Republic of Senegal
Ministry of Environment and Nature Protect
Diretion of Environment

Second National Communication

United Nations Framework Convention on Climate Change

DEEC

CCNUCC

FEM

PNUE

Executive Summary

For this study of the Greenhouse Gases (GHF) from Senegal, the year 2000 has been taken as a reference. The study covered the five (5) sectors recommended by the IPCC's 1996 revised guidelines namely: Energy, Industrial Processes, Agriculture, Land-Use, Land-Use Change and Forestry (ATCATF) and Waste.

The main gases listed are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), azote oxides (NOx), carbon monoxide (CO), Volatile Components Non=Methanic (VCONM) and the Sulfur Dioxide (SO_2). Emissions of other gases such as hydro fluorocarbons (HFCs), per fluorocarbons (PFCs) and sulfur hexafluoride (SF_6) are negligible.

The distribution of these gases is illustrated in Figure 1. The CO_2 accounts for 95% of emissions in 2000. Figures 2, 3 and 4 represent respectively the share of the sectors in the emissions of CO_2, CH_4 and N_2O. This study is also mentioned in Table 1.

In 2000, 95% of the CO2 emissions were due to the energy sector followed by the industrial processes industrial processes for 4%. The forestry sector which is rather a carbon sink has only one per cent (1%) of the emissions in total.

As regards methane, the dominating sectors are agriculture with 69%, and waste for 29%.

Converted to sequestrated CO_2 equivalent, these emissions are divided as follows: 49% for energy, 37% for agriculture, 12% for waste and 2% for industrial processes. The total of these emissions is 16, 890.92 Gg; or an e emission of 1.8 tonne of CO_2 per capita (for a population of 9, 385, 417 inhabitants).

Taking into account the 10, 587 Gg of CO_2 emissions sequestrated in the forestry sector, the emission rate per capita becomes 0.67 tonne.

These figures are below the world average of 4.5 tonnes of CO_2 annually and per capita and that of Africa 1.5 tonne (source: Philippe OSSET, "GreenHouse Effect: A Few Figures", January 2007). Note that the CO2 emissions of the European Union are 9 tonnes per capita while for the USA and Canada, they are 23 tonnes per capita, and 2 tonnes per capita for India and China (source : Philippe OSSET, "Effet de serre : quelques chiffres", January 2007).

To develop programmes to limit these GH emissions, a mitigation analysis has been made in these five sectors.
A mitigation programme in the energy sector has been developed through an analysis of the current policy in the sector more specifically the household sub-sector which energy consumption is the highest (42%) has been analyzed with the LEAP (Long-range Energy Alternatives Planning System) model.

The proposed mitigation options include:

- The management of the energy demand in the sectors of electricity, domestic fuel and transport ;
- The management of the supply through the implementation and strengthening of actions aimed at optimizing the energy supply systems.

The analysis of these options has helped establish the following evolution of emissions in the sector.

In the mitigation scenario the emissions will stand at 14, 540 Gg CO_2 emissions in 2010 against 14, 904 Gg in the reference scenario or about 364, 000 tE-CO_2 of GHG avoided, accounting for 2.44% of emissions in the energy sector, which seems relatively significant.

By 2020, GHG emissions due to energy would account for 17, 281 Gg CO_2 emissions in the mitigation scenario against 21, 057 Gg CO_2 emissions in the reference scenario or about 3, 776 Gg CO_2 emissions or 18% of emissions in the energy sector.

