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The Current Status of CCS development in Brazil

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Abstract

The IEA CCS Roadmap highlighted the significance that CCS will play in achieving an atmospheric CO_2 stabilization on 450ppm. In the scenario it is based on, CCS will provide approximately 20% of the total CO_2 emissions reductions out to 2050. To achieve this contribution it will require an ambitious CCS growth path with 100 projects needed globally by 2020 and over 3000 by 2050. In both 2020 and 2050 the major developing countries will need to contribute to this deployment.

Brazil has a unique electricity and emissions profile. Over 80% of Brazils electricity is produced from hydropower with the rest being made up by a combination of fossil fuels, biomass, and nuclear. This means the energy emissions in Brazil are relatively low. Many people within Brazil see stopping the deforestation of the Amazon as the key emissions reduction mechanism for Brazil. However, the contribution to CO2 emissions from coal is expected to increase due to 6000MW of coal power that is planned to be installed in Brazil by 2030, although this still only represents 2.7% of grid compared to 83% from renewables. CCS in Brazil will be more relevant to industry rather than for electricity generation. In particular CCS could be crucial for the development of some of the "Pre-salt" petroleum fields which bring new challenges. Although there are no conclusive studies on the concentration of carbon dioxide (CO_2) in the region, some wells have shown concentrations of CO_2 above those found in the Campos Basin, while others showed concentrations close to zero. Still, Petrobras have proactively committed to not releasing to the atmosphere, the CO_2 associated with the natural gas produced in the pre-salt layer. In addition, the pre-salt oil is considered of good quality, light oil and therefore, the refining process consumes less energy and will emit less CO_2 when compared to the processing of heavier crude.

This paper looks to discuss the current status of CCS in Brazil. This includes looking at the current status of a number of demonstration projects that are already underway in Brazil as well as additional ones that are planned.

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The paper will also discuss the. Public awareness and engagement about CCS given the crucial role the public play in the smooth progress of projects.

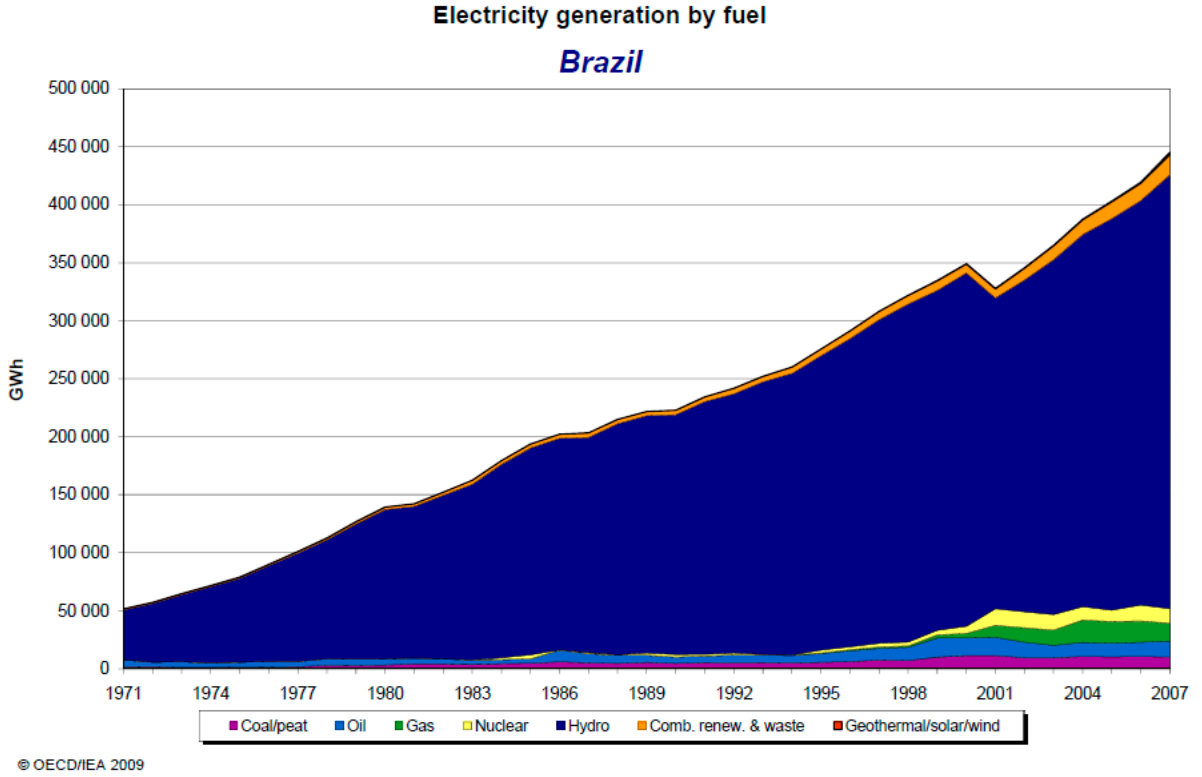
Keywords; Carbon dioxide capture and storage; CCS; Brazil; developing country

1. Introduction

The IEA CCS Roadmap highlighted the significance that CCS will play in achieving an atmospheric CO_2 stabilization on 450ppm. In the scenario it is based on, CCS will provide approximately 20% of the total CO_2 emissions reductions out to 2050. To achieve this contribution it will require an ambitious CCS growth path with 100 projects needed globally by 2020 and over 3000 by 2050. In both 2020 and 2050 the major developing countries will need to contribute to this deployment.

