



# CONTRIBUTION DETERMINED AT NATIONAL LEVEL IN SENEGAL



## Table of contents

Acronyms .....	5
Introduction .....	7
Senegal's NDC is in line with the PES and its priority action plans .....	7
I. Context .....	8
b. Main climate trends and associated risks.....	9
c. Impacts and vulnerabilities .....	11
d. Fairness and Ambition .....	12
II. Mitigation component .....	13
a. Mitigation targets .....	22
b. Sectoral strategies for implementing the NDC.....	24
d. Treatment of emissions of ozone-depleting substances (ODS) .....	29
III. Adaptation component.....	31
a. Adaptation objective .....	31
b. Specific objectives .....	31
c. Main impacts and priority adaptation measures by sector .....	31
IV. NDC monitoring, reporting and verification system .....	41
V. Financial implementation of the CDN .....	41
1. Mitigation .....	41
2. Adaptation .....	42
VI. Macro-economic impact .....	43
a. Relationship between the NDC and the PES 2 Priority Action Plan (PAP) .....	43
b. Socio-economic impact of planned measures .....	43
Conclusion .....	47

## Summary

Senegal's Nationally Determined Contribution (NDC) is part of its forward-looking vision, It is based on the "Plan Sénégal Émergent (PSE)", its strategy and development plans, as well as sectoral programmes for the sustainable management of its natural and environmental resources. The NDC incorporates the achievements of the CPDN. Senegal's CPDN was drawn up by a team of local consultants under the supervision of the Department of the Environment and Classified Establishments (DEEC) of the Ministry of the Environment and Sustainable Development, in collaboration with the National Committee on Climate Change (COMNACC).

A national workshop held on 14 September 2015, and chaired by the Minister for the Environment and Sustainable Development, validated the CPDN, with specific commitments to reduce greenhouse gas (GHG) emissions, relative to projected emissions, by 2035. The CPDN was adopted by the Council of Ministers on 16 September 2015.

In 2016, Senegal embarked on the process of updating its CPDN into a CDN that constitutes the country's commitment under the Paris Agreement. This transition is mainly a response to the need to update the data (sectoral, macro-economic, demographic, etc.) used to draw up the NDC, but also to the need to take on essential components such as Measurement, Reporting and Verification (MRV), capacity-building and technology transfer needs, which are essential for the proper implementation of the NDC, as well as the integration of emissions from the oil and gas industry, which is due to start production in 2022.

A rigorous assessment of the environmental situation has identified :

- Greenhouse gas emission sectors: transport, waste, energy, industry, forestry and agriculture;
- Sensitive areas where priority is given to adapting to and managing the impacts of climate change: coastal erosion, agriculture, fisheries, livestock farming, health, biodiversity and flooding.

The two components of this CDN have two objectives:

- an unconditional objective, consisting of carrying out activities using national resources (State, local authorities, private sector, NGOs, etc.), and
- a conditional objective that will be achieved with the support of the international community.

These targets have been determined and set for each sector, and aggregation of these targets makes it possible to assess the impact on the country's overall emissions. This translates into a relative reduction in greenhouse gas emissions of 5% and 7% respectively, by 2025 and 2030, compared with the reference situation (Business as usual) for the unconditional target (CDN). This reduction could be increased to 23% and 29% respectively, by 2025 and 2030, compared with the reference situation, if Senegal benefits from the support of the international community with substantial financing, the facilitation of the transfer of environmentally sound technologies and the strengthening of its institutional and human capacities, in the field of climate change (CDN+).

In 2010, global emissions stood at 16,752 Gg of CO<sub>2</sub> equivalent. They are set to rise steadily, reaching 37,761 Gg in 2030.

A number of studies carried out in Senegal point to the consequences of climate change. The impacts observed show a downward trend in rainfall, a rise in average temperatures, a rise in sea level, and disruption to the availability of arable land and water and fishery resources. These trends indicate that Senegal's ecosystems are highly vulnerable, requiring specific action to mitigate and adapt to future climate prospects, in order to control the potential impacts, particularly in socio-economic terms for the 60% of the population whose livelihood depends directly on these resources.

With regard to the projected climate risks, their potential impacts and the resulting vulnerabilities, the models generally show a predominance of the risks of droughts, heat waves and an upsurge in extreme wet events. The occurrence of these risks exposes different regions of Senegal to different risks.

The regions most affected by the increase in the risk of extreme drought are located in the north of Senegal, with the Saint Louis region showing the most intense risk, with an increase in the frequency of droughts of between 20% and 30%.

The frequency of extreme wet events is greater in the low warming scenario, mainly in the areas to the north and east of Senegal (Matam, Tambacounda, Louga).

Implementation of Senegal's contribution is estimated to cost 13 billion US dollars, including :

- 8.7 billion dedicated to mitigation, with US\$3.4 billion unconditional and US\$5.3 billion conditional; and
- US\$4.3 billion for adaptation, of which US\$1.4 billion is unconditional and US\$2.9 billion conditional.

The unconditional and conditional totals are US\$4.8 billion and US\$8.2 billion respectively.

It will require significant financial, human and technological resources on the part of Senegal, as well as the support of the international community, to enable even more significant reductions in GHG emissions and resilience to climate change.

Simulations have been used to assess the expected socio-economic impacts and spin-offs of these measures. Although they have a direct impact on the above-mentioned sectors, these measures represent a lever for improving the national economic situation, public health and the management of problems linked to urbanisation, etc.

## Acronyms

**AFAT:** Agriculture, Forestry and Other Land Allocations; **BAU:** Business As Usual; **BRT:** Bus à Haut Niveau de Service - Bus Rapid Transit;

**UNFCCC:** United Nations Framework Convention on Climate Change;

**CET:** Centre d'Enfouissement Technique ;

**CETUD:** Conseil Exécutif des Transports Urbains de Dakar (Dakar Urban Transport Executive Council);

**CIVD:** Centre Intégré de Valorisation des déchets ;

**CN:** National Communications ;

**COMNACC:** Comité National sur les Changements Climatiques (National Committee on Climate Change); **CORDEX:** Experimentation des méthodes dites de désagrégation (Experimentation of disaggregation methods); **CDN:** Contribution Déterminée au niveau National (Contribution determined at national level);

**CPDN:** Contribution Prévue Déterminée au niveau National ;

**CRN:** Centre de Regroupement Normalisé (Standardised Regrouping Centre)

**CRODT:** Dakar Thiaroye Oceanographic Research Centre;

**CSE:** Centre de Suivi Écologique (Ecological Monitoring Centre);

**CSP:** Concentrated Solar Power; **DGPPE:** Direction de la Gestion et de la Planification des Ressources en Eau; **CO2e:** Carbon Dioxide Equivalent;

**SLM:** Sustainable Land Management;

**GHG:** Greenhouse Gases ;

**Gg:** Giga Gramme ;

**IPCC:** Intergovernmental Panel on Climate Change;

**HDI:** Human Development Index ;

**IPCC:** Intergovernmental Panel on Climate Change.

**MRV:** Measuring, Reporting and Verification;

**ONAS:** Office National de l'Assainissement du Sénégal ;

**PANA:** Plan d'Action National d'Adaptation aux changements climatiques (National Action Plan for Adaptation to Climate Change);

**PAP:** Priority Action Plan ;

**PAPIL:** Programme d'Appui à la Petite Irrigation Locale;

**SIDS:** Small Island Developing States; **PGIES:** Projet de Gestion Intégrée des Écosystèmes; **GDP:** Gross Domestic Product;

**PIUP:** Industrial Processes and Product Use ;

**LDC:** Least Developed Country;

**NAP:** National Climate Change Adaptation Plan;

**PNGD:** National Waste Management Programme;

**PRACAS:** Programme d'Accélération de la Cadence de l'Agriculture sénégalaise ;

**PSE:** Plan Sénégal Émergent ;

**RCP:** Trajectoires Représentatives de Concentration - Representative Concentration Pathways ;

**RNA:** Régénération Naturelle Assistée

(Assisted Natural Regeneration); **SRI**:  
Système de Riziculture Intensif (Intensive  
Rice Growing System); **co<sub>2</sub>**: Carbon  
Dioxide.

**CH<sub>4</sub>**: Methane ;

**N<sub>2</sub>O**: Nitrous oxide;

**MW**: Megawatt ;

**MWp**: Megawatt peak.

## Introduction

The Senegal Emerging Plan (PSE) is the reference framework for Senegal's economic and social policy up to 2035. The PES focuses on economic growth based primarily on the intensification of activity in the primary and secondary sectors. However, current losses and damage, as well as the projected impacts of climate change on arable land, water resources and fisheries, are likely to compromise the success of the PES.

Given the country's high exposure and vulnerability to climate change, and in response to the Paris Agreement, Senegal intends to contribute to the collective effort by implementing mitigation and adaptation measures in priority economic sectors, communities, infrastructures, ecosystems and cities.

The strategy is based on integrating the climate change dimension into the formulation and programming of development policies, taking into account other priorities such as human and animal health, the fight against poverty and malnutrition, the promotion of renewable energies and energy efficiency, and gender mainstreaming.

With regard to the latter, Senegal has embarked on the implementation of a National Strategy for Gender Equity and Equality (SNEEG), based on the promotion of gender equity and equality, which involves all development players. The government is committed to integrating gender issues into all public policies.

Senegal's CDN is in line with the PSE and its priority action plans.



