CARBON CAPTURE AND STORAGE
SOUTH AFRICAN ACTIVITIES AND PLANS

A D SURRIDGE[1]

1. Introduction

South Africa's energy economy is dominated by coal, that commodity accounting for approximately 75% of primary energy production. Within that primary energy framework, coal provides for ~95% of electricity generation. Moreover, coal and gas provide for ~35% of liquid fuel requirements courtesy of the synthetic fuel industry [namely Sasol and PetroSA].

South Africa has acceded to the Kyoto Protocol as a Non-Annex I Party and as such its mitigation measures are addressed through the Clean Development Mechanism.

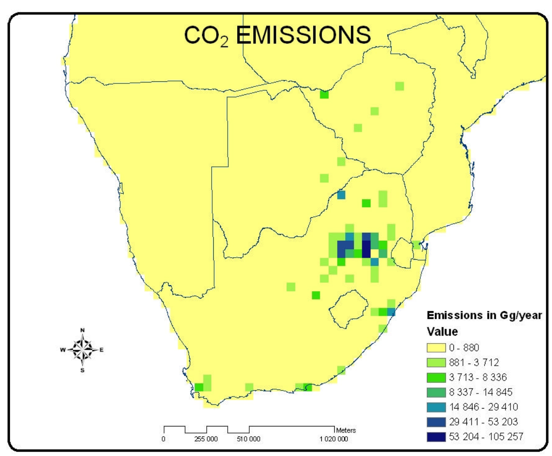
In accordance with policy to address climate change, carbon capture and storage is being investigated as one of the potential tools to limit greenhouse gas emissions.

2. CCS Potential in South Africa

Concurrent with joining the Carbon Sequestration Leadership Forum, South Africa undertook a first step investigation established whether there were sources and possible sinks for carbon capture and storage.

That study indicated potential carbon sources and storage sites. Carbon dioxide emissions were concentrated in the central industrial region, the highest emission concentrations being associated with coal-fired electricity generation and the synthetic liquid fuel plants.

Figure 1: Carbon dioxide emissions in South Africa.



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Quantifying the emissions indicated that approximately 39% of emissions were non-sequestratable because of their diffuse nature. Of the sequestratable emissions, approximately 65% were associated with electricity generation.

Table 1: Quantification of sequestratable and non-sequestratable carbon dioxide emissions in South Africa.

	Mt	% Emission		
SEQUESTRABLE				
Electricity	161	65	249 Mt	61 %
Industrial	28	11		
Other Energy	30	12		
Manufacturing	30	12		
NON-SEQUESTRABLE				
Waste	10	6	159 Mt	39 %
Agriculture	48	27		
Fugitive	42	24		
Transport	22	21		
Heat Production	37	21		
Total	**408**			

Moreover, one prominent source was the ~30 Mt/y of ~95% carbon dioxide emissions from synthetic fuel plants. Such a source would be the obvious choice should a carbon capture and storage project take place in South Africa as the capture element has essentially been done.

3. Stakeholder Outreach

During mid-2006, a workshop of stakeholders was held as an outreach activity and to solicit recommendations regarding the way forward. Noting the challenges from the environmental groups, who saw carbon capture and storage as perpetuating the use of fossil fuels, the three main outcomes were:

1. Carbon capture and storage should be one of the tools to mitigate greenhouse gas emissions;
2. Ocean storage should not be considered at this stage; and
3. A study should be done to identify and characterise potential storage sites.

4. Country Readiness

There are very few countries that do not have some experience of extracting resources from beneath the earth's surface. However, injecting deep waste is another matter. Country readiness is defined as addressing enablers that will facilitate the implementation of a carbon capture and storage project.

South Africa is currently addressing 'country readiness' through the following activities:

1. <u>Identification and Characterisation of Sources:</u>
   Although the identification of sources had ostensibly been done, the characteristics need further detail and information updated as new plant are brought into operation.
2. <u>Identification and Characterisation of Storage Sites:</u>
   Potential geological storage sites have been identified, but their detailed characteristics are yet to be investigated. To this end, the generation of a detailed 'Carbon Storage Sites Atlas' is being addressed. The terms of reference for such a study are nearly complete[2] and international expersise being sought. This study is a 'make-and-break' for carbon capture and storage in South Africa. If there are no suitable storage sites, then any such projects will be moribund.
3. <u>Regulatory Systems:</u>
   There are two scales of regulatory systems that are important for carbon capture and storage;
   (a) <u>Global</u>
   Greenhouse gases mitigation activities are by themselves non-economic and therefore not viewed as a priority by wealth generating industries. However, international agreements such as the Kyoto Protocol provide a basis for such undertakings. To incentivise Non-Annex I Parties to undertake carbon capture and storage projects, then the technology needs to be recognised by the Clean Development Mechanism as a legitimate method of earning carbon credits.
   (b) <u>National</u>
   A national regulatory system needs to be established to implement a Party's international obligations – say under the Kyoto Protocol – thereby ensuring industrial implementation.
   On the other hand, industrial activities within a country need to be regulated to ensure, inter alia, orderly development, health, safety and environment protection. Whilst many countries have a well developed regulatory system related to the extraction of minerals, the re-injection of substances is rarely addressed.
4. <u>Plant Readiness:</u>
   Carbon capture and storage is not yet developed to the point where it can readily be applied to industrial processes. Hence, there are many plants currently being planned or under construction for which carbon capture

[2] Undertaken by the South African Council for Geological Sciences.

and storage would be appropriate. In such a case, it would be prudent for such plants to be constructed in such a manner that carbon capture and storage could readily be retrofitted. The minimum in such a case would be to allow for a footprint that would accommodate later retrofit.

5. Capacity Building:
   (a) Technical Know-How
   Technical know-how is imperative for the successful operation of ant technology. Technology transfer is complete when the recipient country can maintain and reproduce the technology without external assistance.
   To this end, South Africa is a member of the Carbon Sequestration Leadership Forum, is addressing membership of the International Energy Agency Greenhouse Gas Programme, and is actively seeking bi/multi-lateral cooperation.
   (b) Human Capacity
   Without qualified human capacity, any project is doomed to failure. To this end, South Africa has been participating in courses on carbon capture and storage organised by the Carbon Sequestration Leadership Forum and International Energy Agency Greenhouse Gas Programme.
6. Public Outreach
   The participation of stakeholders is vital for community acceptance of any project. To this end, a Workshop was held under the auspices of the South African Fossil Fuel Foundation – the outcomes of that Workshop are addressed in Section 3 above.
   Interest is also been shown by the Media, with a number of articles appearing in engineering journals as well as public newsprint.

5. Conclusion

The recently established South African National Energy Research Institute has taken carbon capture and storage as part of the advanced fossil fuel use division.

Sasol is currently investigating the feasibility of utilising carbon dioxide for enhanced coal-bed methane production.

A Terms of Reference for the detailed identification and characterisation of potential carbon dioxide storage sites has been drafted. This process is calling on international expertise. The results of this investigation are a ‘make-or-break’ for carbon capture and storage in South Africa.