GLOBAL CCS INSTITUTE

CARBON DIOXIDE STORAGE IN THE CLEAN DEVELOPMENT MECHANISM - OPPORTUNITIES IN PORTUGUESE LANGUAGE COUNTRIES

Workshop: Lisbon 19–20 September 2013

Final Report and future actions

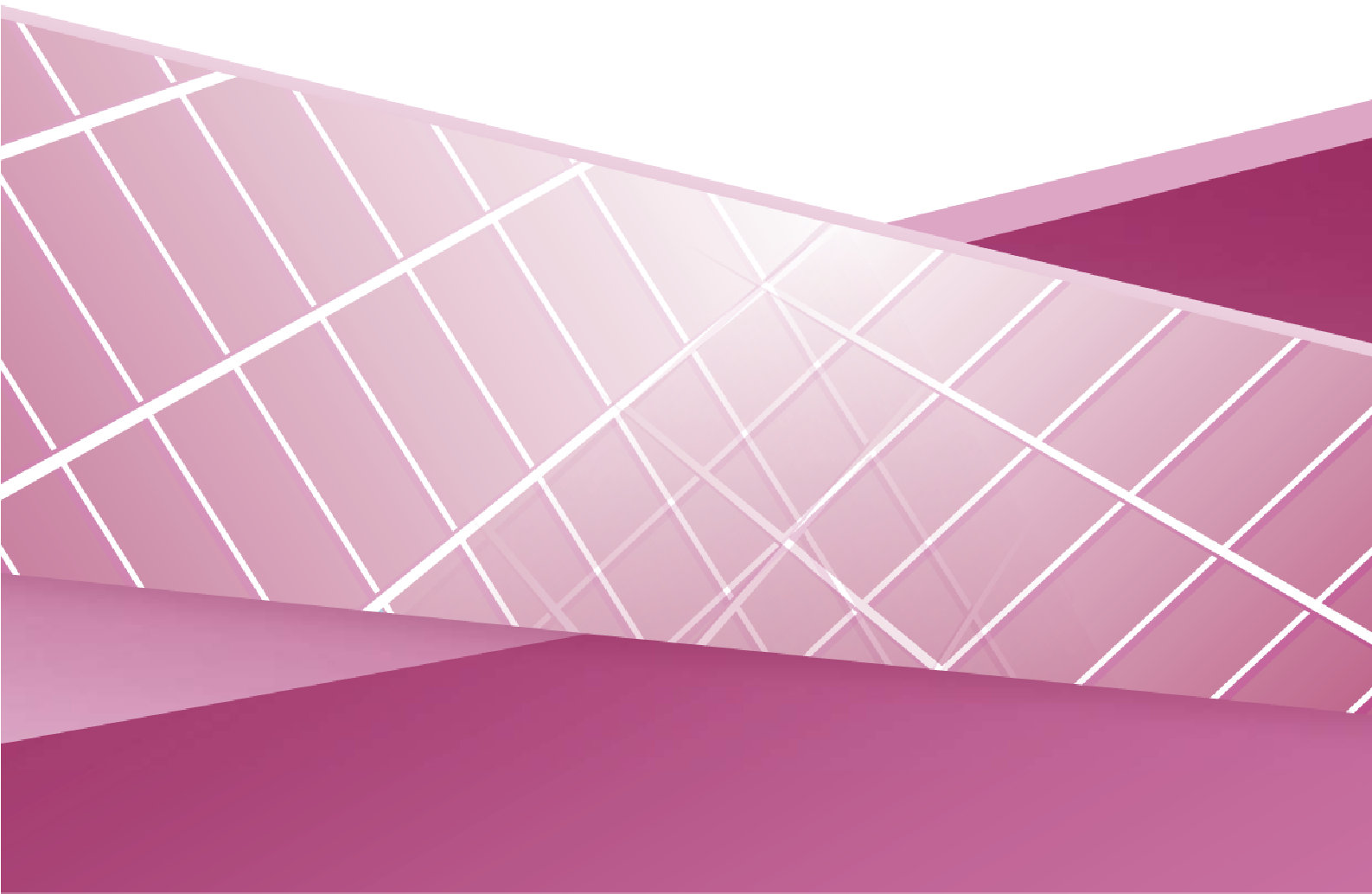
Centro de Geofísica de Évora

CPLP

REN Redes Energéticas Nacionais

carbon sequestration leadership forum

FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA



Contents

1 Workshop description

The first workshop about cooperation on Carbon Dioxide (CO_2) Capture and Storage (CCS) among the Community of Portuguese Language Countries (the CPLP) was held in Lisbon, on the 19th and 20th of September 2013, at the CPLP headquarters. As CCS is now accepted in the United Nations Framework Convention on Climate Change (UNFCCC) Clean Development Mechanism (CDM), the workshop focused on the dissemination of knowledge about CCS, discussion around the current stage of development of the technology and identification of opportunities for cooperation among the CPLP countries. The programme of the workshop is included in Annex A.