## I. Context

### a. Emissions trends

Senegal submitted three communications to the UNFCCC in 1997, 2010 and 2015, using 1994, 2000 and 2005 as the reference years. These show a net increase in national emissions. The energy and agriculture sectors are the main sources, accounting for 40% and 48% of emissions respectively in 2005. The dynamics show an increase in emissions in all sectors between 1994 and 2005, with the exception of the waste sector, which required data refinement in 2005 (Table 2).

Details of the 03 papers submitted are summarised in the table below:

**Table 1: Summary of emissions from the three national communications (Gg CO<sub>2e</sub>)**

Inventory year Sectors	1994 Communication 1	2000 Communication 2	2005 Communication 3
Energy excluding biomass	3 788,6	4 663	5 178,93
Agriculture	2 957,6	6 275,89	6 359,84
Waste	2 226,2	2 075,64	979,4
Industrial processes and Use of Products	345,5	301, 51	541
Overall emissions (Excluding forestry absorptions)	9317,9	13 298	13 084

**Sources: Senegal's national communications to the UNFCCC**

NB: The land use, land-use change and forestry sector remains a major carbon sink, with net absorptions increasing (Table 3).

**Table 2: Carbon absorbed in the forestry and land sector (Gg CO<sub>2e</sub>)**

Inventory year Sector	1994 Communication 1	2000 Communication 2	2005 Communication 3
Forestry and land	-5 997	-10 555	-11 434

Senegal has gradually improved the GHG inventory method in the forestry sector, with the use of certain specific factors, the collection of more precise data on forest formations and the application of recent IPCC guidelines.

b. Main climate trends and associated risks

Climate trends in Senegal have been assessed on the basis of three key parameters, namely temperature, rainfall and sea state. These trends have been modelled using the two scenarios RCP 4.5 and RCP 8.5. Information on climate scenarios and trends is presented in the tables below:

**Table 3: Projected average change in rainfall and temperature by zone and scenario. Rainfall is expressed in mm, while temperature is expressed in degrees Celsius.**

	<b>Scenarios</b>	<b>Nord</b>	<b>Sud-Est</b>	<b>Sud-Ouest</b>	<b>Centre-Ouest</b>
<b>Pluie</b>	<b>RCP4.5</b>	<b>-16</b>	<b>-89</b>	<b>-89</b>	<b>-89</b>
	<b>RCP8.5</b>	<b>-8</b>	<b>-61</b>	<b>-61</b>	<b>-61</b>
<b>Température</b>	<b>RCP4.5</b>	<b>+1.18</b>	<b>+1.17</b>	<b>+1.17</b>	<b>+1.17</b>
	<b>RCP8.5</b>	<b>+1.41</b>	<b>+1.37</b>	<b>+1.37</b>	<b>+1.37</b>

**Table 4: Current and future trends in key climate parameters**

Climatic parameters		Current trends	Future trends
Temperature		<ul style="list-style-type: none"> <li>Global rise in minimum temperatures between 1961 and 2010 ;</li> <li>The increase ranged from 0.58°C in Dakar to around 1.88°C in Ziguinchor, where the rise in minimum temperatures was greater than in Tambacounda (around 1.06°C).</li> </ul>	Average increase of between +1.17 and 1.41°C by <sup>2035</sup> <sup>1</sup> (table 3)
Rainfall		<ul style="list-style-type: none"> <li>Fall in rainfall from 1951 to 2000 at reference <sup>stations</sup><sup>2</sup>. This trend has led to a shift in isohyets from the north to the south of the country. The 500mm isohyet, which was located on the north-Dakar and Linguère axis between 1951 and 1980, is now found in the Kaolack and Fatick regions. Similarly, the 1000mm isohyet migrated from southern Gambia towards the Senegalese-Guinean border between 1981 and 2013.</li> <li>However, there was a trend towards an increase in rainfall between 2000 and 2010.</li> </ul>	<ul style="list-style-type: none"> <li>Decline (negative) towards 2035. The northern zone of Senegal will see a drop of 16 mm on average compared with the reference period (1976-2005). Elsewhere, the drop will be more pronounced, averaging 89 mm (Table 3).</li> </ul>
State of the sea	Sea level	<ul style="list-style-type: none"> <li>An average rise in sea level of 1.4 mm per year was recorded.</li> <li>Over the last fifty years or so, the average rate of retreat of the coastline has been between 1 and 1.30 <sup>m/year</sup><sup>3</sup>.</li> </ul>	For the whole of the Senegalese coastline, and for a rise in sea level of 1 m by 2100, they predicted that 55 to 86 <sup>km</sup> <sup>2</sup> of beaches would disappear. Around 6,000 <sup>km</sup> <sup>2</sup> of low-lying areas, mainly estuaries, would be flooded. <b>This would be equivalent to the disappearance of all current mangroves.</b>
	Temperature sea surface	Increase in sea surface temperature of around 0.04°C to 0.05°C per year since the early 1980s.	
	Wind speed	High variability in wind speed over the period 1981-2010. Wind strength always remains on a downward slope between 2010 and 2015, with peaks of over 6 m/s.	

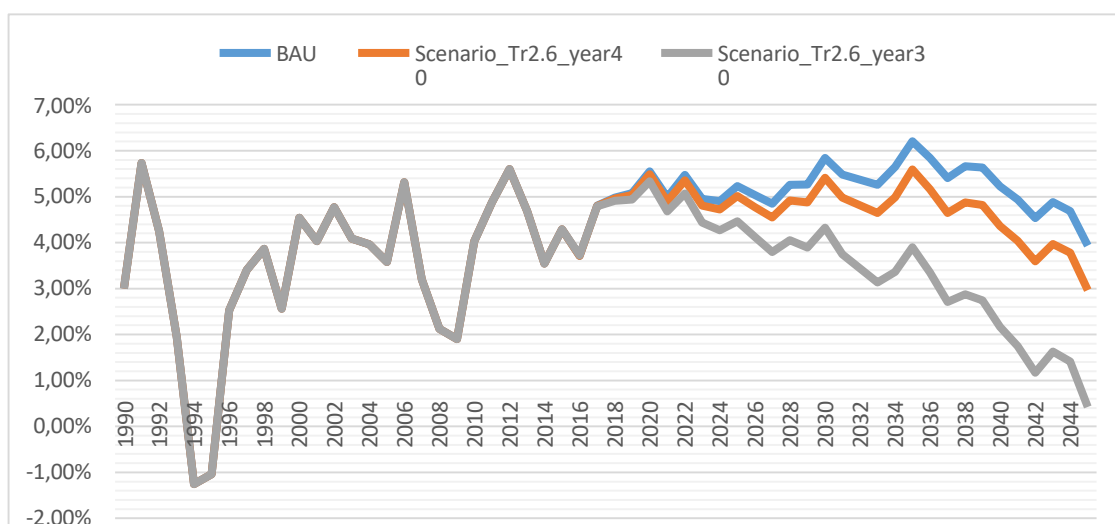
<sup>1</sup> Data from the National Civil Aviation and Meteorology Agency (ANACIM)

<sup>2</sup> Podor, Dakar, Ziguinchor, Tambacounda

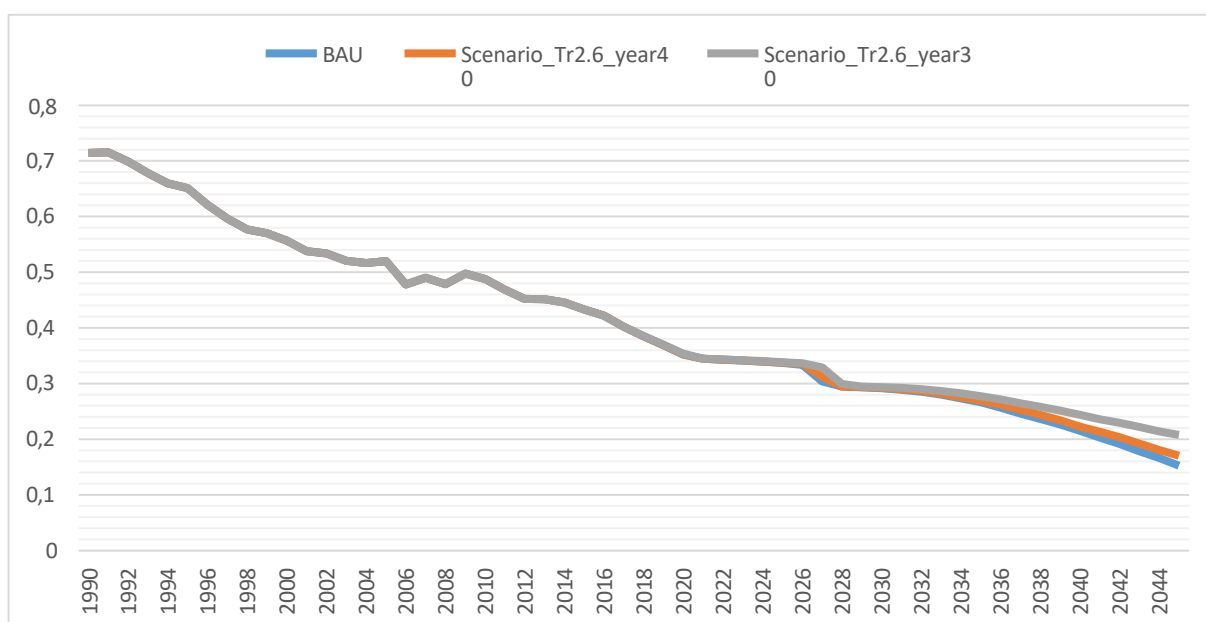
<sup>3</sup> Department of the Environment and Classified Establishments, 2005

### c. Impacts and vulnerabilities

The assessment of the various impacts and vulnerabilities at national level shows that all the key sectors of the PES remain directly or indirectly exposed to the impacts of climate change. This vulnerability concerns communities, ecosystems, infrastructures and the national economy. In economic terms, a simulation using the T21 model shows that rising temperatures will have a negative impact on GDP growth and lead to a higher level of poverty in Senegal (Figures 1 and 2)<sup>4</sup>.