Economic impact

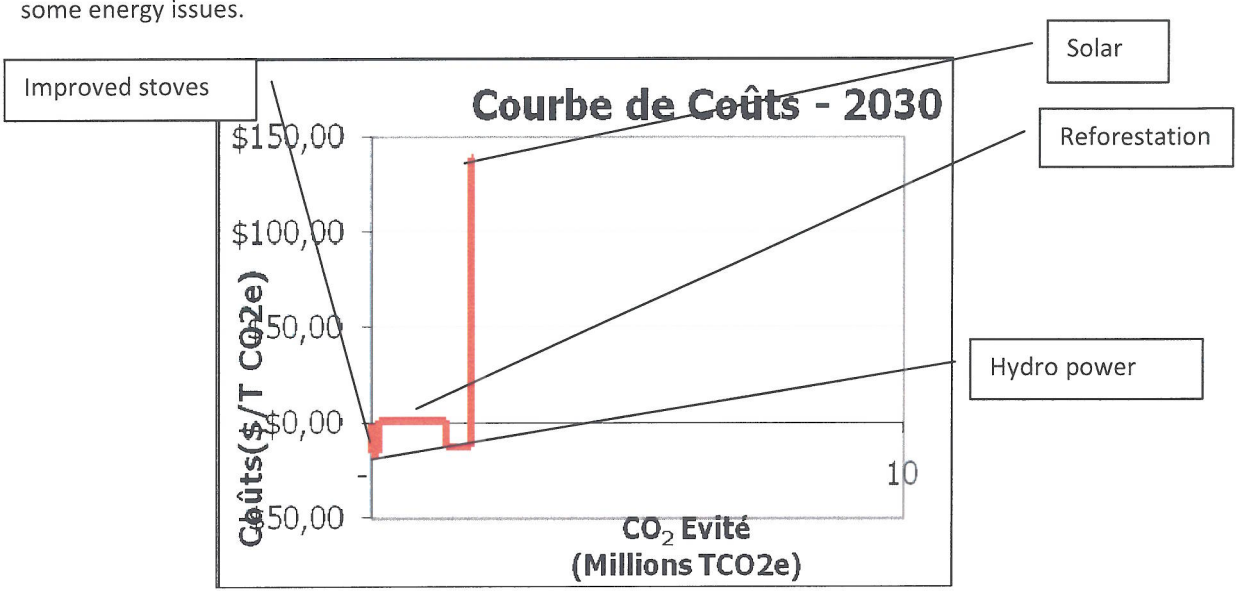
Investments planned under the Electric Demand Control (EDC) programme are estimated at 300 billion CFA Francs during 2009-2020. This programme will help save up to 709 billion CFA Francs over the same period.

Moreover, the recovery of carbon credits will incur financial gains estimated at 11 billion CFA francs.

For the improved stoves extension programme, the investments will be about 16 billion CFA Francs during 2009-2020 and resources from carbon credit recovery estimated at 25 billion CFA Francs.

Total investments will represent 316 Billions of CFA Francs over 2009-2020 with a carbon credit recovery estimated at 36 billion CFA Francs.

Additionally, mitigation analysis in the household sub-sector with the massive introduction of improved stoves, the development of some projects : 100MW water plants, construction of a 20 MW solar power plant and the reforestation of 430 million hectares, show the environmental significance of these programmes due to the large amounts of carbon avoided (illustrated by the following figure). The implementation of these projects would help not only reduce GHG emissions but address some energy issues.



Cost curve for projects Improved Stoves, hydraulic, solar and reforestation above

In the sector of industrial processes, the proposed mitigation options include:

- Improving the quality of clinker
- Using good practices to improve processes
- Developing combined technologic options.

In the agricultural sector, good practices are proposed in order to reduce the GHG emissions. These are:

- Promoting new land management methods ;
- Promoting the burial of crop residues instead of incineration ;

- Promoting agroforestry ;

With respect to the Land-Use and Land-Use Change sector, despite the very insignificant quantity of emitted carbon (32 Gg CO_2) for a very high absorption capacity (10, 587 $GgCO_2$), a mitigation analysis was made with the COMAP ( ) model. Several mitigation programmes were identified with a special option for the enriched fencing in the groundnut basin.

The analysis results are:

- In the mitigation scenario, **40 tC/ha** for the soil carbon ;
- The carbon sequestrated through the fencing is **15 tC/ha** or **a** total of 15 x 508500 = **7 627 500** tonnes of carbon in 20 years ;
- The mitigation effect of the fencing is **55 tC/ha ;**
- The carbon stored in the reforested soil is **20, 340, 000 T** in 20 years.

Overall after 20 years of implementation, the project will help store **27, 967, 500** tonnes of carbon.

Ultimately, the fencing was able to set up a wood capital of **30m^3/ha** or **900, 000m^3** of wood on a land that was initially bare.

