PROJECT INFORMATION DOCUMENT (PID)
APPRAISAL STAGE

Report No.: PIDA73210

Project Name	Development Carbon Capture and Storage in South Africa (P149521)
Region	AFRICA
Country	South Africa
Lending Instrument	Investment Project Financing
Project ID	P149521
Borrower(s)	Department of Energy
Implementing Agency	South African Centre for Carbon Capture and Storage
Environmental Category	A-Full Assessment
Date PID Prepared/Updated	19-Sep-2016
Date PID Approved/Disclosed	20-Sep-2016
Estimated Date of Appraisal Completion	29-Jul-2016
Estimated Date of First Grant Approval	28-Oct-2016
Appraisal Review Decision (from Decision Note)	The following Review Meeting Decisions were taken: The Chairperson commended the Team on the ongoing CCS program of support in South Africa and for the work on the PAD. The meeting agreed to upgrade the project from pre-appraisal to appraisal. The Team was authorized to proceed with negotiations and submission of the proposed project to the Regional Vice-President for approval subject to addressing the points, raised during the meeting.
Other Decision	It was thought that the timetable to move to effectiveness seems reasonable although a comment was received that the Bank support for the project would benefit from continuing into the Closure stage of the PCSP. It was however stressed that this could result in the project extended up to 10 years or beyond which would not be ideal. Instead, it was requested that in the Grant Agreement, SANEDI would be asked to keep the Bank up to date on the project, including monitoring results, beyond the end of the Bank supported program. It was also suggested that the completion of the site specific PCSP ESIA become a disbursement condition however it was confirmed that this was already in the draft. It was also noted that the Grant Agreement would contain the standard requirements for the Subsidiary Agreements to be in place.

I. Project Context

Country Context

South Africa was significantly affected by the economic crisis of 2008 and the country➢(s economic recovery has been slow. According to the most recent World Bank economic update for South Africa, growth momentum has faded progressively since reaching the post-crisis peak gross domestic product growth of 3.6 percent in 2011. Growth fell to 1.5 percent in 2014, and is estimated to have dropped to 1.3 percent in 2015. The estimate for 2016 is 0.8 percent, with a recovery to 1.1 percent projected in 2017. However, projections of gross domestic product growth for 2016➢(2018 are subject to considerable uncertainty given the fluctuations during the past few years. Multiple factors including, but not limited to, lack of competition in domestic input and downstream production markets, falling commodity prices, declining revenues, rising borrowing costs, power shortages, labor strikes (particularly in the energy-intensive mining sector), poor governance, and others are expected to continue to create fiscal stress.

Despite the current economic difficulties, the Government of South Africa (GoSA) pledges to sustain the implementation of the National Development Plan 2030 (NDP 2030), which aims to roll back poverty and inequality and raise living standards. One of the cornerstones of NDP 2030 as well as the 2016 Budget Review is to remove electricity supply constraints that impede economic recovery and to increase further access to affordable electricity services. Electricity access increased from 34 percent of the population in 1994 to about 82 percent by 2014. This massive electrification took place without significant additions to new generation capacity. To improve availability of electric energy, the GoSA➢(s strategy is to (a) accelerate improvements in energy efficiency; (b) pursue a low-carbon strategy by investing in clean energy and creating the necessary regulatory and economic instruments to stabilize greenhouse gas (GHG) emissions over the medium term and reduce them over the long term; and (c) give priority in the near term to increasing generation capacity and reliability of electricity.

South Africa➢(s electricity generation sector is heavily dependent on fossil fuels. The current share of coal-fired generation capacity in the overall electricity generation mix constitutes 92 percent. Notwithstanding South Africa➢(s commitment to implementing renewable energy and energy efficiency programs, fossil fuels are likely to remain the country➢(s primary energy source in the decades to come. By 2020, the national utility, Eskom, plans to add about 11,086 MW of capacity, of which 78 percent will come from supercritical coal-fired plants. Based on this schedule, the installed capacity will increase from an estimated 42,889 MW in 2016 to 52,291 MW in 2020. The expansion of the country➢(s coal-fired generation fleet means that emissions of carbon dioxide (CO2), currently estimated at 500 million metric tons per year, are unlikely to decline for some time.