**Figure 1: Effects of temperature increase on GDP growth measured by the T21 model** Source: Planning Department (MEFP)



**Figure 2: Effects of rising temperatures on the fight against poverty** Source: Planning Department (MEFP)

<sup>4</sup> Multi-sector report WB, 2017

The continuation of trends observed in the past, in particular rising temperatures and falling rainfall, will have a negative impact on the productive bases of the national economy (biodiversity, agriculture, livestock farming, water resources, fishing, coastal zones, etc.) by 2031-2041. Climate change thus appears to be holding back development and the fight against poverty. This represents a major challenge for achieving the objectives of the PES by 2035.

d. Fairness and Ambition

Senegal's NDC reflects a sustained commitment to putting the country on a low-carbon development path that ensures the resilience of the economy, communities, infrastructure and cities.

The NDC is fair in relation to national capacities and the country's climate vulnerability. It is ambitious in that it goes beyond the strategies and programmes proposed for LDCs and SIDS in the Paris Agreement.

## II. Attenuation component

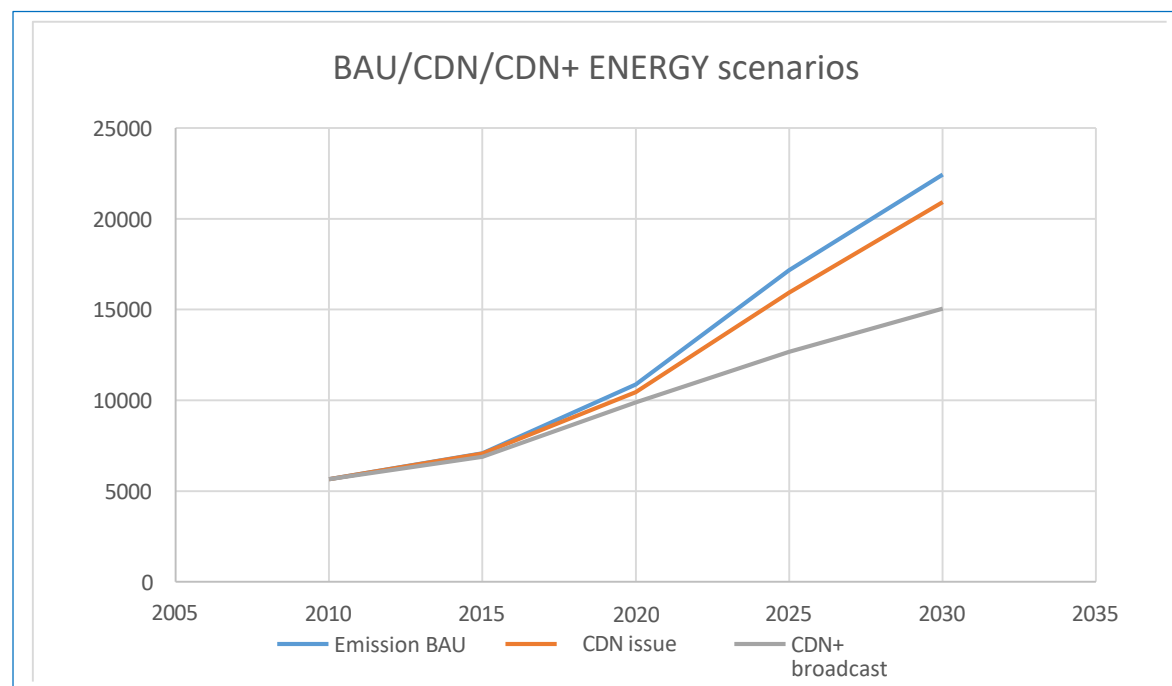
The contribution provides for a reduction in GHG emissions in 2025 and 2030 in various sectors of the economy compared with projected emissions for the same years, according to a reference scenario based on a number of assumptions. It is made up of an unconditional contribution (CDN) and a conditional contribution (CDN+).

The main activities included in the unconditional and conditional contributions cover each sector of the Senegalese economy, and their impacts are presented in relation to the GHG emissions of each sector. These emission reductions are also aggregated to show how they have changed in relation to overall emissions. Senegal has made an unconditional and conditional commitment to reduce its GHG emissions in 2025 and 2030 respectively, compared with projected emissions for the same years under a "Business as Usual" scenario in the following sectors:

## ENERGY

**Table 5: BAU/CDN Energy emissions (Gg CO<sub>2</sub>e)**

Scenarios	2025	2030
BAU	19512	23927
CDN	18022	21523
CDN+	12615	14048
% discount CDN	7,6	10
CDN+ discount	35,3	41,2

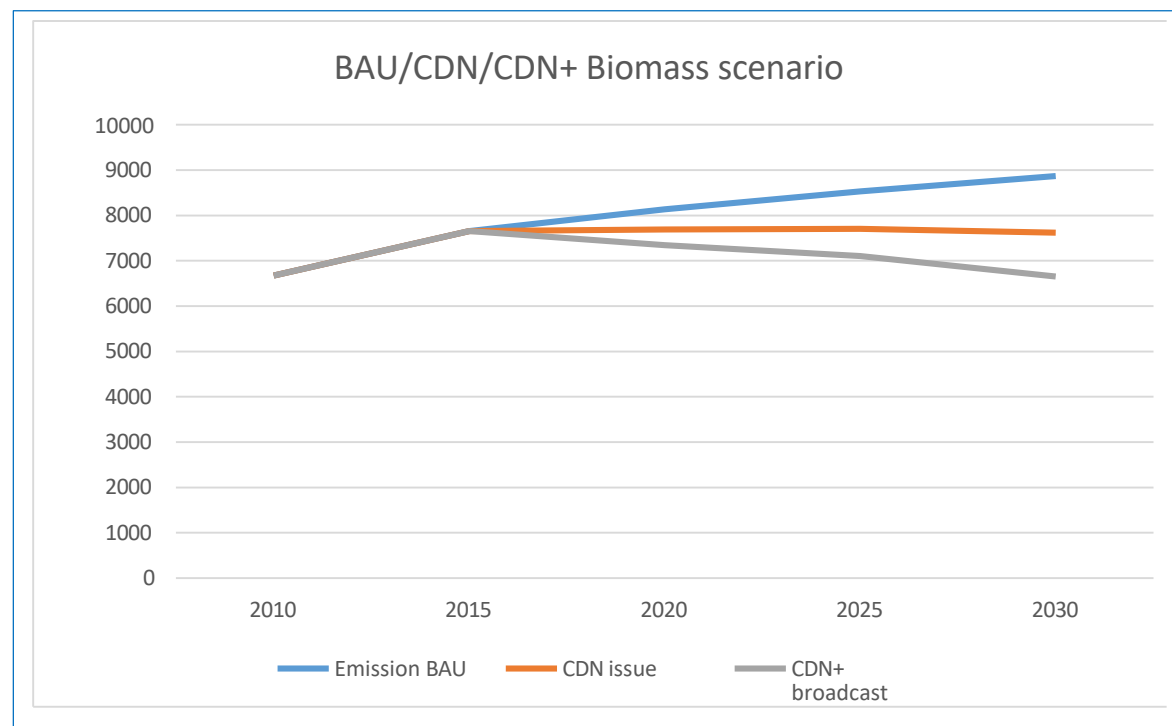


**Figure 2: BAU/CDN/CDN+ Energy scenarios**

Emissions linked to biomass (charcoal and wood production) are accounted for in the forestry sector. Knowledge and control of biomass emissions levels will be used to define mitigation actions for this sub-sector. Details of biomass emissions are given in the table below:

**Table 6: BAU/CDN Biomass emissions (Gg CO<sub>2</sub>e)**

Scenarios	2025	2030
<b>BAU</b>	8533	8867
<b>CDN</b>	7702	7621
<b>CDN+</b>	7106	6652
<b>% discount CDN</b>	9,76	16
<b>CDN+ discount</b>	14	24



