the **EU Directive** on the geological storage of carbon dioxide

WP5 – Knowledge Dissemination

Main activities:

- Project website www.cgseurope.net

Knowledge Dissemination

- Venice Open Forum (every year)
- Knowledge dissemination workshops & planned)
- CCS awareness raising workshops (3 planned)
- Spring School on CO2 storage (2 planned)

Annual Open Forum
May 2011 Venice
April 2012 Venice

Workshops
CGS knowledge-dissemination

- Denmark / Norway (Copenhagen) – organised on 12-13 December 2011
- Spain (Madrid) – Spring 2012
- Italy (Rome) – Autumn 2012
- France (Lorraine) – postponed to 2013
- Greece (Athens) – postponed to 2013
- Finland (Espoo) – 2013

Workshops

CCS awareness-raising workshops

First workshop 13-14 April 2011, Vilnius, Lithuania

CCS Awareness-raising workshops

Second workshop 13-14 June 2012
Ankara TURKEY,
Middle East Technical University

Third awareness raising workshop
will be in Bulgaria, June 2013

CGS Europe Spring School on CO_2 geological storage

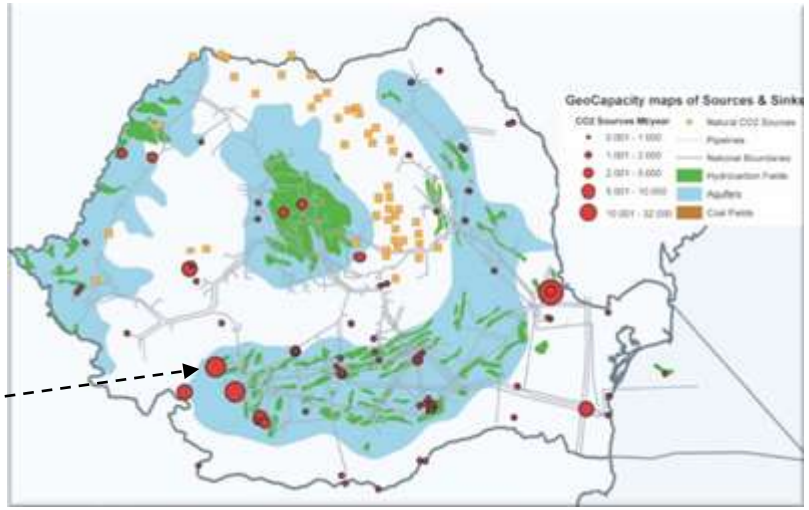
March 12–18, 2012
at Leszcze near Bełchatów, Poland

Polish Geological Institute
National Research Institute

19 participants from 11 countries

Second Spring School on CO_2 storage

Next Spring School 2013, probably in March in Romania hosted by GeoEcoMar



CO_2GeoNet Educational Brochures

- 13 additional language versions

Several papers and leaflets were prepared to introduce the project at different meetings or as information to media

EUPROFILE

CO_2 geological storage

Where do we stand in Europe?

Since the very first European research project initiated in 1993 under the 3rd Framework Programme, called Javle II 'The underground disposal of carbon dioxide', many developments have led towards the emergence of a new technology. CCS for CO_2 capture and storage, which could contribute 20% of the CO_2 reduction needed by 2050 in order to combat climate change. According to the EU Energy Roadmap 2050, CCS needs to be applied from around 2030 in the power sector in order to reach emission reduction targets. It is also an important option for decarbonisation of several heavy industries and, combined with biomass, could deliver 'carbon negative' values. The timeline in Fig. 1 describes key milestones at European and international levels. Much progress has been made on the scientific, technical, economic, regulatory and societal aspects. So, where do we stand now in Europe? Will we be ready for starting progressive commercial deployment from 2020?

Fig. 1: Timeline from pioneer research project to large-scale demos and industrial deployment

CO_2 geological storage can be done safely

A good level of confidence has been reached in terms of safety, based on a variety of previous experience and know-how:

- Studies of many natural sub surface CO_2 accumulations;
- CO_2 injection for Enhanced Oil Recovery (EOR);
- Seasonal natural gas storage (CH_4);
- Major cooperative research programmes on CO_2 geological storage since 1993;
- Pioneer large-scale industrial CCS projects, eg Sleipner (Norway) from 1996, Weyburn (Canada) from 2000, In Salah (Algeria) from 2004;
- Small-scale CO_2 injection pilots: Frio (USA), Ringkøbing (Japan), Ketzin (Germany), Otway (Australia), Lacq (France), etc;
- Best practice manuals;
- Networking and knowledge-sharing activities at national, European and international levels.

> "Much progress has been made on the scientific, technical, economic, regulatory and societal aspects. So, where do we stand now in Europe? Will we be ready for progressive commercial deployment from 2020?"

Europe is preparing for large-scale demonstration

Robust technical expertise already exists, and the world is now moving into a large-scale demonstration phase. In Europe, the first CCS demonstration projects are under preparation (see Fig. 2), under the leadership of major power and industrial companies and with the financial support from the European Economic Plan for Recovery, the NER300 mechanism for the co-financing of CCS and innovative renewables in the framework of the European Union's Emissions Trading Scheme, and member states. The goal is to have some 12 large-scale demonstration projects up and running by 2015 to harness knowledge and experience from a number of different geological, geographical and industrial contexts, both onshore and offshore.