However, South Africa is committed to reducing its CO2 emissions. In pursuit of this goal, the president of South Africa announced in 2009 that the country would implement measures to reduce its emissions by 34 percent and 42 percent, against the business-as-usual scenario, by 2020 and 2025, respectively. This pledge has led South Africa to explore the potential of one of the key climate change mitigation technologies, carbon capture and storage (CCS), as part of its climate change mitigation strategy. The GoSA prepared its National Climate Change Response White Paper (2011), in which the deployment of CCS is considered a critical element. The GoSA designated CCS as one of its eight Near-Term Priority Flagship Programs to address climate change.

Sectoral and institutional Context

Investigations into the viability of CCS in South Africa began in 2004. The GoSA has since accelerated the investigation of CCS through a number of policy measures, and in 2009 supported the establishment of a division within the South African National Energy Development Institute (SANEDI), the South African Centre for Carbon Capture and Storage (SACCCS), with a specific mandate to undertake and lead technical investigations of CCS in South Africa and to build technical capacity and expertise in the country.

To guide the development of CCS in South Africa, the SANEDI, through the SACCCS, prepared the South African CCS Roadmap in 2009, which the GoSA fully endorsed in 2012. The South African CCS Roadmap comprises the following five phases to be completed over 20 years: (a) assessment of CCS potential, (b) completion of CO2 storage atlas, (c) CO2 test injection, (d) CCS demonstration, and (e) commercial CCS application. Each phase represents a major milestone in the investigation and development of CCS in the country.

Following a preliminary assessment of CCS potential in South Africa, the South African Council for Geoscience (CGS) completed the second milestone of the roadmap in 2010 – the Atlas on Geological Storage of Carbon Dioxide in South Africa (hereinafter "the Atlas"). The Atlas identified a number of potential storage areas with a total national theoretical CO2 storage capacity of 150 billion metric tons, of which 98 percent is located offshore. To put this capacity in perspective, if only 10 percent of South Africa's current annual CO2 emissions were to be captured over 100 years, this would require only 5 billion metric tons of storage capacity, or just over 3 percent of South Africa's total estimated theoretical storage capacity.

CCS development in South Africa has now entered the third phase of the roadmap – the Test Injection, which consists of a comprehensive five-year program comprising the implementation of two CCS-related pilot projects:

- A stand-alone Pilot Carbon Dioxide Storage Project (PCSP), which involves the exploration, characterization, and selection of a geological storage site, and the subsequent injection, storage, and monitoring of 10,000 – 50,000 metric tons of CO2
- A stand-alone Carbon Dioxide Capture Pilot Project (CCPP), which includes the design, construction, integration, and operation of a CO2 capture pilot plant at a supercritical coal-fired power plant under construction (Kusile), with the goal of providing a testing and learning facility for industry and academia across the southern Africa region and beyond.

These pilot projects are intended to be a proof of concept for CCS technology under South African conditions – including storing in South African geology, capturing from South African coals, and overseen by South Africa laws and regulations. The projects are also intended to build local expert capacity and raise awareness about the technology. Should the projects succeed, South Africa will be in a much better position to implement the later stages of the roadmap. If one or both of the projects do not succeed, it does not necessarily mean that CCS will not work in South Africa, however the reasons for failure will have to be thoroughly reviewed by GoSA and SANEDI to determine if/how to prceed with the later stages of the roadmap.

Based on the information provided in the Atlas, follow-up studies were undertaken to further analyze two onshore basins that were assumed to have greater storage capacity potential: the Zululand Basin and the Algoa Basin. An independent, international group of CO2 storage experts,

the PCSP International Advisory Committee (PAC), reviewed the completed studies and confirmed that the two basins could be suitable for CO2 geological storage. In parallel, stakeholder engagement activities commenced in the two basins. Following the initial PAC review and outcomes of the preliminary stakeholder engagement, the Zululand Basin has been prioritized and selected for further investigation. The activities related to the preparation and implementation of the PCSP will be carried out in the Zululand Basin. The CGS is working with international CO2 storage experts to ensure adherence to international best practices as well as application and harmonization of the most current methodologies relatin g to the assessment of CO2 storage potential.

Despite significant experience with industrial CO2 capture and some small-scale CO2 transport in South Africa, the integrated CCS chain is a new technical area. Human and institutional capacities and technical expertise in this area are limited, except for some pockets of specific knowledge. Companies involved in CCS development and deployment (in collaboration with the SACCCS) include the national electric utility Eskom, Sasol (a private sector chemical and coal/gas-to-liquids company), Anglo-American (a mining company), and PetroSA (the state oil company), among others.