For the waste the targeted mitigation strategies are:

- **Solid waste in dumps**
  - ✓ The Mbeubeus Dump closure and rehabilitation project ;
  - ✓ The Sindia CET (Technical Burial Centre) completion and operation mining project;
  - ✓ The establishments of a technical order on the CET, taking into account the management of the biogas.

- **Processed wastewater**
  - ✓ Optimizing the operation of processing basins and reducing methane emissions ;
  - ✓ The implementation of the rural sanitation under the PEPAM ;
  - ✓ Addressing a component '' biogas recovery'' in the rural sanitation component under the PEPAM ;
  - ✓ Conducting technical studies and/or implementing biogas recovery projects in the slaughterhouses in Dakar, Thies, and Touba and on the location of the future national slaughterhouse.

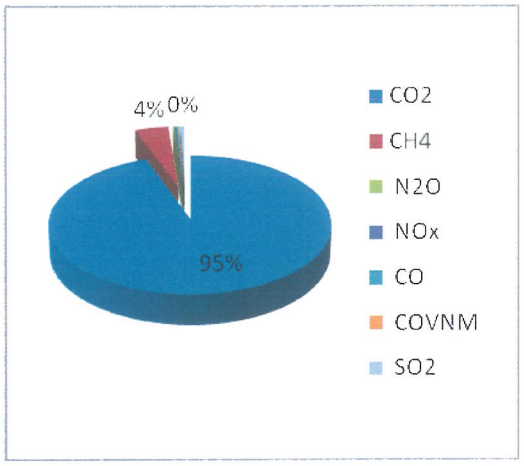
Senegal is suffering from the adverse effects of climate change and must adapt in order to meet the various development challenges. Based on the climate scenarios, sector-based studies, the analysis of the current development strategies (DSRP, SCA), an adaptation strategy is proposed along with a financial plan for integrating adaptation efforts into the development programmes.

Other programs aimed at achieving the Convention goals were also studied, i.e. recherch and systematic observation as well as capacity building. The report proposes projects which implementation would build the capacities of Senegal.

Table 1 : Summary of GHG emissions (in Gg CO_2) per sector and per gas for 2000

Emission sectors	Emissions CO_2	Sequestration CO_2	Emissions CH_4	Emissions N_2O	Emissions NO_x	Emissions CO	Emissions COVNM	Emissions SO_2
TOTAL CO2 Emissions	**6, 814.90**	**-10, 587.00**	**6, 458.32**	**3, 617.70**	-	-	-	-
TOTAL	**6, 814.90**	**-10, 587.00**	**307.54**	**11.67**	**5.91**	**19.84**	**11.21**	**41.11**
ENERGY	**6, 481.39**	**0.00**	**4.62**	**5.30**	**5.12**	**5.12**	**5.27**	**24.78**
Energy Industry	491,.27		4.62	5.30	5.12	5.12	5.27	4.36
Construction and manufacturing	651.00							11.64
Transportation	1, 920.81							6.56
Trade and institution	10.65							1.02
Residential	3, 352.06							1.20
Non-Energy Use	55.60							
Industrial processes	**301.51**	**0.00**	**0,00**	**0,00**	**0,00**	**0,00**	**5,94**	**16,33**
Clinker	301.51							
Cement								0.40
Sulphuric Acid								15.93
Food and beverage							2.65	
Beer and alcohol							0.01	
Asphalt							3.28	
Agriculture	**0.00**	**0.00**	**213.38**	**5.74**	**0.79**	**14.72**	**0.00**	**0.00**
Enteric Fermentation and manure management			197.87					
Rice production			14.81					
Farmlands				5.72				
Savannah Burning								
Burning of agricultural residues			0.70	0.02	0.79	14.72		
Land-Use and Forestry	**32.00**	**-10, 587.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Forest lands which purpose has not changed		-9, 932.00						
Lands converted to forest lands		-596.00						
Croplands which purpose has not changed		-57.00						
Pastures which purpose has not changed	32.00							
Settlements which purpose has not changed		-2.00						
Waste	**0.00**	**0.00**	**89.54**	**0.63**	**0.00**	**0.00**	**0.00**	**0.00**
Municipal solid waste			89.48					
Domestic and commercial wastewater			0.06					
Human waste				0.63				

