Republic of Botswana

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6th International CCS regulatory Framework Meeting

CCS potential study in Botswana

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Presentation Outline

- Introduction
- CO2 Emissions
- CCS activities in Botswana
- Project overview
- Project Approach
  - Work Package 1 (Geological Scoping)
  - Work Package 2 (Institutional and Regulatory Framework)
- Deliverables
- Conclusion

Introduction

- Botswana is a land locked & a sparsely populated country **(~2 million**) with an area of 582, 000 km^2.
- Economically, Botswana is an upper middle income country with her economy mainly driven by diamond mining (**contributing ~23% to the GDP**).
- In her quest to diversify the economy, Botswana has identified a number of strategies for growth, e.g.:
  - ✓ **To attain the capacity to supply SADC region with coal and coal bed methane based (CBM) electricity.**
  - ✓ **To create a range of support industries and activities from these resources.**

Location of Botswana in Southern Africa

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Introduction

- Currently Botswana imports most of its electricity from Eskom of South Africa & other Southern African Power Pool (SAPP) countries.
  - **However, supply from Eskom is being steadily reduced which will subsequently come to no supply once Morupule B is fully functional.**
- Irrespective of this, Botswana still comes up with various strategies / Initiatives, e.g.,
  - **Upgrading and building of new power plants,**
  - **New mines,**
  - **The high electrification targets**
  - **The desired diversification to non mining sectors.**
- Turning to domestic solutions, Botswana's energy resource options include:
  - **Solar**
  - **CBM (estimate @ ~190 TCF) still remain largely unexplored & thus not yet available for base-load generation.**
  - **Coal is extensive, estimated at ~ 212 billion tonnes.**
- However, with such large resources, Botswana is likely to depend on coal for power generation into the foreseeable future, and as such;

Making it necessary to explore clean coal technologies including CCS as a measure to reduce CO2 emissions.

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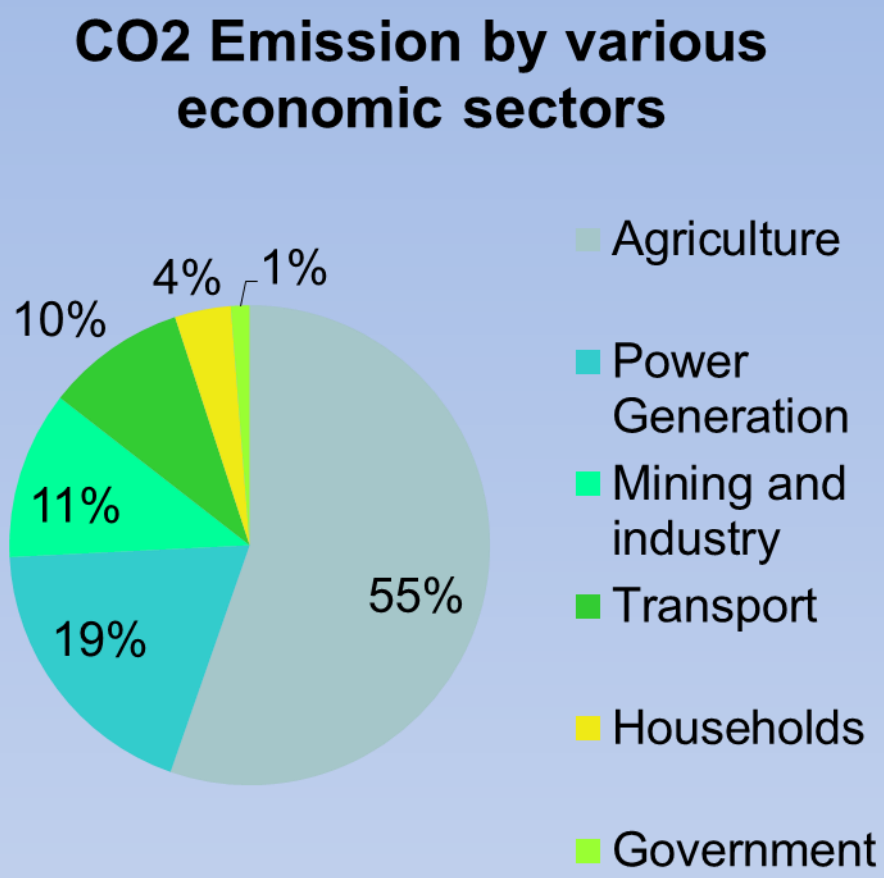
CO2 Emissions

Greenhouse gas (GHG) emissions

- As energy demand grows Botswana will continue to generate more GHG emissions mainly from the existing, newly built power station and planned ones.
- Power generation will increase emission by 15-fold compared to 1750g estimated for 1994 in the National Communication.
- The increase in CO2 emission can only be curb by the low carbon/ clean coal technologies.



Source: Greenhouse gas (GHG) inventory data (1994)

CCS activities in Botswana

Existing CCS activities

- CCS-Africa Southern African regional workshop in 2007
- SASOL of South Africa wanted to engage with Botswana govmnt in possibility of storing CO2 from its operations in S.A(agreements were not made)
- Preliminary assessment of potential storage facilities was also made CIC energy(Jindall Botswana) 2008.
- Feasibility of CCS in Botswana (ERM and Wellfields, 2008)
- CCS in Southern Africa (2010)
- CCS Legal and Regulatory activity in Botswana done by Chilume Company, 2011

Planned CCS activities

- Current project will produce a CCS atlas for the country.
- A detailed CCS exploration to be carried out in one of the identified sites.
- CCS pilot plant to be done after potential sites has being identified.