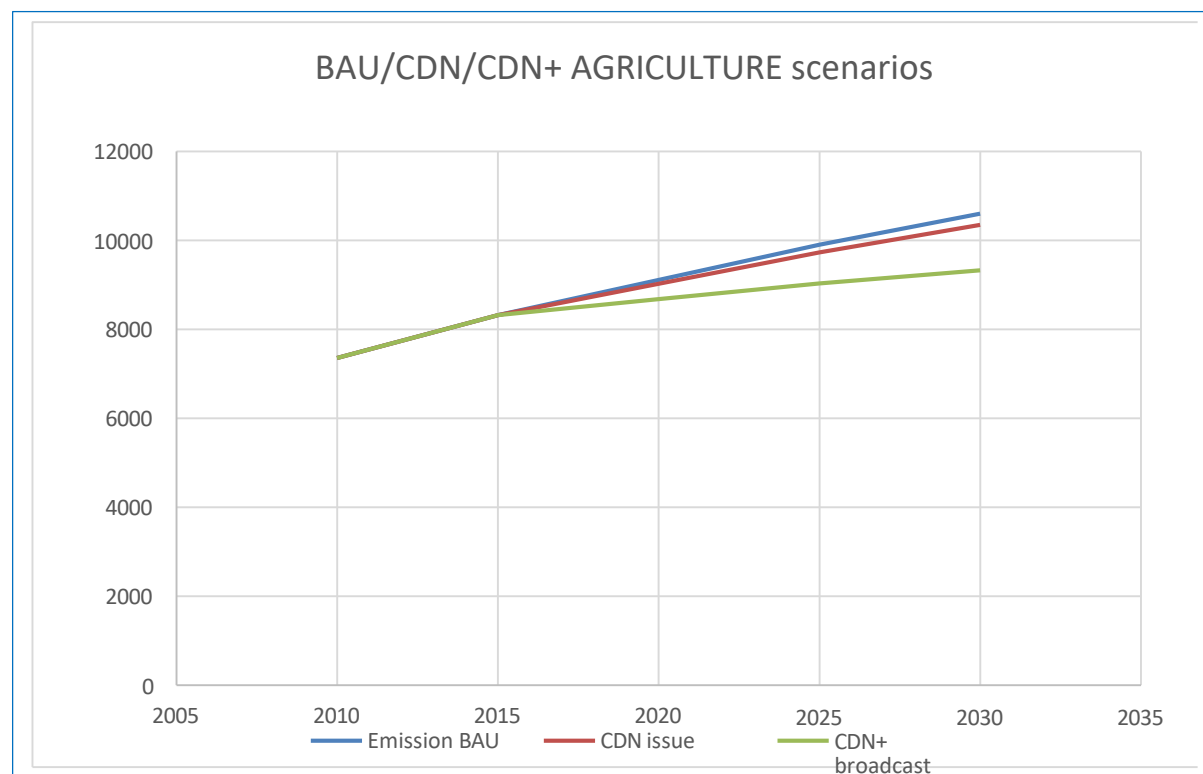
**Figure 3: BAU/CDN/CDN+ Biomass scenarios**



## AGRICULTURE

**Table 7: BAU/CDN emissions (Gg CO<sub>2</sub>e)**

Scenarios	2025	2030
<b>BAU</b>	9903	10600
<b>CDN</b>	9732	10350
<b>CDN+</b>	9034	9329
<b>% discount CDN</b>	1,72	2,36
<b>CDN+ discount</b>	8,76	11,98

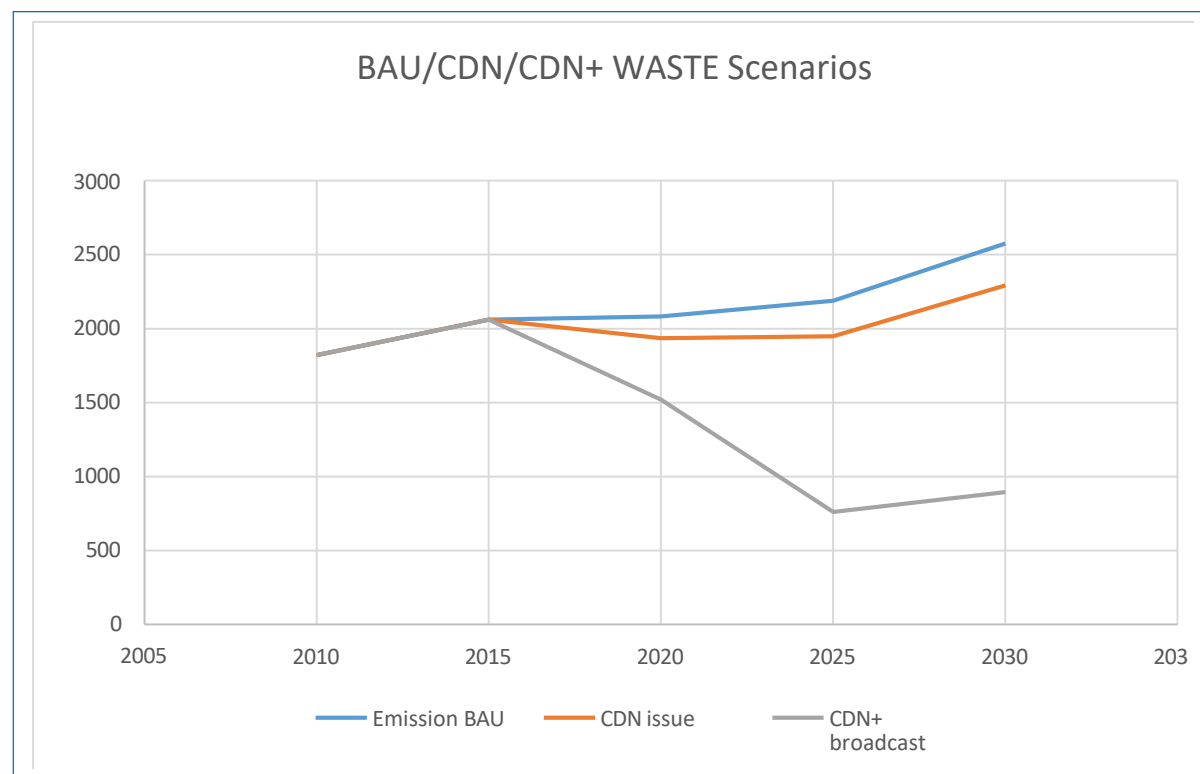


**Figure 4: BAU/CDN/CDN+ Agriculture scenarios**

## WASTE

**Table 8: BAU/CDN WASTE emissions (Gg CO<sub>2</sub>e)**

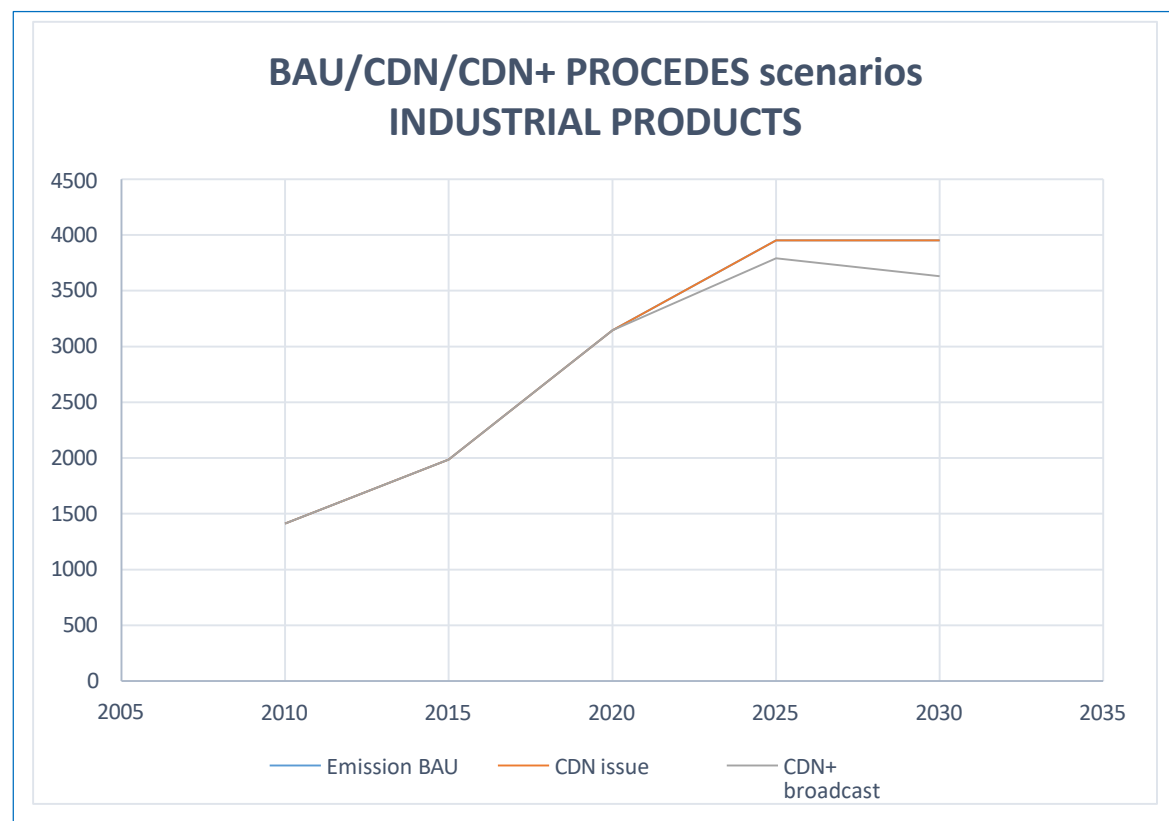
Scenarios	2025	2030
<b>BAU</b>	2189	2575
<b>CDN</b>	1948	2292
<b>CDN+</b>	759	893
<b>% discount CDN</b>	10,99	11,00
<b>CDN+ discount</b>	65,28	65,28