Graphic Illustration :



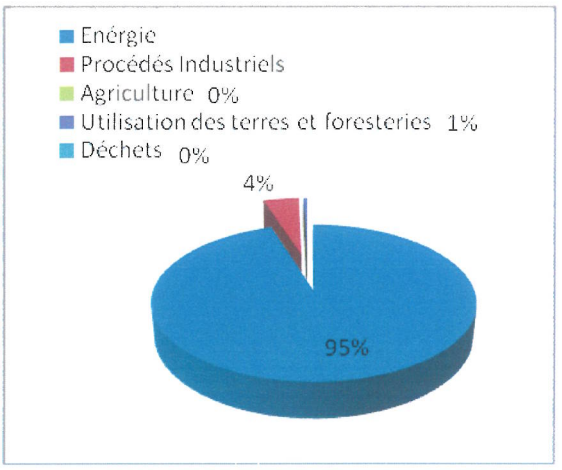
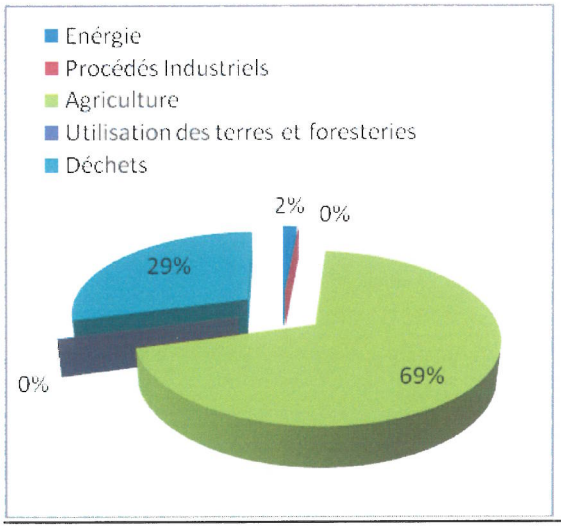


***Figure 1**: Distribution of total emissions per Gas* ***Figure 2**: Distribution of CO2 emissions per sector*



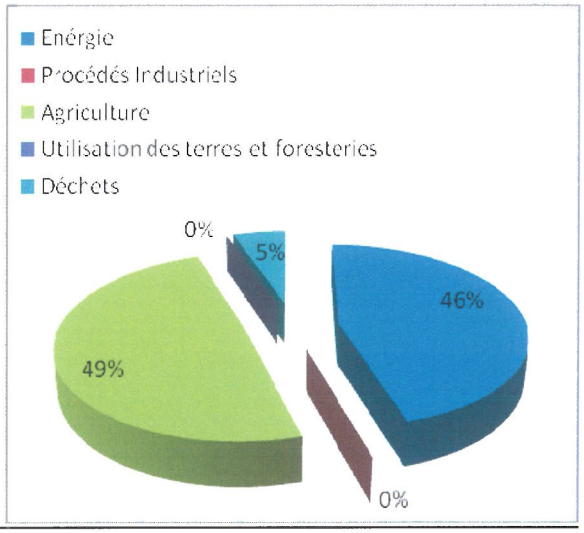


***Figure 3**: distribution of CH_4 emissions per sector* ***Figure 4:** Distribution of N_2O emissions per sector*

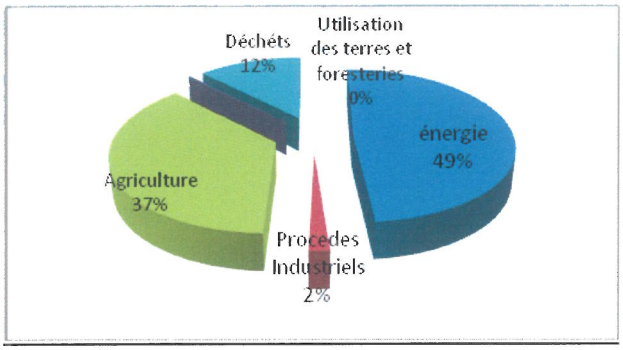


***Figure 5**: Distribution of total emissions in CO_2 equivalent*