Directive 2009/31/EC on the geological storage of CO_2

An EU Directive on the geological storage of CO_2 was issued in 2009 and is currently being transposed in national legislations. By end 2011, this process was complete for three member states: Spain, the Netherlands and France. This directive gives the legal framework for the permanent geological storage of CO_2, whilst preventing or reducing as far as possible negative effects on the environment and any resulting risk to human health. A permit application will be required for each storage site.

EUPROFILE

Fig. 2: Europe is preparing large-scale demonstration of CO_2 geological storage. Countries where the first CCS demonstration projects are under preparation are indicated, as well as the 34 research institutes from 14 countries making the CGS Europe pan-European scientific body on CO_2 storage

Costs and economics

The storage costs range between €1 and €20 per ton of CO_2 stored, depending on the storage types and characteristics. Onshore storage is cheaper than offshore storage. Storage costs represent only 10-20% of the costs of the full capture, transport, storage value chain. The CO_2 price in the EU Emissions Trading System (EU ETS) is currently below €10 per ton. This low level will not enable the funding of as many NER300 demos as anticipated and does not provide a secure investment for long term investment. The selection, characterisation and permit application for a storage site is a long process that takes several years, as well as its connection to a CO_2 emitting power or industrial plant via the set up of an appropriate transport infrastructure. The need for early planning means that other incentives will be needed.

Social support

Demos and further deployment will require support from all stakeholders. A few pilot and full-scale projects have already been implemented successfully. However, some societal and policy issues still need to be addressed, such as the NIMBY syndrome for onshore storage, denial of climate change or of the role of CCS, alternative perspectives on energy mix and economic development. A constructive societal dialogue demands early communication and continuous interaction involving local and national stakeholders in the decisions. The scientific community can play a key role in such a dialogue by providing advice and high quality information.

> "Demos and further deployment will require support from all stakeholders. A few pilot and full-scale projects have already been implemented successfully. However, some societal and policy issues still need to be addressed..."

Current R&D challenges

Research efforts must be increased at national and European levels for supporting and valorising the demos, enabling progressive large scale deployment from 2020, and preparing next-generation technologies. Cheap, efficient and quickly implementable methods and tools are needed for improving storage site characterisation, capacity assessment, monitoring, risk assessment and, if necessary, remediation. In addition to the large-scale demos, more small-scale CO_2 injection pilots and research infrastructures are needed to test and validate these methods and tools.

CO_2GeoNet and CGS Europe – a pan-European scientific body durably engaged in providing knowledge for sustainable Geological Storage of CO_2

From 2004, the FP6-founded CO_2GeoNet European Network of Excellence on CO_2 Geological Storage, supplemented by the FP7 CGS-Europe coordination action, has enabled to develop a pan-European scientific body composed of 34 key research institutes over 26 countries coordinating their efforts in four domains of activity: research, scientific advice, training, information and communication. The lighthouse event is the annual CO_2GeoNet Open Forum in Venice enabling dialogue between the scientific community and all stakeholders. The seventh edition will be held on 17-19th April 2012.

Isabelle Czernichowski-Lauriol
Coordinator of CGS Europe
President of CO2GeoNet
Head of BRGM's Deep Aquifer Unit
BRGM, Water Division
Avenue Claude Guillemin
45060 Orléans Cedex 2
France
Tel. +33 238 644 855
i.czernichowski@brgm.fr
www.cgseurope.net
www.co2geonet.com

Publications

44 policy Carbon Capture & Storage

In de lucht of in de grond

CO_2 capteren om voor altijd op te slaan

Als tussenoplossing in het proces naar een koolstofvrije samenleving is de technologie voor het afvangen en opslaan van CO_2 (CCS) één van de opties om binnen nu en 2100 de hoeveelheid in de lucht uitgestoten CO_2 aanmerkelijk terug te dringen. Midden februari was er nog voorzorg van discussie op een conferentie in Brussel waar politici en experts de energiestrategie van de EU evalueerden in het kader van de economische crisis. Waar staat CCS precies voor? Wanneer wordt het gecommercialiseerd? Hypothekeert de lage prijs van carbon de ontwikkeling ervan? Biedt potentieel heeft CCS voor de industrie? Wat zijn de risico's? Vragen waarop dit dossier een antwoord geeft.

