Technology Fact Sheet for Mitigation

M. The carbon capture and sequestration (CCS) technology [i]

1. Introduction	
1.1 Historical	- Early 1970s, in Texas(USA) and in Canada, non- anthropogenic CO_2 were injected underground for the purposes of recovering oil fuel from geological reservoirs - In 1996, in North Sea, the first large unit of CO_2 storage was installed by the Sleipner Gas Field (Norway). - In 1998 and 2003, the Alberta Research Council(ARC) installed a CCS pilot project respectively in Canada and Chine - In Algeria some industrial projects are developing a program of CO_2 as a mitigation option, it is the case for the in Salah project
1.2 Location of Resources	- Significant sources of CO_2 emissions to be captured and sent to geological storage are manufacturing units in Kigali, thermal oil power plants, and cement factories in Rusizi district. - Small and mobile sources of GHG emissions are not included in this context of potential CCS deployment
1.3 Variability of Resources	- An important increase of flue gases in expected due to current promotion of industrial sector and energy sector
2. Brief Description	

2.1 Conditions	- Applying CCS required a high support through the promotion of carbon credit market - Development of large units of Kivu methane CCGT - CCS can be justified by the coming extraction of peat resources at large scale for power generation
2.2 Characteristics	- The first step is the capture of CO_2 from flue gases - Before transportation to storage unit, removal of moisture to avoid corrosion of pipelines and compression process are required - Transport of compressed and dry CO_2 is done through a network of pipelines - Location of geological formations can be far from the source of CO_2; - Efficiency of capture and storage: about 85% - The post-combustion capture is commercially feasible - Depth of injection is up to 1km - Geological storage plays the double role of CO_2 sequestration and extraction of methane fuel through recovery like ECBM (Enhanced oil recovery);
3. Applicability and Potentialities in Rwanda	

3.1 Applicability	- Development of electric power generation by Kivu methane gas and by peat-based technologies can consider the feasible options of CCS such as the post-combustion capture and geological storage
3.2 Potentialities	- Industrial thermal oil power plants in Kigali - Coming power projects based on Kivu methane and peat resources - Existing cement factories in rural areas of Bugarama in Southern West of Rwanda, Rusizi district
3.3 Limitations	- Distance between potential geological formations appropriate for storage and location of industrial sources of CO_2 emission .
4. Status of the Technology in Rwanda	
4.1 Local Production	- NA
4.2 Shared Power Plants	- NA
4.3 Projects	- NA
5. Benefits to Development	
5.1 Social	- Creation of jobs especially for installation and maintenance of the CCS components
5.2 Economic	- Generation of additional revenues due to the recovery of methane from the geological peat-based seams - Benefits from the carbon credit market

5.3 Environmental	- GHG emissions to atmosphere are avoided - Combine to natural sequestration by forests, the CCS deployment in Rwanda can secure future scenario of fully green country
6. Climate Change Mitigation Benefits	
6.1 Reduction GHG Emissions	- In case of CCS combined to Kivu CCGT, at least 360 kg of CO_2 are captured from flue gases per each MWh generated; i.e. about 300 kg of CO_2 emission are avoided. For the case of peat-based IGCC with CCS, at least 670 kg of CO_2 are captured and hence 590 kg of CO_2 per MWh are avoided
6.2 Low Carbon Credits	- Application and deployment of the CCS in the energy sector are expected to be given priority to access of carbon credit finances
7. Financing Requirements and Costs	
7.1 Private Sector Involvement	- Investment in CCS technology for further deployment on local market is possible if private companies are given loans and incentives or access to carbon credits funds
7.2 Capital Cost	- Unless the CCS is developed for both mitigation purposes and extraction of methane (ECBM) from deep peat steams , the capital cost of a post-combustion capture system and

	geological storage of CO_2 emissions from IGCC or ECBM or CCGT plants is an additional non affordable cost.
7.3 Generating Costs	- Cost of electric energy ranges between about 4 and 8 USD cents per kWh for the case of methane CCGT combined with the CCCS against about 3 to 5 USD cents per kWh generated by a CCGT without a CCS option. - Therefore applying CCS to CCGT results in cost increase of about 37 to 85%

[i] **This fact sheet has been extracted from TNA Report – Technology Needs Assessment and Technology Action Plans For Climate Change Mitigation– Rwanda. You can access the complete report from the TNA project website http://tech-action.org/**