Delegates to the workshop were welcomed by Ambassador Murade Murargy, Executive Secretary of the Community of Portuguese Language Countries, and by Professor Alexandre Araújo, Vice-President of the School of Science and Technology of the University of Évora.

The keynote speaker, Professor Júlia Seixas of the New University of Lisbon (and coordinator of the CCS Roadmap for Portugal), introduced the climate change scenarios and role that CCS can play in a low carbon future, stressing the recommendations from the International Energy Agency (IEA) CCS roadmap (2013) and some results of the Intergovernmental Panel on Climate Change (IPCC) 5th assessment report (2013). The main messages from her keynote included that by 2050, about 70 per cent of the CCS projects should be in non-OECD countries and that a 10-year delay in deploying CCS will imply an additional investment cost over US$1 trillion until 2035.

Welcome and opening remarks by the Executive Secretary of the CPLP.

The goal of the first session *("CCS Technology - what are the experiences and what are the challenges for future deployment")* was to provide information on the CCS projects components (capture, transport and storage) and range of technologies, including the global status of current CCS projects, either under development or operational. This was a very important session since the technology was new to most of the delegates from the CPLP countries, other than Portugal and Brazil. The first session concluded with a presentation on the use of CO_2 for Enhanced Oil Recovery, building on the experience of the oil company PARTEX O&G work in the Gulf countries.

The second *session ("CCS in CDM – Requirements, procedures and financial aspects")* focused on the incorporation of CCS projects in the UNFCCC CDM, with a keynote speech by Dr. Pedro Barata, a former member of the CDM Executive Board involved in the Durban Conference negotiations (December 2011), who described the process leading to the inclusion of CCS in the CDM and presented the evolution of the CDM since. His main message was that the current very low prices of the Certified Emissions Reduction credits (CERs) and the large number of the projects in the CDM pipeline, make it difficult to launch CCS projects in the CDM in the near future.

The same message was conveyed by Dr. José Miguez from Brazil, the current Chair of the CCS working group in the CDM. He discussed the main challenges for deploying CCS projects in the CDM and the requirements and procedures that must be followed to submit CCS projects to the CDM. This was another of the aims of the workshop, since it can allow planning for scenarios in which the costs of CERs increase in the coming decades, making it feasible to launch CCS projects in the CDM. Other presentations given in session two focused on the identification of early opportunities for deploying CCS, some of which, such as gas processing and Enhanced Oil Recovery with carbon dioxide (CO_2 EOR), are areas where CPLP countries may have an interest, as well as in the United Nations Industrial Development Organisation (UNIDO) and IEA CCS roadmap for the industry. Risk management in CCS was also addressed, based on the Norwegian company DNV's expertise.

Dinner was arranged after day one of the workshop to provide time for networking.

The third session *("CCS opportunities in the CPLP – setting the ground for cooperation")* which started on the second day of the workshop, focused on the status of CCS R&D in Portugal and in Brazil. The level of R&D activities in Brazil is very significant, particularly with regards to CO_2 storage, as Brazil has established a research centre (CEPAC) focusing specifically on that component of CCS. CEPAC has also conducted significant work with the energy company PETROBRAS to capture their experience in CO_2 EOR. In 2014, Brazil will publish a CCS Storage Atlas, which could become a reference for other CPLP countries.

Portugal's work on CCS was discussed at length in this session, and while it initiated R&D activities more recently than Brazil, a large body of work has already been completed on storage capacity assessments and on the definition of integrated transport and storage infrastructures with Spain and Morocco. During this session, the work plan for the development of a CCS roadmap for Portugal which will start in Q4 of 2013 was presented. It will include an analysis of CCS related business opportunities in the CPLP countries. This session concluded with a presentation by Portugal's National Energy Grid (REN) on its role as the *Guarantee of Origin Issuing Entity* for cogeneration and for renewable energy.