At the institutional level, the GoSA►(s Department of Energy (DoE) and associated institutions and organizations, for example, the SANEDI (including the SACCCS), has led the investigation and development of CCS in South Africa. These efforts have been supported by other institutions, including the CGS, Centre for Scientific and Industrial Research, several South African universities, and the World Wildlife Fund, which has been engaged in CCS-related activities and discussions in South Africa for many years.

The CGS in particular has been a key contributor to CCS development in South Africa. As mentioned above, CGS led an 18-month investigation of South Africa►(s geological CO2 storage potential (an effort sponsored by Sasol, Eskom, PetroSA, Anglo-American, and SANEDI) and compiled and published the aforementioned Atlas in collaboration with the SANEDI, SACCCS, and PetroSA.

In support of the DoE►(s and GoSA►(s broader efforts to reduce GHG emissions and mitigate the nation►(s contribution to climate change, South Africa►(s National Treasury is looking to introduce a carbon tax. The carbon tax has been under development for a number of years culminating in a draft Carbon Tax Bill, issued for comment in November 2015, along with a number of supporting documents. The carbon tax, which is intended to come into effect in 2017, includes a provision for carbon offsets, whereby companies can invest in GHG and CO2 mitigation projects to reduce their carbon tax liability. The availability of carbon offsets will incentivize investment in GHG mitigation projects, including potentially CCS. Carbon taxes have demonstrated to be an effective policy instrument for accelerating the deployment of CCS technology in countries such as Norway.

The World Bank Multi-Donor Carbon Capture and Storage Capacity Building Trust Fund (CCS TF) was established in 2009 to support CCS capacity and knowledge building in developing countries. In Phase 1, the CCS TF supported CCS development in South Africa with an allocation of US$1.35 million for the following:

►(¢ The development of a regulatory framework for CCS in South Africa

- A techno-economic review of CCS implementation in South Africa
- Capacity building for CCS in South Africa
- The development of a national and local public engagement plan for the South African PCSP

Phase 1 activities in South Africa are now complete.

Based on the outcomes of Phase 1 and the GoSA's demonstrated commitment to CCS development, the CCS TF donors, in consultation with the World Bank team, agreed to fund Phase 2 of the World Bank-supported activities in South Africa. Phase 2 consists of the Programmatic Technical Assistance for Capacity Building for Carbon Capture and Storage in the Republic of South Africa (PTA, P151193) and the proposed Technical Assistance Project for the Development of Carbon Capture and Storage in the Republic of South Africa (TAP).

The ongoing PTA, being undertaken in parallel with the TAP, has a five-year time frame and lays the analytical foundation for the proposed TAP. The PTA supports Stage 2 of the PCSP - Data Analysis and Project Planning, along with the Stage 1 of CCPP - Pre-feasibility. The PTA will continue providing the required analytical support during TAP implementation.

The support for the GoSA's CCS program forms a key element of the World Bank's broader energy and climate change support program in South Africa. The larger program includes support for: (a) the Medupi coal-fired power plant; (b) the Sere wind power plant ; (c) the Upington concentrating solar plant; and (d) the investigation of a CO2 tax in South Africa.

II. Proposed Development Objectives

The Project Development Objective (PDO) is to assess the feasibility of, and build expert capacity for, carbon capture and storage in South Africa.

III. Project Description

Component Name

Component 1: Pilot CO2 Storage Project (US$21.5 million CCS TF, US$13.5 million GoSA)

Comments (optional)

Component Name

Component 2: CO2 Capture Pilot Project Front-End Engineering Design (US$1.5 million CCS TF)

Comments (optional)

IV. Financing *(in USD Million)*

Total Project Cost:	36.50	Total Bank Financing:	0.00
Financing Gap:	0.00		

For Loans/Credits/Others	**Amount**
Borrower	13.50
Carbon Fund	23.00
Total	36.50

V. Implementation

A. Institutional and Implementation Arrangements:

SANEDI is the project implementation agency. The PCSP Division of SANEDI will be responsible for the implementation of Component 1. The SACCCS Division of SANEDI will be responsible for the implementation of Component 2.