TEKST FLORENCE DELBOVE
FOTO IEA, ZEP

46 Standaard policy

Cap rock

Deep saline aquifer

Cap rock

Depleted oil and gas fields

"De opslag is bepalend voor de hele keten"
Philippe Mathieu (VLaG / GSEO)

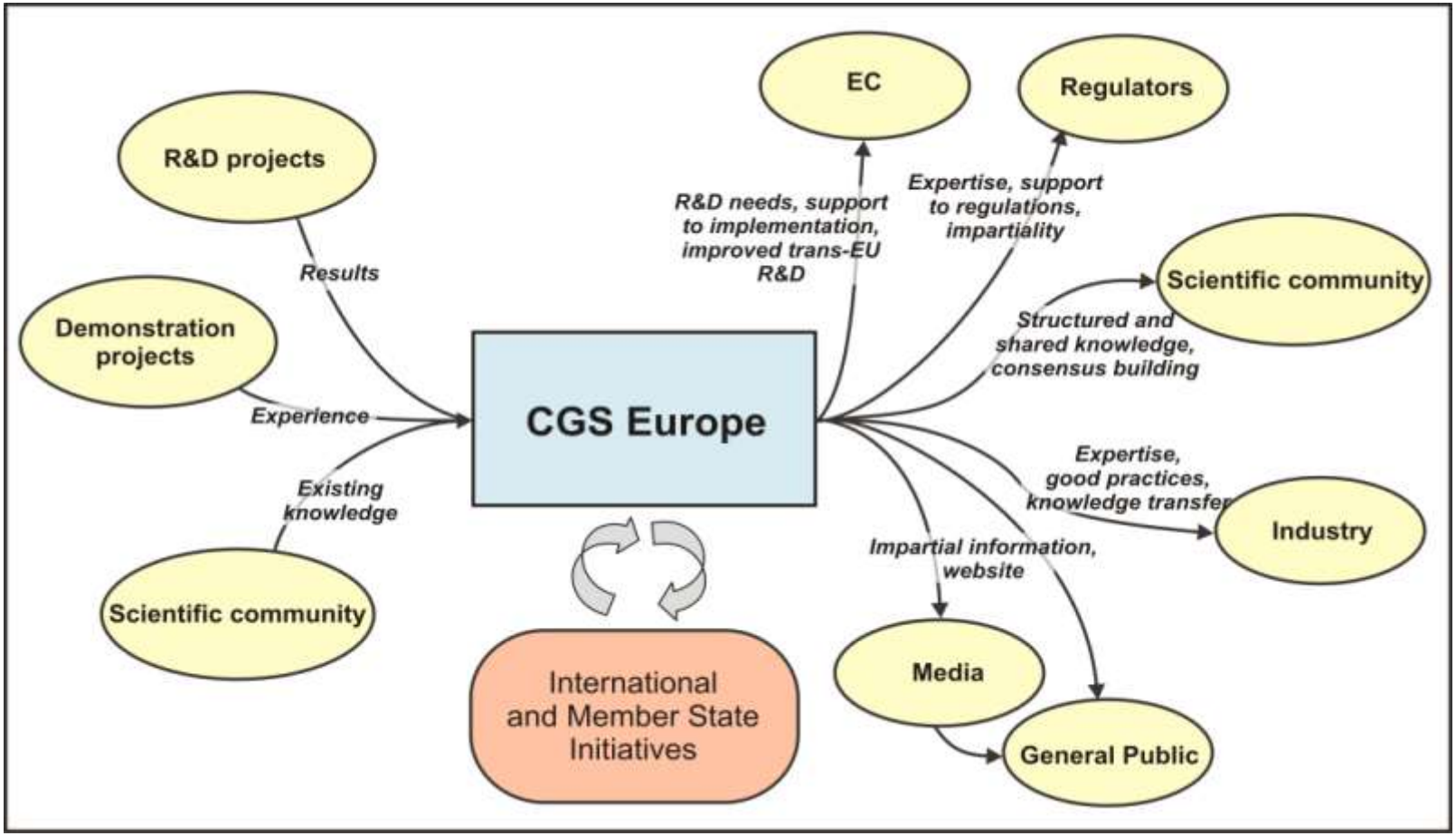
Capteren kost het meest

Transport via pijpleiding

Interaction with media

- Communications workshop
  Brussels 22-23 Sept. 2011

Expected Impacts on Stakeholders



Expected Internal Impacts

- Knowledge-sharing workshops help establishment of true networking and integration
- Staff-exchange programmes increase the mobility of personnel within the EU, and integration of the CCS research community will be possible.
- Promotion of new research projects by complementing demonstration projects within the SET Plan
- It is expected that project partners will plan their internal research in a more effective way so that research resources across the EU are used more effectively.

Expected External Impacts

- Provide a structured view and access to the available knowledge on CO_2 Geological storage
- Support the implementation of the European Industrial Initiative on CCS
- To become an independent reference point on geological storage issues for European stakeholders
- Being a reference body where the national regulators can seek external unbiased expertise
- Preparing documents for the stakeholders, as well as understandable material targeted at the general public
- Disseminating reliable information towards the media and the general public.

This workshop is spğonsored by **Turkish Chamber of Petroleum Engineers**, we thank for their support.

I want to extend my appreciation to the **organizing committee**

Ilhan Topkaya
Çağlar Sınayuç
Vit Hladik
Mahmut Parlaktuna

And to my **young colleagues**, without their help this workshop will not be possible.

Sevtaç Bülbül, Gizem Gül, Merve Turanlı, Oytun Örs, Hatice Adalan

THANK YOU