Session four *("Addressing barriers to CCS deployment in developing countries")* started with a presentation by the Global CCS Institute (GCCSI) on CCS activities in developing countries, and the opportunities of funding from several international bodies. The next steps for interested

countries were identified, which include pre-commercial storage assessments and the development of legal and regulatory frameworks. The Bellona Foundation also conveyed the importance of the national CCS roadmaps and shared its experience in developing these roadmaps for several European countries.

Session four was concluded with a panel discussion, moderated by the Dutch National Geological Survey TNO, engaging representatives from Angola, Cape Verde, East Timor, Mozambique, and S. Tomé and Principe, that presented the national environment and climate change policies, as well as CDM related activities.

Panel on environment and climate change policies in CPLP countries.

The last session of the workshop, session five *(CPLP and cooperation mechanisms on CCS)* started with a presentation by the Portuguese Environment Agency about the existing cooperation between CPLP countries on climate change and environment. The session closed with a roundtable, moderated by the Designated National Authority (DNA) of Angola and involved representatives of GCCSI, DNV, the New University of Lisbon, the Chair of the CDM working group on CCS, and the former coordinator of the task force for implementing the European CO_2 Storage Directive 2009/31/EC in Portugal. The roundtable started with a presentation of the strategy pursued in Portugal to translate the EU CO_2 storage directive into national law, and continued with the proposal of joint activities to be implemented in the coming months. These activities are described in section two of this report.

Group photo at the closure of the workshop.

To conclude the workshop, Júlio Carneiro, Professor at the University of Évora, on behalf of the organisation, thanked all the members of the steering committee, the sponsors (GCCSI, Carbon Sequestration Leadership Forum (CSLF), REN and the Portuguese Foundation for Science and Technology (FCT)), the speakers, the invited delegates and the CPLP staff members for a successful event.

2 Future actions

The final roundtable proposed the following actions for future activities:

- To hold a follow-up workshop in Angola, in the Q3 of 2014, targeting primarily Industry in the African CPLP and East Timor. Giza Martins, the Angola DNA to the CDM, agreed to take the lead on organising the workshop, with support from a steering committee. Dates for the workshop will be announced by the end of 2013;
- Representatives of CPLP countries are invited to engage in the development of the CCS roadmap for Portugal, as a way to facilitate knowledge transfer and develop cooperation opportunities;
- Organisation of a one week short-course with the aim to build scientific and technical capacity among young professionals and students. This first short-course could be organised in Angola back-to-back to the workshop to be held in Q3 2014. The GCCSI, with the help of the Universities in Portugal and participants to this workshop such as TNO and DNV, as well as the hosting country, will identify the target audience for this course, their needs, and estimate the resources required to develop and deliver such a short-course. The short-course proposal is to be completed by the end of 2013.
- Identify a technical team that will be drafting 4-5 pages long briefings on “Opportunities, challenges and future actions for CCS” in each CPLP country, focusing on the existing storage possibilities, likely industrial and energy projects, and the short-term actions required in each country. The briefings will be the basis for engaging Industry and Policy-makers in the follow-up workshop. DNV proposed to provide a template for the briefings, based on the work completed by DNV in Mozambique and Angola.
- Create a website (or webpages that could be hosted on an existing website) to facilitate communication and dissemination of information between the coordination group and the key stakeholders. The University of Évora will design a communication platform in Q4 2013. The presentations given at the workshop will be made available through this platform, although copies have already been supplied to all delegates.

All of the above activities will be implemented by a Steering Committee made of a representative from each CPLP country and the Global CCS Institute. Invited delegates from CPLP countries were asked to designate a key contact person to the University of Évora by the end of September.

3 Main achievements

The workshop was designed to achieve four objectives, namely:

- *Disseminate knowledge about the CCS technology among CPLP countries* – this objective was entirely achieved, mostly through the presentations in session one, but also through the supply of several leaflets, brochures and reports about the technology that were made available by the GCCSI, REN, UNIDO, LNEG and CGE, and that are listed in Annex B;
- *Discuss the inclusion of CCS projects in the CDM and the implications for the implementation of the technology in developing countries* - the workshop was able to accomplish this objective largely in part because of the presence and presentations given by Pedro Barata, former member of the CDM Executive Board, and José Miguez, current Head of the CDM working group on CCS. Both provided a realistic view of the challenges and difficulties faced by the possibility of launching CCS projects in the CDM, but they also detailed the current requirements and procedures for preparing applications for CCS projects in the CDM, when more favourable conditions are met by this mechanism;
- *Discuss cooperation mechanisms between CPLP countries* – the activities proposed by the roundtable in session five, and listed in section two of this report, are clear examples that this objective was achieved, since they set the ground for initiating a stable cooperation among CPLP countries, and ultimately lead to the identification of commercial opportunities for deploying CCS in the CPLP countries;
- *Identify opportunities and challenges in each CPLP country for the implementation of CCS projects within the scope of the CDM* - this objective was not achieved, and in retrospective, was not very realistic, given the current difficulties faced by the CDM mechanism and the state of knowledge about CCS in many of the CPLP countries. Nevertheless, presentations in session two and three, by UNIDO, GCCSI and DNV, identified early opportunities for CCS and possible sources of funding for projects in developing countries.

4 Feedback from participants

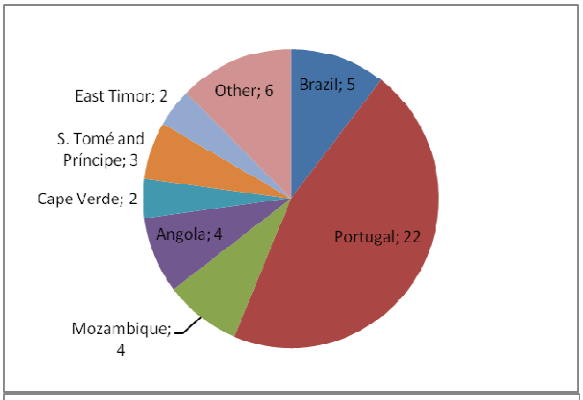
During the event and in the weeks following, the University of Évora received positive feed-back from some of the institutions that participated in this workshop, namely:

- CIMPOR, the main cement producer in Portugal and part of the INTERCEMENT group, a leading player in the sector of cement production in several CPLP countries, has stated its interest to participate in the development of the CCS roadmap for Portugal and supplied information about CCS deployment in the cement sector;
- The delegates representing the geology departments of the two main universities in Angola and Mozambique, respectively, Universidade Agostinho Neto and Universidade Eduardo Mondlane, have both considered the event very positive in terms of knowledge sharing and expressed their interest in being involved in further events related to CCS and in possible CCS projects to be developed in CPLP countries;
- The CPLP secretariat for Cooperation and Development has informed that CCS projects involving CPLP countries could possibly be considered within the scope of the recently launched CIICLAA, a climate and applications research centre for the Portuguese speaking countries and Africa, supported by the CPLP and based in Cape Verde. The CPLP secretariat has supplied information about CIICLAA for analysis of the possibility of incorporating CCS within its research portfolio;
- The two delegates from Cape Verde (the CDM Designated National Authority and the General Director for Environment) have expressed their interest on the topic and suggested the possibility of launching studies for capacity assessment under the framework of the FAST START projects, a funding mechanism linked to the Portuguese Carbon Fund, in which they have some experience. They also have offered to organise a follow-up workshop in Cape Verde, either in 2014, as an alternative to Angola, or later;
- TNO has expressed its interest in participating in projects related to CO_2 storage in basalts, eventually coupled with geothermal energy, in Cape Verde;
- The delegates from the Ministry of Oil of Angola have expressed very positive views of the workshop and their commitment to engage in the follow-up workshop the oil companies active in Angola;
- The Director for Mineral Resources of East Timor has communicated that the Department is open to cooperate and work together with other CPLP countries on this topic;
- The Head of the CCS working group has considered this workshop as “excellent and very important”;
- PARTEX O&G, a Portuguese oil company very active in the Gulf countries, also with activities in Angola, has provided positive feed-back and expressed their interest in participating in future activities related to CCS in the CPLP countries. This feed-back was particularly positive since PARTEX has experience in EOR and has the potential to become a major player in that area for the CPLP countries.