## INDUSTRIAL PROCESSES AND PRODUCT USES

**Table 9: BAU/CDN Industrial Process emissions (Gg CO<sub>2e</sub>)**

Scenarios	2025	2030
<b>BAU</b>	3 953	3 953
<b>CDN</b>	3 953	3 953
<b>CDN+</b>	3 792	3 631
<b>% discount CDN</b>	0,0	0,0
<b>CDN+ discount</b>	4,0	8,1

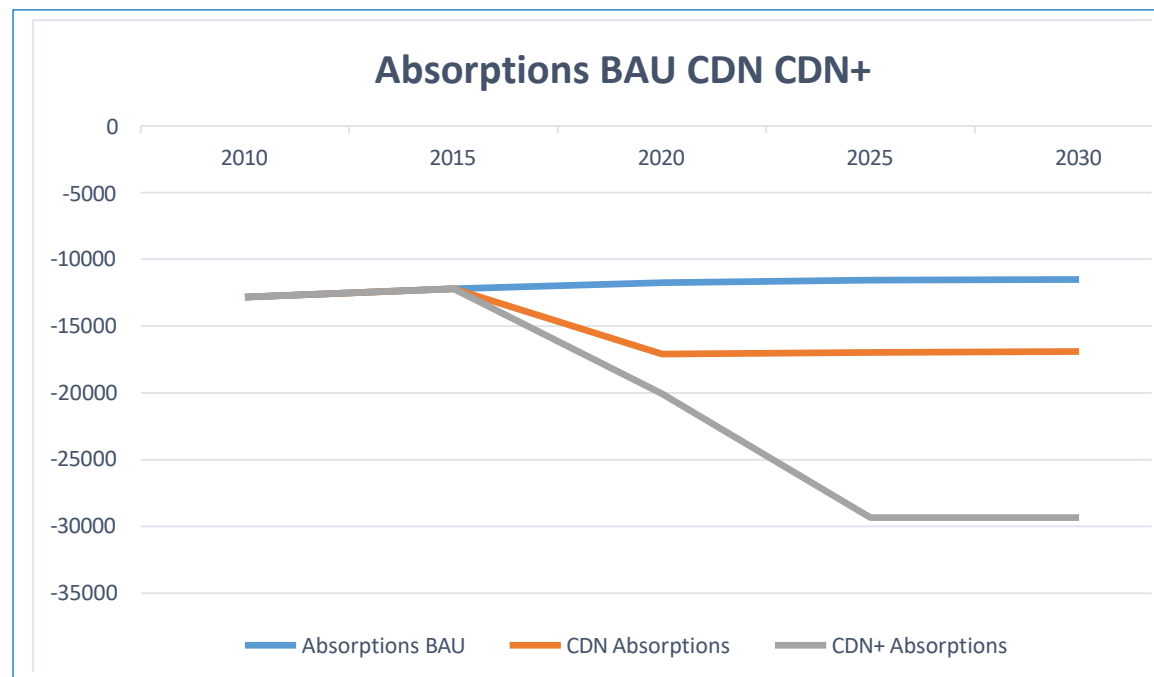


**Figure 6: BAU/CDN/CDN+ PI scenarios**

## FORESTRIE

**Table 10: Absorptions BAU/CDN (Gg CO<sub>2e</sub>)**

Scenarios	2025	2030
<b>BAU</b>	-11573,11	-11510,66
<b>CDN</b>	-16967,12	-16894,32
<b>CDN+</b>	-29328,21	-29328,21
<b>CDN absorptions</b>	-46,608129	-46,77108
<b>CDN+ absorptions</b>	-153,41684	-154,79173

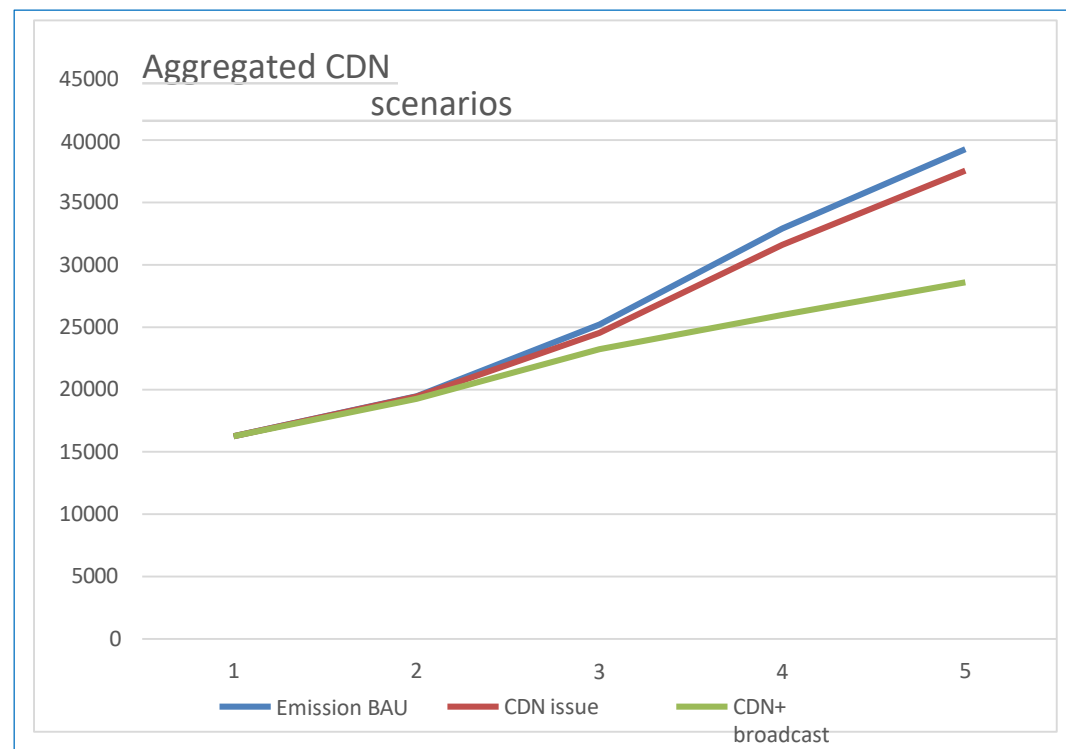


**Figure 7: BAU/CDN/CDN+ Forestry scenarios**

Aggregated, these emissions reductions will represent 05% and 07% respectively, in 2025 and 2030, compared with projected emissions, according to a "Business as Usual" scenario, on the basis of domestic and controlled financing. These reductions will reach 23.7% and 29.5% respectively in 2025 and 2030, provided that they receive substantial support from the international community.

**Table 11: Overall BAU/CDN/CDN+ emissions (Gg CO<sub>2e</sub>)**

Scenarios	2025	2030
<b>BAU</b>	32648,6097	37761,1405
<b>CDN</b>	30 987	35 106
<b>CDN+</b>	24883,0564	26611,0057
<b>% discount CDN</b>	5,09	7,03
<b>CDN+ discount</b>	23,78	29,53



**Figure 8: Overall emissions trajectory**

The contribution will be implemented mainly by :

- Increasing carbon sequestration by implementing projects in the agriculture and forestry sectors;
- Energy transition, with the integration of renewable energies and greater energy efficiency in electricity production, industry, transport and the residential/tertiary sectors;
- Improving solid and liquid waste management;
- Improving industrial processes.

The activities presented in this report are not exhaustive. Nevertheless, they form the basis of the contribution in the field of mitigation.

The contribution is defined by the reduction in GHG emissions in 2025 and 2030 compared with the projected emissions in each of the sectors concerned under a "Business as Usual" scenario.