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Project Background

- Botswana's approach is therefore to develop a domestic energy portfolio including low-carbon (e.g., CBM and possible coal gasification) and no-carbon (e.g., CSTP) technologies and also examine **carbon capture and storage (CCS)**, all of which support economic diversification and also have the potential to make demonstrative impact on the countries in the region in mitigating climate change.
- The immediate intervention was for Botswana to develop new generation capacity for energy security – the **Morupule B power plant which is now operating**.
- The first objective has been achieved through the provision of a partial by adding 600 MW new capacity through 4 units of 150 MW each, adjacent to the existing Morupule A Power Station, and associated transmission lines and substations.
- The second objective is to assist with the preparation of a **lower carbon growth strategy** to help the Government and private sector fast track exploration of alternative energy sources (e.g., CBM, CSP) and new technologies (e.g., CCS) through feasibility studies and securing appropriate financing.
- The third objective will be achieved by improving the sector **frameworks—policy, legal, and regulatory**—for the electricity, coal, and CBM, and enhancing capacity of the relevant institutions, including setting up of a new independent electricity regulator.

Project Background

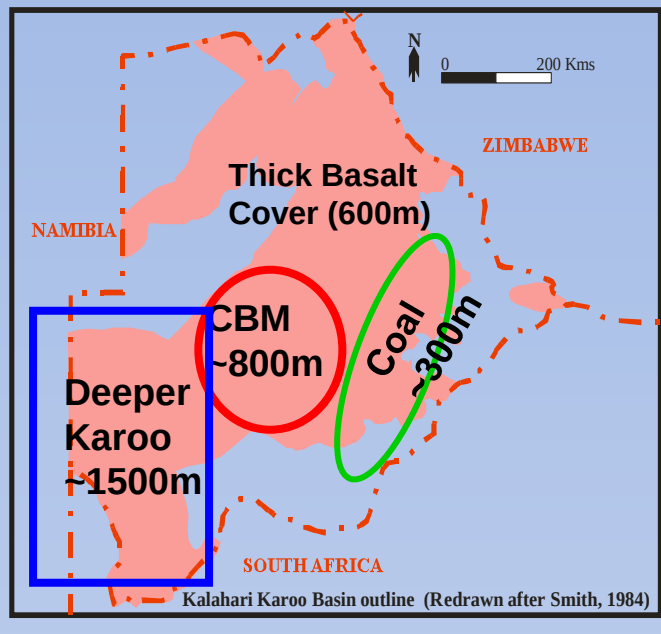
- Botswana's main energy resources are coal and CBM, and the Government is therefore considering a number of coal-fired power plant proposals and CBM pilot project proposals, including:
  - The Morupule B project, involving the establishment by BPC of a new coal-fired power plant alongside the existing Morupule A facility;
  - the planned Mmamabula IPP, involving a new coal-fired power plant near the border with South Africa; and
- In view of these proposed projects, and given the on-going international concern over climate change, the Government wishes to examine various strategies to mitigate CO2 emissions.
- CCS is considered as one of the most important options for reducing atmospheric anthropogenic CO2 emissions.
- From the outset, it is anticipated that the first task is to define carbon storage potential that will have a high degree of association with the ongoing activities around the exploration and development of coal bed methane (CBM). CBM exploration will serve to define the prospective storage horizons, candidate well fields, and thus infrastructure needs in terms of pipelines and ongoing monitoring, reporting and validation.
- The purpose of the **proposed feasibility study** is to assess geological potential for CCS in Botswana. If such potential is confirmed the following an in-depth examination and recommendations on legal and regulatory frameworks will be necessary to address underlying concerns and/or issues and identify a pilot CCS project.

Project Approach/Scope of work

- Work Plan 1 (Geological Scoping)
  - Geological and Structural Overview
  - Review of existing knowledge
  - Identification of Potential CCS development Zones
  - Selection of Pilot (Candidate) Area

Geological Scoping

- Detailed investigations will need to be undertaken to expose where the potential is , e.g.,
  - Conducting geological storage assessments, i.e.,
    - **Is the geology suitable for CCS?**
- Botswana has prospective sedimentary basins, with:
  - The Karoo Supergroup (with av. thickness not exceeding 1000 – 1500 m) covering ~70% of the country, but is poorly exposed.
- Key crucial elements
  - Is there sufficient underground porous reservoir space (capacity & injectivity) at sufficient depths with;
    - **Appropriate containment (cap rock to avoid leakage)**
- Is there sufficient data to analyze these parameters and/or are they freely available?



Project Approach

- Work Plan 2 (Institutional and Regulatory Framework review)
  - Analog Analysis
  - Legislative and regulatory environment
  - Institutional Implementation Framework
  - Summary and Recommendation for Regulatory Framework.

Deliverables

- WORK PLAN 1
- Geological Site Selection Scoping Report
  - Geological Findings in relation to potential storage locations
  - SWOT analysis for a pilot location
  - Recommendations
- WORK PLAN 2
- Institutional and regulatory Framework Report
  - Legal framework for CCS in Botswana
  - Institutional framework

Conclusion

- It is partly through such further geological investigations and a wide consultative process that stakeholders will be informed about how best to proceed, if at all, with CCS in Botswana.
- In addition, given the current lack of regulatory and limited human capacity to regulate CCS, the regulatory capacity will therefore have to be enhanced.
- With the plan to develop 2*300MW coal fired power plants, CCS becomes a good mitigation measure, as long as it is technically and financially viable.