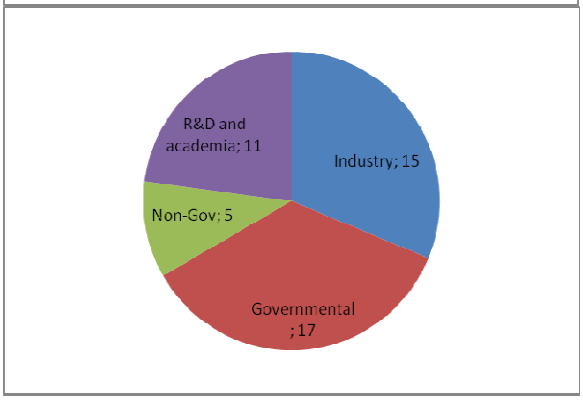
5 Attendance

In total, forty eight delegates attended the workshop, of which forty four attended day one and thirty-nine attended day two. The full list of participants is included as Annex C. Delegates from CPLP countries totalled forty-three. Not surprisingly, Portugal had the largest number of delegates, but it was very positive that attendance included delegates from all CPLP countries, with the exception of Guinea-Bissau, whose government is not officially recognised by the CPLP.

The event was attended by government officials, researchers from research and academic institutions, as well as by industry. Governmental officials predominated among the delegates from the African CPLP countries and East Timor, but the most important Universities from Angola (Universidade Agostinho Neto) and from Mozambique (Universidade Eduardo Mondlane) were also represented at the event.



Brazil was represented mostly by R&D institutions or academia, although the Oil company PETROBRAS attended the second day of the event. Portuguese delegates were mostly from industry, but the R&D institutions most involved in CCS research were present, as were the key governmental offices, the Portuguese Environment Agency and the General Directorate for Energy and Geology.



6 Lessons learned

A number of lessons were learned from the workshop that should be considered when planning the follow-up workshop in Angola:

- Although the Portuguese industry was well represented in the workshop, and the Brazilian oil company Petrobras was also present, there were no delegates from the oil, gas processing, coal mining, and cement producing companies active in the African CPLP countries and in East Timor. Efforts to engage them should step up for the follow-up workshop, namely by providing those companies with time slots to present their industrial/environmental plans;
- It was not possible to have a presentation specifically on 'Other sources of funding for CCS projects in developing countries', which was anticipated to close session two, because it was not possible to engage speakers from the World Bank, the African Development Bank or from the International Energy Agency. Although some information was provided by the GCCSI in session four, the relevance of the topic advises to increase efforts to engage those institutions, particularly the African Development Bank or the World Bank, in the follow-up workshop.
- There was little attendance to the dinner at the end of day one, probably because it was not in the initial programme. The intended aim of networking during the dinner did not result fully, as a consequence. In the follow-up workshop there should be separate confirmation for dinner attendance to avoid unnecessary expenditure.
- The workshop benefited a lot from the simultaneous translation. Although this service can be quite expensive, it is certainly well worth maintaining for the follow-up workshop.

Évora, 25 October 2013

Annex A: Workshop programme

AGENDA

CO_2 storage in the Clean Development Mechanism -

Opportunities in Portuguese language countries

19th SEPTEMBER

Session 1 - CCS Technology - what are the experiences and what are the challenges for future deployment? *Chair: Júlio Carneiro (Universidade de Évora, Portugal)*		
8:30 – 9:00	Registration.	
9:00- 9:15	Welcome - **Dr. Murade Murargy,** Secretário Executivo da CPLP; **Alexandre Araújo**, vice-presidente CGE, vice-presidente Escola de Ciências e Tecnologia, Universidade de Évora	
9:15 – 10:00	**Keynote**: Climate change scenarios and the role for CCS	Júlia Seixas *(Universidade Nova de Lisboa, Portugal)*
10:00 - 10:20	What is CCS? A chain of technologies (capture, transport and storage)	Rodrigo Iglesias *(Centro de Excelência em Pesquisa e Inovação em Armazenamento de Carbono, Brasil)*
10:20 –10:40	The status of CCS – An international overview	Meade Harris *(Global CSS Institute, Australia)*
10:40 - 11:10	**Coffee-break**	
11:10 – 11:30	CO_2 capture and transport – Introduction to the technologies and challenges.	Dulce Boavida (*Laboratório Nacional de Energia e Geologia, Portugal)*
11:30 - 11:50	CO_2 storage - Reservoir types and site selection	Júlio Carneiro *(Universidade de Évora, Portugal)*
11:50 – 12:10	Experience of TNO in large scale CCS projects	Edésio Miranda Barbosa *(TNO, Holanda)*
12:10 -12:30	CO_2 usage in Enhanced Oil recovery	Teresa Ribeiro *(PARTEX O&G, Portugal)*
12:30 – 14:00	**Lunch -** Restaurante Santa Rita (Rua de São Mamede, 24C)	