## a. Mitigation targets

**Table 12:** Characteristics of CDN

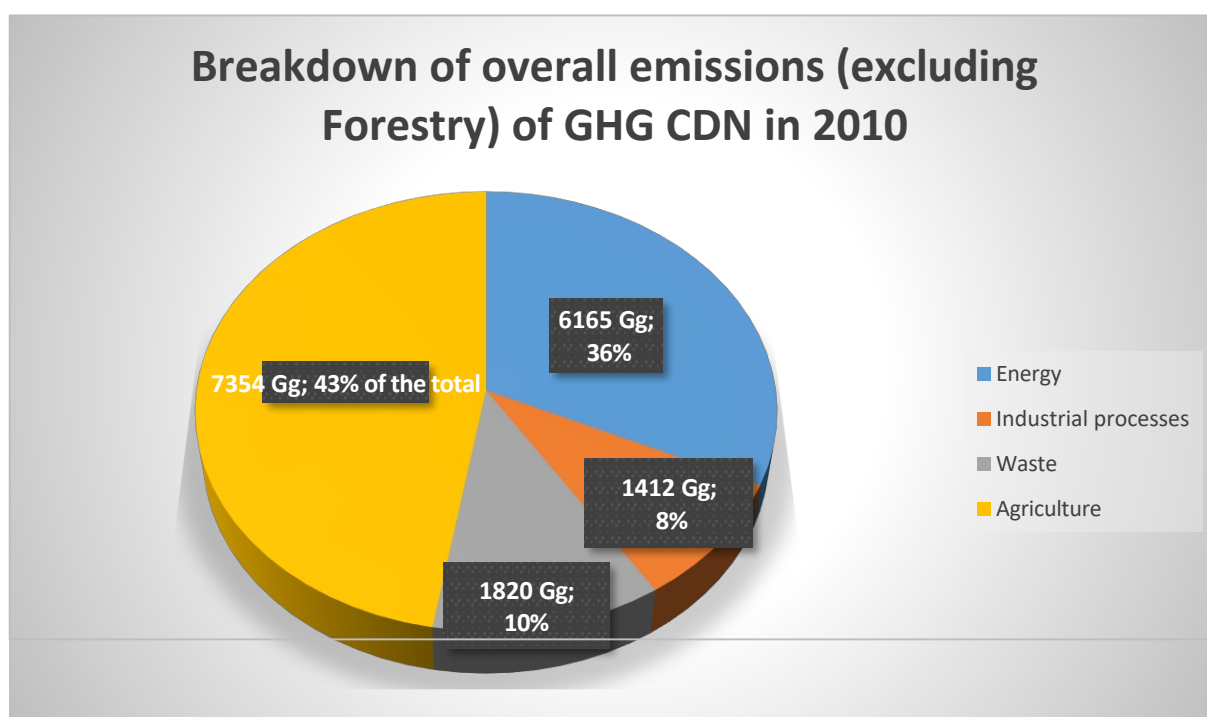
<b>Type of lens</b>	Deviation from current practice (BAU) for each of the sectors concerned (Energy, AFAT, Waste and Industry). Unconditional reduction in emissions compared with a BAU scenario and according to the reference year. Conditional reduction in emissions compared with a BAU scenario and following the reference year.
<b>Base year</b>	2010
<b>Implementation period</b>	2025-2030
<b>Covered gases</b>	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O
<b>Sectors covered</b>	All sectors (IPCC 2006) <ul style="list-style-type: none"> <li>- Energy (power generation, domestic fuels, energy efficiency, transport)</li> <li>- Industrial Processes,</li> <li>- Waste,</li> <li>- AFAT (Agriculture, Forestry and Land Use)</li> </ul>
<b>Global Warming Potential:</b> CO <sub>2</sub> : 1, CH <sub>4</sub> : 21, N <sub>2</sub> O: 310	
<b>Emissions inventory methodology:</b> IPCC 2006	
<b>Sector objectives</b>	
<b>Energy :</b>	
<b>Unconditional objective</b>	7.6 and 10%,
<b>Conditional objective</b>	35.4% and 41.2% respectively
<b>Agriculture</b>	
<b>Unconditional objective</b>	1.72 and 2.36% respectively
<b>Conditional objective</b>	8.76 and 11.98%.
<b>Waste</b>	
<b>Unconditional objective</b>	10.99 and 11%.
<b>Conditional objective</b>	65.28 and 65.28% respectively
<b>Industrial Processes and Product Use</b>	
<b>Unconditional objective</b>	0%
<b>Conditional objective</b>	4 and 8.1%.
<b>Aggregation of sectoral objectives</b>	
<b>Unconditional objective</b>	5% and 7% reduction in GHG emissions by 2025 and 2030 respectively
<b>Conditional objective</b>	23.7% and 29.5% reduction in GHG emissions by 2025 and 2030 respectively

GHG emissions for the 2010 base year (BAU) break down as follows: (see table 13)

**Table 13: Breakdown of GHG emissions in 2010**

Sector	Level of emissions in Gg CO <sub>2</sub> e	Percentage
Energy	6165	36,8
Agriculture	7354	43,8
Waste	1820,8	10,8
Industrial Processes and Product Use	1412	8
Total	16 752	100

NB: Senegal's net emissions in 2010 are estimated at 3,925 Gg CO<sub>2</sub>e.



**Figure 9: Breakdown of GHG emissions in Gg in 2010**



The agricultural sector accounted for almost half of Senegal's emissions in 2010. However, projections for 2020-2030 show that the trend will be reversed in favour of the energy sector, due in particular to the increase in energy demand. Detailed information on projected emissions up to 2030 is presented in the table below:

**Table 14: Emissions projections by sector to 2030 (Gg CO<sub>2e</sub>)**

Year Sectors	2010	2015	2020	2025	2030
Energy	6165	10 080	13 060	19512	23 927
Agriculture	7354	8323,9	9110,7	9903,4	10600
Waste	1820	2061	2081	2189	2575
Industrial processes and Use of Products	1412	1 986	3 146	3 953	3 953
Total	16752	21 637	25 404	32 648	37 761

Two sectors stand out as the main emitters of greenhouse gases at national level. The energy sector is set to grow exponentially. It will account for more than 50% of the country's total emissions by 2022. This situation can be explained by the sector's dynamism, particularly with the start of oil and gas production in 2022.

Emissions from the agricultural sector will rise gradually and steadily until 2030. Enteric fermentation will remain the major category of emissions from this sector.

## b. Sectoral strategies for implementing the NDC

### • Energy sector

The energy sector is a major contributor to economic development and the reduction of social and territorial inequalities. The oil bill represents almost 34% of the country's export revenues.

The Emergence Strategy introduced in 2012 reflects Senegal's ambition to guarantee universal access to reliable, sustainable and affordable electricity by 2025. The Plan Sénégal Émergent (PSE) reinforces the guidelines set out in the Lettre de Politique de Développement du Secteur de l'Energie (Energy Sector Development Policy Letter) of October 2012 concerning electricity, hydrocarbons, accessibility to energy in rural areas, energy efficiency and domestic fuels.

i. Electricity generation sub-sector

Context of the sub-sector	<p>Public electricity production is essentially thermal, with 93% of installed capacity, and the dominant fuel is fuel oil, at 75%. Access to electricity in rural areas is still limited.</p> <p>A national strategy for the sector has been developed and focused on the following points:</p> <ul style="list-style-type: none"> <li>- Expanding supply with 1,000 MW of new generating capacity;</li> <li>- Universal access to electricity for rural areas by 2025 ;</li> <li>- Upgrading and developing the transmission and distribution network;</li> </ul>
CDN's strategic actions	<ul style="list-style-type: none"> <li>- Achieve a cumulative installed capacity of 235 MW in solar energy, 150 MW in wind energy and 314 MW in hydroelectricity by 2030;</li> <li>- Injection of a total of 699 MW of renewable energy by 2030;</li> <li>- Achieve a penetration rate of 13.68% for renewable energies in terms of installed capacity, excluding hydroelectricity, in the electricity grid by 2019;</li> <li>- The installation of 6.18 MWp as part of the promotion of solar electrification in isolated systems outside the interconnected grid;</li> </ul>
CDN+ strategic actions	<ul style="list-style-type: none"> <li>- Achieving an additional 100 MW of installed solar capacity, 100 MW of installed wind capacity, 50 MW of installed biomass capacity and 50 MW of installed CSP capacity by 2030;</li> <li>- Injection of a total additional renewable energy capacity of 300 MW, bringing the total (CDN and <sup>CDN+</sup>) to 999 MW of renewable energy;</li> <li>- Replacement of fuel oil by natural gas in dual thermal power stations (fuel oil/gas) and of the 320 MW Jindal coal-fired power station by combined-cycle gas power stations, bringing the total installed capacity of natural gas to 600 MW between 2025 and 2030;</li> <li>- 18% penetration of renewable energies, excluding hydroelectricity, in the electricity system by 2022;</li> <li>- Solar rural electrification in 2025 of : <ul style="list-style-type: none"> <li>• 2292 localities via mini networks ;</li> <li>• 4356 localities Solar Home System (SHS) ;</li> </ul> </li> </ul>

ii. Domestic fuels sub-sector

Context of the sub-sector	<p>Domestic fuels (mainly charcoal and firewood) accounted for almost 35% of household final energy consumption in 2016. Firewood and charcoal make up more than 75% of household cooking energy sources.</p> <p>The PSE, through the LPDSE, has set itself the objective of diversifying energy sources, promoting the use of wood and charcoal substitutes.</p>
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	Measures for domestic fuels help to preserve forest resources, by replacing firewood and charcoal with sustainable sources and efficient cooking equipment.
CDN's strategic actions	<ul style="list-style-type: none"> <li>- 800,000 improved cookstoves per year by 2030, compared with around 350,000 in 2016</li> <li>- 27,000 bio-digesters by 2030.</li> <li>- Continuation of the butane gas policy and promotion of bio-coal</li> </ul>
Strategic actions of CDN+.	<ul style="list-style-type: none"> <li>- Distribution of around 1,500,000 improved stoves per year</li> <li>- More than 48,000 bio-digesters by 2030</li> <li>- Promoting bio-coal</li> </ul>

iii. Energy efficiency sub-sector

Context of the sub-sector	The national energy saving potential can be mobilised across all sectors, including the introduction of an operational legislative and regulatory framework, measures to make efficient lamps (LBC and LED) more widespread, standardisation and labelling of household and office equipment, and sustainable management of public lighting. The aim is also to make the A programme based on the Energy Management Strategy, to 2030.
Strategic actions of the CDN	<ul style="list-style-type: none"> <li>- Energy savings of 627.028 GWh (CDN)</li> <li>- Electricity demand down by 126.8 MW (CDN)</li> </ul>
Strategic actions of CDN+.	<ul style="list-style-type: none"> <li>- Energy savings of 3,402 GWh (CDN+)</li> <li>- Reduction in demand for electricity of 687.9 MW (CDN+), i.e. a total of 814.4 MW, corresponding to a 48.9% reduction in the expected peak in 2030.</li> </ul>