2. Brazilian energy and CO_2 emissions profile

Brazil has a unique electricity and emissions profile. Over 80% of Brazils electricity is produced from hydropower with the rest being made up by a combination of fossil fuels, biomass, and nuclear. This means the energy emissions in Brazil are relatively low. Many people within Brazil see stopping the deforestation of the Amazon as the key emissions reduction mechanism for Brazil. However, the contribution to CO2 emissions from coal is expected to increase due to 6000MW of coal power that is planned to be installed in Brazil by 2030, although this still only represents 2.7% of grid compared to 83% from renewables.



Given the unique energy profile of Brazil, CCS in Brazil will be more relevant to industry rather than for electricity generation. In particular, CCS associated with oil and gas production, industrial emissions, coal power plants and in conjunction with biofuel production and use is likely to be the focus area in the near-term.

3. CCS technology research, development and demonstration

Brazil has significant experience in the technology required for CCS development and deployment. Petrobras, the Brazilian National Oil and Gas Company, in particular has been active in this field with a significant amount of ongoing CCS research and development built on 25 years of experience of CO_2 injection in oil fields for EOR. In recent years this has been supported by organizations such as the Centre of Excellence in Research on Carbon Storage (CEPAC) and the Brazilian Coal Association (BCA). CEPAC was launched in 2006 and is a joint initiative between Petrobras and the Pontifical Catholic University of Rio Grande do Sul with the purpose of analysing the potentiality, risk, capacity, durability and profitability of CO2 geological storage activities in Brazil, associated or not to energy production (oil, gas and hydrogen). The BCA is also looking at CCS within Brazil and are currently part of a joint venture with the Ministry of Science and Technology to build a clean coal center in Brazil as well as working with NETL in the US to develop a coal gasification program in Brazil.

Although there are no large scale CCS projects in operation in Brazil today, the country currently has a number of operating and planned CCS demonstration projects. Two such demonstration projects are the Petrobras Miranga Project and the CEPAC Carbometano Porto Batista Project. The Petrobras Miranga Project has three different storage scenarios: EOR, depleted gas reservoir and saline aquifer. The CEPAC Carbometano Porto Batista Project is being developed to look at enhanced coal bed methane production. It will inject CO_2 into the Charqueadas coal field, with the drilling phase finished and injection planned to commence in 2011. In respect to CO2 capture, Petrobras are also part of a consortium looking to develop an oxycombustion pilot project in Brazil at a Petrobras Oil Shale Facility.

In addition to the development of demonstration projects in Brazil, there is also a significant research and development program ongoing. The Brazilian CCS Network, leaded by Petrobras, have established twenty CCS research projects around the country to work on every aspect of CO_2 capture, transport and storage, and have also ran a number of international CCS conferences within Brazil with as many as 400 attendees. One of the major contributions that CEPAC has made to CCS in Brazil is a study matching sources and sinks throughout Brazil. Included in the study were an risk analysis for ranking of storage reservoirs. CEPAC will also release a storage atlas at the end of 2011 which will provide preliminary mapping of storage at a country scale, and at basin scale for aquifers. Petrobras also has a number of their own CCS research facilities around the country in cooperation with other Brazilian universities.

Looking forward, CCS could be crucial for the development of some of the “Pre-salt” petroleum fields which bring new challenges. Although, there are no conclusive studies on the concentration of CO_2 in the region, some wells have shown concentrations of CO_2 above those found in the Campos Basin, while others showed concentrations close to zero. Still Petrobras have proactively committed to not releasing to the atmosphere, the CO_2 associated with the natural gas produced in the pre-salt layer.

The disposal of the CO_2 expected to be produced with the hydrocarbon streams in the Pre-Salt development is being studied comprehensively with no possible options or disposal technologies disregarded in advance. The following options are being technically and economically evaluated: Enhanced Oil Recovery (EOR) in the pre-salt areas; CO_2 storage in saline aquifers; EOR in heavy oil reservoirs in the nearby oil fields (Santos Basin); CO_2 storage in depleted gas fields; CO_2 storage in salt caverns, to be constructed in the Pre-salt area; CO_2 transportation to shore and commercialization in industrial plants (non-geological option).

Biomass poses a very interesting prospect for CCS in Brazil. Brazil has a significant industry producing biomass and biofuels and when combined with CCS these projects could generate negative emissions with CO2 being drawn from the atmosphere in the growing process and being stored through CCS. This technology is already under development in the US by the Midwest Geological Sequestration Consortium who is looking to capture CO2 from the Archer Daniels Midlands biofuels plant in Decatur site in Illinois. More work does however need to the CCS with biofuels in Brazil. A project such as this could however be a very good way to involve a number of key industries in Brazil in the CCS development process.

4. Public awareness

Public awareness of environmental issues in general and climate change issues specifically is quite good in Brazil with extensive environmental coverage in the media and on the internet. The primary focus of this discussion however is on forestry and de-forestation, and on local environmental issues rather than on emissions from energy and industry. However with more coal plants planed for Brazil public awareness of these issues is growing.

Petrobras have conducted a survey to gauge public opinion about CCS which received over 2000 responses. It was found that, unlike results from similar surveys in Europe and elsewhere, there were no inherent objections to the technology and no specific groups against CCS. This issues is however always difficult to assess in the absence of an actual commercial projects.

As with elsewhere however the recent global financial crisis has delayed the public discussion of fossil fuel power and associated environmental impacts with the focus turning instead to the economy.

5. Next steps

Although Brazil has a unique energy and CO_2 emissions profile, there is still a significant potential for CCS within the country. In the near term this potential is likely to be offshore with the development of gas field with CO_2 such as some of the Pre-salt fields. In the future onshore CO2 sources will also become targets for CCS development with a particular focus being on CCS for oil and gas production, industrial, coal power plants and biofuel production.