Session 2 - CCS in the CDM - Requirements, procedures and financial aspects. *Chair: Rodrigo Iglesias (CEPAC, Brasil)*		
14:00 – 14:45	**Keynote**: The Story of CCS in CDM	Pedro Martins Barata *(Get2C, Portugal)*
14:45 – 15:05	Prospects for CCS in the CDM (and the possibility for NAMAS)	José Miguez *(Grupo de trabalho CCS no MDL, Brasil)*
15:05 – 15:25	UNIDO/IEA Roadmap and early opportunities for CCS projects in the CDM	Bettina Schreck *(United Nations organisation for Industrial Development, Austria)*
15:25 – 15:55	**Coffee-break**	
15:55 – 16:15	CCS in the CDM: the case of gas processing in Mozambique, Angola and Tanzania	Pernille Holtedahl *(Det Norske Veritas, Noruega)*
16:15 – 16:35	Modalities and procedures for submission of CCS projects to the CDM – UNFCCC methodology	José Miguez *(Grupo de trabalho CCS no MDL, Brasil)*
16:35 – 16:55	Requirements for risk management, validation and verification of CCS project activities in the CDM.	Pernille Holtedahl *(Det Norske Veritas, Noruega)*
20:00	**Dinner – Casa do Alentejo (**Rua das Portas de Santo Antão 58)	

AGENDA

CO_2 storage in the Clean Development Mechanism-

Opportunities in Portuguese language countries

20th SEPTEMBER

Session 3 - CCS opportunities in the CPLP - setting the ground for cooperation *Chair: Dulce Boavida (LNEG, Portugal)*		
9:20 - 9:30	Summary of previous day.	Giza Martins *(Autoridade Nacional Designada, Angola)*
9:30 – 10:00	Status of CCS research in Brazil.	Rodrigo Iglesias *(CEPAC, Brasil),* Cristina Quintella (*Universidade Federal da Bahia, Brasil)*
10:00 – 10:20	Status of CCS research in Portugal.	Júlio Carneiro *(Universidade de Évora, Portugal)*
10:20 – 10:40	Towards a CCS roadmap for Portugal	Patricia Fortes *(Universidade Nova de Lisboa, Portugal)*
10:40 - 11:00	EEGO – Guarantees and certificates of origin.	Bruno Caetano (*REN. Portugal)*
11:00 - 11:30	**Coffee-break.**	

Sessão 4 - Addressing barriers to CCS deployment in developing countries *Chair: John Scowcroft (Global CSS Institute, Australia)*		
11:30-11:50	Country specific CCS roadmaps.	Jonas Helseth *(Bellona Foundation, Noruega)*
11:50 – 12:10	CCS in developing countries.	Jessica Morton *(Global CSS Institute, Australia)*
12.10 - 13:00	Panel: Climate mitigation in a changing energy landscape: a discussion on the CDM, climate change goals and energy developments in CPLP countries	Edésio Miranda *(Brasil, moderador)* Giza Martins *(Angola)* Moisés Borges *(Cabo Verde)* Anísio Manuel (*Moçambique)* Elisa Pereira (*Timor Leste)* Guilherme Mota (*S. Tomé e Príncipe)*
13:00 – 14:30	**Almoço -** Restaurante Santa Rita (Rua de São Mamede, 24C)	

Sessão 5 - CPLP and cooperation mechanisms on CCS *Chair: Giza Martins (Autoridade Nacional Designada, Angola)*		
14:30-15:00	The CPLP and cooperation in the field of environment and climate change – prospects for CCS.	Eduardo Santos *(Agência Portuguesa do Ambiente, Portugal)*
15:00-16:00	Roundtable - Cooperation on CCS within the CPLP and opportunities in the field of CDM • Assessing storage capacity • Capacity building • Regulation • Knowledge sharing	
16:00 – 16:15	Closing remarks and preparation of follow-up workshop	Giza Martins *(Autoridade Nacional Designada, Angola),* Júlio Carneiro *(Universidade de Évora, Portugal)*