• Industry sector

Context of the sector	<p>For the past decade, industry's contribution to Senegal's total GDP has fluctuated between 20% and 23%. The PES focuses on industrialisation, with strategic choices directed towards :</p> <ul style="list-style-type: none"> <li>- The development of platforms and industrial parks that should enable agricultural value chains to be upgraded and a high-performance manufacturing industry to be developed;</li> <li>- Better development of mining resources and exploitation of new phosphate, zircon, iron and gold deposits.</li> </ul>
Strategic actions of the CDN/CDN+	<ul style="list-style-type: none"> <li>- Improving regulations in the industrial sector (energy supply studies, periodic energy audits, controls, etc.),</li> <li>- Energy/environmental upgrades for businesses,</li> <li>- Waste recovery in the agro-industry,</li> <li>- Energy efficiency in cement plants and the substitution of clinker and the use of gas.</li> </ul>

- Transport sector

Context of the sector	<p>The "transport, post and telecommunications" sub-sector accounted for 22% to 23% of the tertiary sector between 2008 and 2012. The ten-year strategy 2014-2023 of the PSE under its Pillar 1 is based on "an efficient transport sector to support the transformation of production and growth". The options proposed as part of the NDC will help to reinforce the ambitious actions underway. They will enable :</p> <ul style="list-style-type: none"> <li>- A comprehensive and sustainable improvement in people's travel conditions;</li> <li>- A better contribution from the sub-sector to the growth and productivity of the national economy;</li> <li>- A significant reduction in pollution and its negative impact on economic growth;</li> <li>- Diversification of modes of transport, with recourse to rail and sea transport.</li> </ul>
CDN/CDN+ strategic actions	<ul style="list-style-type: none"> <li>- Increasing the use of sustainable public transport (Bus Rapid Transit, Regional Express Train)</li> <li>- Promoting hybrid cars</li> </ul>

- Waste sector

Context of the sector	<p>The waste sector is cross-cutting and in line with the PES. The government has made enormous efforts which have resulted in: (1) the reorganisation of the sector, through the drafting of appropriate regulations, (2) the implementation of the National Solid Waste Management Programme, (3) the development of solid and liquid waste management infrastructure, and (4) the adoption of an awareness-raising, training and capacity-building programme.</p>
Strategic actions the e CDN/CDN+	<p><u>Liquid sanitation</u></p> <ul style="list-style-type: none"> <li>- To achieve 85% access to the sewerage network by 2030 (i.e. a treatment rate of almost 70% and a depollution rate of over 55%).</li> </ul> <p><u>Solid waste treatment</u></p> <ul style="list-style-type: none"> <li>- Rehabilitation or closure of departmental and unauthorised landfill sites by 2030;</li> <li>- Construction of standardised collection points and integrated waste management centres.</li> <li>- Promulgation of regulations on solid waste management.</li> </ul>

- Agriculture sector

Sector context	<p>The second phase of the Programme de Relance et d'Accélération de la Cadence de l'Agriculture sénégalaise (PRACAS2 2019-2023), the agricultural component of the PES, has set itself the strategic objective of achieving annual production of 2,100,000 tonnes of paddy rice, 2,000,000 tonnes of groundnuts, 600,000 tonnes of wheat, 1,000,000 tonnes of maize, 1,000,000 tonnes of maize powder and 1,000,000 tonnes of maize meal.</p>
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	tonnes of onions and 200,000 tonnes of fruit and vegetable exports by 2023. The strategy of
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	<p>Implementation of the programme is based on improving soil fertility, increasing yields of targeted crops and water management. Rice acreage will increase from 677,197 ha in 2019 to 1,001,640 ha in 2023, of which 17.5% will be irrigated, 32.5% rainfed and 50% irrigated and rainfed simultaneously.</p> <p>In line with the Livestock Development Policy letter (2017-2021), the Senegalese government is also aiming to significantly increase animal productivity and production by 2021, by modernising livestock farming practices and supporting the meat (cattle and small ruminants), poultry (family and industrial) and milk sectors.</p>
Actions CDN's strategic priorities	<ul style="list-style-type: none"> <li>- By 2030, 99,621 ha of farmland will be under Assisted Natural Regeneration (ANR) and 4,500 ha under compost.</li> <li>- Providing organic manure and improved compost with biogas production</li> </ul>
CDN+ strategic actions	<ul style="list-style-type: none"> <li>- To convert 28,500 ha of irrigated rice to an Intensive Rice Cultivation System (SRI), reducing both the volumes of water used and the quantities of methane emitted.</li> <li>- Increase to 498,105 ha for RNA and 14,400 ha for compost.</li> </ul>

- Forestry sector

Context of the sector	<p>The Environment Policy Letter includes among its specific objectives "Reducing the degradation of the environment and natural resources, and combating the harmful effects of climate change" and biodiversity loss". One of the programmes focuses on the fight against deforestation and land degradation with a view to :</p> <ul style="list-style-type: none"> <li>○ Ensuring the restoration and sustainable management of land ;</li> <li>○ Significantly reduce the frequency and scale of bushfires;</li> <li>○ Reduce the degradation of forest resources.</li> </ul>
CDN's strategic actions	<ul style="list-style-type: none"> <li>○ Annually increase the reforested/restored area by around 1,297 ha of mangroves and 21,000 ha of various plantations;</li> <li>○ Reduce the area burnt by late fires by 5% and the area burnt by controlled fires by 10% compared with 2015.</li> </ul>
CDN+ strategic actions	<ul style="list-style-type: none"> <li>- Defend 500,000 ha of forest,</li> <li>- Reforest and restore 4,000 ha/year of mangroves,</li> <li>- Planting 500,000 ha of various crops</li> <li>- Reduce the area burnt by bush fires by 90% by the fifth year of implementation of the management plans.</li> </ul> <p>These efforts will reduce the rate of deforestation by 25%, from 40,000 ha/year, in 2010 to 30,000 ha/year in 2030.</p>

### c. Treatment of emissions reductions involving mechanisms linked and not linked to carbon markets

Market mechanisms are a prime tool for implementing NDCs. As with the Clean Development Mechanism (CDM) under the Kyoto Protocol, Senegal will continue to carry out mitigation activities under the international carbon market mechanisms of the Paris Agreement for the purposes of the NDC with the collaboration of international partners.

Senegal undertakes to comply with the rules guaranteeing environmental integrity, promoting sustainable development and avoiding double counting of emission reductions, in accordance with the rules to be adopted under Article 6 of the Paris Agreement. Senegal also supports a coherent transition of its CDM project portfolio in the context of the Paris Agreement, taking into account the rules to be adopted under Article 6.4 of the Paris Agreement.

Senegal's NDC contains a wide range of mitigation activities in the energy, forestry, agriculture, industry and waste sectors. The conditional targets could be met through market mechanisms. An appropriate emission reduction sharing arrangement between Senegal and partner countries should be considered.

Carbon market projects will have to contribute to financing adaptation.

### d. Treatment of emissions of ozone-depleting substances (ODS)

Some ozone-depleting substances (ODS) are also GHGs, with, to a greater or lesser extent, very significant global warming p o w e r s

These substances are governed by the Vienna Convention, the Montreal Protocol and the Kigali Amendment. At national level, progress in the implementation of these legal texts has been noted with the establishment of :

- Decree no. 2000.73 of 31 January 2000 on the consumption of ODS (CFCs, HCFCs);
- Interministerial Order no. 00526 of 15 January 2014 on HCFCs, currently in force;
- an interministerial decree to incorporate the reduction of HFCs, which have a very high global warming potential.

Results have been obtained in the implementation of actions aimed at reducing or even eliminating the consumption of ODS:

- Elimination of CFC consumption since 2010 ;
- The forecast reduction in HCFC consumption by 35% by 2020 and total elimination by 2030;
- The forecast reduction in HFC consumption by 10, 30, 50% and 80% respectively in 2029, 2035, 2040 and 2045. With the help of the international community, apart from the Multilateral Fund of the Montreal Protocol, this programme could be accelerated under the Kigali Amendment.

With this in mind, Senegal has expressed its interest in continuing the fight against ODS and implementing related flagship programmes in conjunction with existing international initiatives in the following areas:

- Energy efficiency in industry and the service sector;

- The introduction of high-performance food refrigeration equipment;  
Appropriate regulations will be introduced on energy standards for household appliances.

The impacts in terms of GHG emission reductions expected from the implementation of (1) the Kigali Amendment (substitution of HFCs) (2) complementary flagship programmes on ODS are presented in the table below:

**Table 15: HFC emissions avoided**

Periods	2009	2035	2040	2045
Emissions avoided (Gg) with HFC substitution	267	801	1334	2135
Emissions avoided (Gg) by implementing implementation of additional programmes (additional elimination scenarios of 10%)	294	881	1468	2348



### III. Adaptation component

#### a. Adaptation objective

The aim of implementing adaptation measures is to increase the resilience of ecosystems and populations to the impacts of climate variability and change.

#### b. Specific objectives

On the basis of trends in rising temperatures and falling rainfall, the specific adaptation objectives could be structured around three points:

- Strengthening networks for observing and collecting climate, ocean and coastal data;
- Strengthening the resilience of ecosystems and production activities ;
- To ensure the health, well-being and protection of populations against the risks and disasters associated with extreme events and climate change.

#### c. Main impacts and priority adaptation measures by sector

Given the potential consequences of climate change on certain areas of the PES (Agriculture, livestock, fisheries and aquaculture and agri-food (3.1.1); Health and nutrition (3.2.3) and Social protection (3.2.4)), it would appear necessary to strengthen the resilience of the national economy to the consequences of climate variability and change, through current and preventive adaptation measures (**Simulations based on the T21-iSDG-Senegal model**).