The SANEDI Board oversees SANEDI operations. The SANEDI Board will also be in charge of making major decisions relating to the PCSP and CCPP FEED, including the completion of stages and decision points. The PCSP and CCPP FEED development are governed on a more regular basis by the PCSP Steering Committee and the SACCCS Steering Committee, respectively. These Steering Committees are then provided with technical support from a number of sub-committees and advisory committees.

B. Results Monitoring and Evaluation:

As the implementing agency, SANEDI, through its PCSP Division and SACCCS, will be responsible for day-to-day project operation, including monitoring project indicators and budget. SANEDI has some experience in this area, acquired from smaller desktop studies and projects. However, the implementing agency would benefit from strengthening of its monitoring and evaluation capacity to handle the magnitude, complexity, and budget of the proposed project.
To strengthen SANEDI►(s monitoring and evaluation capacity, the Bank has structured an implementation support plan which involves:
►(¢ Day-to-day support from a Project Implementation Support Consultant;
►(¢ Weekly project team meetings with support from a Project Implementation Support Consultant;
►(¢ Monthly consultant and contractor progress meetings with support from a Project Implementation Support Consultant;
►(¢ Quarterly PCSP and SACCCS Steering Committee meetings with support from a Project Implementation Support Consultant; and
►(¢ Annual project progress reports by a Project Implementation Support Consultant and semi-annual Bank supervision missions.
The PCSP Steering Committee will support and oversee SANEDI►(s implementation, monitoring and evaluation functions, systematically reviewing the implementation on a monthly/quarterly basis. The PCSP Steering Committee will focus primarily on the verification of performance against project indicators and verification of budgetary and governance performance.
For the CCPP FEED, the SACCCS Steering Committee will support and oversee SANEDI►(s monitoring and evaluation functions, systematically reviewing the implementation on a monthly/ quarterly basis.

C. Sustainability:

Mitigating South Africa►(s GHGs emissions, while facilitating the ongoing and future sustainable use of the country►(s vast coal reserves, is a priority for the GoSA. CCS is one of the few technologies identified globally that can make a significant contribution to these sustainability aims of the GoSA.
The TAP is the critical next step in understanding the potential for CCS in South Africa. The findings of the PCSP and CCPP FEED will form the foundation of, and be leveraged for, the implementation of CCPP and of the next milestones of the South African CCS Roadmap ►(CCS Demonstration and CCS Commercialization. In particular, the development of the human technical

capacity, including technical capacity amongst previously disadvantaged South African individuals and women, through the implementation of the TAP will underpin the ongoing development and deployment of CCS and the associated large-scale CO2mitigation in South Africa. This capacity will also be applicable more widely in the energy and natural resource sectors.
This project builds on an established governance structure, comprising existing institutions, such as the DoE, SANEDI and SACCCS. Of these, the SACCCS has a specific mandate to undertake and lead technical investigations of CCS and build technical expertise. The existence of this infrastructure, together with the priority that the GoSA has placed on the CCS agenda, is key to the long-term sustainability of CCS development and implementation.

VI. Safeguard Policies (including public consultation)

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	×	
Natural Habitats OP/BP 4.04	×	
Forests OP/BP 4.36		×
Pest Management OP 4.09		×
Physical Cultural Resources OP/BP 4.11		×
Indigenous Peoples OP/BP 4.10		×
Involuntary Resettlement OP/BP 4.12		×
Safety of Dams OP/BP 4.37		×
Projects on International Waterways OP/BP 7.50		×
Projects in Disputed Areas OP/BP 7.60		×

Comments (optional)

VII. Contact point

World Bank

Contact: Nataliya Kulichenko
Title: Senior Energy Specialist
Tel: 5355+3291
Email: nkulichenko@worldbank.org

Borrower/Client/Recipient

Name: Department of Energy
Contact: Landi Themba
Title: Director Coal and Gas Policy
Tel: 27124068000
Email: Landi Themba Landi.Themba@energy.gov.za

Implementing Agencies

Name: South African Centre for Carbon Capture and Storage
Contact: Tony Surridge
Title: Senior Manager: Advanced Fossil Fuel Use
Tel: 0027110384348
Email: tonys@sanedi.org.za

VIII. For more information contact:

The InfoShop
The World Bank
1818 H Street, NW
Washington, D.C. 20433
Telephone: (202) 458-4500
Fax: (202) 522-1500
Web: http://www.worldbank.org/infoshop