Annex B: List of information provided to delegates

Information provided to delegates

1. CCS in developing countries – GCCSI fact sheet
2. Geological CO_2 storage – GCCSI fact sheet
3. Transport of CO_2 – GCCSI fact sheet
4. What is CCS? – GCCSI fact sheet
5. CCS projects in action – GCCSI fact sheet
6. Meeting the climate change – GCCSI fact sheet
7. Bio-energy with CCS – GCCSI fact sheet
8. COMET FP7 project newsletter 1
9. What does CO_2 geological storage really mean? - CO2GEONET brochure, Portuguese translation
10. REN technical data 2012 - electricity
11. REN technical data 2012 - natural gas
12. GCCSI annual operational plan 2013-2014
13. GCCSI Illustrative List of CCS Activities in Developing Countries, as at Sept 2013
14. Technology Roadmap: CCS in Industrial Application. IEA/UNIDO roadmap.
15. CGE newsletter, special edition 20 years of activity
16. *Two decades of earth science and research*. Book on the occasion of the 20th anniversary of CGE.

Annex C: Delegates list

	Name	Institution / Company	Country
1	Ana Paula Musse	Petrobras	Brazil
2	Andreia Severiano	EDP Energias de Portugal	Portugal
3	Anísio Manuel	Direcção Nacional de Energia	Mozambique
4	António Lopes da Silva	Tejo Energia	Portugal
5	António Olímpio Gonçalves	Universidade Agostinho Neto	Angola
6	Bettina Schreck	UNIDO	Argentina
7	Bruno Caetano	REN- Redes Energéticas Nacionais	Portugal
8	Carlos Moniz	Instituto Nacional de Meteorologia e Geofísica	Cape Verde
9	Clara Justino	CPLP - Comunidade dos Países de Língua Portuguesa	Portugal
10	Cristina Quintella	Universidade Federal da Bahia	Brazil
11	Dulce Boavida	Laboratório Nacional de Energia e Geologia	Portugal
12	Edésio Miranda Barbosa	TNO	Brazil
13	Eduardo Santos	Agência Portuguesa do Ambiente	Portugal
14	Elga Pereira	Direcção Geral dos Recursos Minerais	East Timor
15	Elisa Pereira	Ministério do Ambiente	East Timor
16	Ema Gomes	Ministério dos Petróleos	Angola
17	Ferreira Marques	REN- Redes Energéticas Nacionais	Portugal
18	Gelsa Carvalho	Direcção Geral do Ambiente	S. Tomé and Príncipe
19	Giza Martins	Ministério Ambiente	Angola
20	Guilherme Mota	Agência Nacional de Petróleo	S. Tomé and Príncipe
21	Inês Mourão	CAOS sustentabilidade	Portugal
22	Isaque Bragança	Direcção Geral dos Recursos Naturais e Energia	S. Tomé and Príncipe
23	Jessica Morton	Global CCS Institute	Australia
24	João Mugabe	Universidade Eduardo Mondlane	Mozambique
25	John Scowcroft	Global CCS Institute	Reino Unido
26	Jonas Helseth	Bellona Foundation	Norway
27	José Bravo Ferreira	SECIL	Portugal
28	José Miguez	Ministério do Meio Ambiente	Brazil
29	Júlia Seixas	Universidade Nova de Lisboa	Portugal
30	Júlio Carneiro	Universidade de Évora	Portugal
31	Luís Bernardes	Universidade de Évora	Portugal

	Name	Institution / Company	Country
32	Luís Costa		Portugal
33	Manuel Xavier Junior	Ministério dos Petróleos	Angola
34	Meade Harris	Global CCS Institute	United Kingdom
35	Miguel Moreira da Silva	REN- Redes Energéticas Nacionais	Portugal
36	Moisés Borges	Direcção Geral do Ambiente	Cape Verde
37	Nazário Bangalane	Instituto Nacional de Petróleo	Mozambique
38	Nuno Miguel Pereira	EDP Gás	Portugal
39	Patricia Fortes	Universidade Nova de Lisboa	Portugal
40	Paulo Rocha	CIMPOR	Portugal
41	Pedro Martins Barata	Get2C	Portugal
42	Pernille Holtendahl	DNV	Norway
43	Ricardo Moita	Get2C	Portugal
44	Rodrigo Iglésias	CEPAC	Brazil
45	Ruben Eiras	GALP ENERGIA	Portugal
46	Rui Baptista	GALP ENERGIA	Portugal
47	Salomão Mujui	Direcção Nacional de Geologia	Mozambique
48	Teresa Ribeiro	PARTEX O&G	Portugal