**Table 16: Main impacts and current and preventive priority adaptation measures by sector**

SECTOR	IMPACTS AND VULNERABILITY BY SECTOR		PRIORITY ADAPTATION MEASURES	
	Current impacts - 2°C scenario	Future impacts - 4°C scenario	Main current priority adaptation measures (horizon 2025-2030 for 2°C)	Main priority preventive adaptation measures (horizon 2040-2050 for 4°C)
<b>Agriculture</b>	<ul style="list-style-type: none"> <li>• Increase in evapotranspiration</li> <li>• Disturbance of the variety map</li> <li>• Disruption to the cropping calendar</li> <li>• A resurgence of weeds and insect pests</li> <li>• Decline in soil fertility</li> <li>• Reduction in agricultural land (2,500,000 ha of arable land degraded in 2014)</li> <li>• Fall in agricultural production</li> </ul>	<ul style="list-style-type: none"> <li>• Disturbance of the variety map</li> <li>• Disruption of eating habits</li> <li>• 30% drop in cereal production expected by 2025</li> <li>• Increase in potential evapotranspiration of around 5% in West Africa</li> <li>• An 8% drop in millet yields by 2050</li> </ul>	<ul style="list-style-type: none"> <li>• Early warning system</li> <li>• Sustainable land management (protection and restoration of degraded land; restoration of soil organic fertility; agroforestry, etc.)</li> <li>• Recovery of salty soil</li> <li>• Use of suitable varieties (short cycle and temperature)</li> <li>• Promoting integrated agriculture-livestock-agroforestry production systems</li> <li>• Strengthening resilience by diversifying production systems (improving food and nutritional security, etc.)</li> <li>• Water management (promotion of local irrigation, development of retention basins for supplementary irrigation)</li> <li>• Promotion and use of climate information and services</li> <li>• Managing climate-related risks and disasters</li> <li>• Agricultural insurance</li> <li>• Post-harvest strategies and management (storage, drying, etc.)</li> <li>• Planning agricultural production</li> <li>• Processing and adding value to agricultural products</li> </ul>	<ul style="list-style-type: none"> <li>• Early warning system</li> <li>• Strengthening research into adapted varieties (short cycle and temperature)</li> <li>• Strengthening resilience by diversifying production systems (promoting integrated systems)</li> <li>• Institutionalising the use of climate information and services</li> <li>• Managing climate-related risks and disasters</li> <li>• Promoting agricultural insurance</li> <li>• Post-harvest strategies and management (storage, drying, etc.)</li> <li>• Specialisation of agro-ecological zones according to climate projections</li> <li>• Artificial rain</li> <li>• Agricultural production planning ;</li> <li>• Processing and adding value to agricultural products</li> </ul>

SECTOR	IMPACTS AND VULNERABILITY BY SECTOR		PRIORITY ADAPTATION MEASURES	
	Current impacts - 2°C scenario	Future impacts - 4°C scenario	Main current priority adaptation measures (horizon 2025-2030 for 2°C)	Main priority preventive adaptation measures (by 2040-2050 for 4°C)
<b>Breeding</b>	<ul style="list-style-type: none"> <li>• Lower productivity and forage quality</li> <li>• Dwindling water and fodder resources</li> <li>• Increased competition for access to water resources</li> <li>• Decline in livestock productivity</li> <li>• New outbreaks of animal diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Inflation in the price of livestock products, which could have a major impact on farmers' incomes</li> <li>• Changes in the severity and spread of animal diseases</li> <li>• Decline in the quality of livestock production (meat, milk, etc.).</li> </ul>	<ul style="list-style-type: none"> <li>• Early warning system</li> <li>• Semi-stabling</li> <li>• Sustainable management and conservation of pastoral resources (transhumance corridors, integration of fodder crops, cross-border management) ;</li> <li>• Promotion of sustainable fodder collection and conservation systems</li> <li>• Improving the production, dissemination and use of climate information</li> <li>• Promoting livestock insurance</li> <li>• Improving animal health and productivity</li> <li>• Development and strengthening of pastoral units (to be specified)</li> <li>• Genetic improvement of species</li> </ul>	<ul style="list-style-type: none"> <li>• Early warning system Semi stabling</li> <li>• Sustainable management of pastoral resources (transhumance corridors, integration of fodder crops, cross-border management)</li> <li>• Improving the production, dissemination and use of climate information</li> <li>• Promoting livestock insurance</li> <li>• Improving animal health and productivity</li> <li>• Developing and strengthening pastoral units</li> <li>• Genetic improvement of species</li> </ul>

SECTOR	IMPACTS AND VULNERABILITY BY SECTOR		PRIORITY ADAPTATION MEASURES	
	Current impacts - 2°C scenario	Future impacts - 4°C scenario	Current impacts - 2°C scenario	Future impacts - 4°C scenario
<b>Fishing</b>	<ul style="list-style-type: none"> <li>• Depletion and/or migration of fish stocks</li> <li>• Massive job losses</li> <li>• Increase in accidents at sea and destruction of fishing equipment and infrastructure</li> <li>• Senegal's trade deficit</li> <li>• Impoverishment of fishing communities</li> <li>• Increase in illegal emigration</li> </ul>	<ul style="list-style-type: none"> <li>• Collapse of fisheries (e.g. sardinella, sole, molluscs)</li> <li>• Increase in conflicts between artisanal fishermen and between artisanal fishermen and industrial fishermen.</li> <li>• Senegal's trade deficit widens</li> <li>• </li> </ul>	<ul style="list-style-type: none"> <li>• Sustainable management of fisheries resources and restoration of marine habitats;</li> <li>• Improving management efficiency and extending marine protected areas and marine parks (10 MPAs by 2025)</li> <li>• Promoting the development of sustainable aquaculture ;</li> <li>• Improving the safety of fishing communities and fishing-related infrastructure</li> <li>• Restoration and sustainable management of mangroves</li> </ul>	<ul style="list-style-type: none"> <li>• Sustainable management of fisheries resources and restoration of marine habitats</li> <li>• Improving management efficiency and extending marine protected areas and marine parks (15 MPAs)</li> <li>• Promoting the development of sustainable aquaculture</li> <li>• Improving the safety of fishing communities and fishing-related infrastructure</li> <li>• Improving research into the dynamics of mangrove development and related ecosystem services</li> <li>• Restoration and sustainable management of mangroves</li> </ul>

SECTOR	IMPACTS AND VULNERABILITY BY SECTOR		PRIORITY ADAPTATION MEASURES	
	Current impacts - 2°C scenario	Future impacts - 4°C scenario	Current impacts - 2°C scenario	Future impacts - 4°C scenario
<b>Coastal zone</b>	<ul style="list-style-type: none"> <li>• Widespread retreat of the coastline (1.25 to 1.30 m/year)<sup>5</sup></li> <li>• Loss of sandy beaches with an immediate negative impact on seaside tourism</li> <li>• Displacement of coastal communities</li> <li>• Reduction in the size of islands (risk of islands disappearing)</li> <li>• Destruction of coastal infrastructures</li> <li>• Salinisation of groundwater and farmland</li> </ul>	<ul style="list-style-type: none"> <li>• Increase in sea level rise</li> <li>• Risk of flooding of low-lying coastal areas</li> <li>• Increased vulnerability of small islands<sup>6</sup> and low-lying coastal areas to coastal erosion and sea-level rise</li> <li>• Increase in the number of displaced coastal communities</li> <li>• Increased salinisation of groundwater and farmland</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated coastal zone management (setting up a coastal monitoring system, identifying the forcing factors and physical processes that govern the functioning and dynamics of the coastline, updating the legal and institutional framework for the coastline, morphodynamic modelling of the coastal zone, identifying the main coastal risks and areas at risk, planning coastal occupation, etc.).</li> <li>• Protection and development of at-risk areas and restoration of degraded coastal ecosystems</li> <li>• Identifying adaptation issues</li> <li>• Regulation of coastal occupation</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of swell climate and modelling</li> <li>• Identifying areas at risk from rising sea levels</li> <li>• Analysis of coastal risks and the vulnerability of infrastructures and populations</li> <li>• Regulation of coastal occupation</li> </ul>

<sup>5</sup> IUCN, 2004

<sup>6</sup> Sr15\_spm\_final (IPCC, 2018)

SECTOR	IMPACTS AND VULNERABILITY BY SECTOR		PRIORITY ADAPTATION MEASURES	
	Current impacts - 2°C scenario	Future impacts - 4°C scenario	Current impacts - 2°C scenario	Future impacts - 4°C scenario
<b>Water resources</b>	<ul style="list-style-type: none"> <li>• Variation in cumulative rainfall since the 1970s</li> <li>• Shift in isohyets from north to south</li> <li>• Sharp drop in average annual flows of major rivers (almost 60% for the Senegal<sup>7</sup>)</li> <li>• Local drying up of certain rivers (Casamance, Sine Saloum) as well as certain continental rivers, temporary pools and other flood plains.</li> <li>• General fall in groundwater levels</li> </ul>	<ul style="list-style-type: none"> <li>• Rainfall down by 5-20% across West Africa as a whole</li> <li>• Threats to demand for fresh water</li> <li>• Increase in the maximum duration of pockets of drought by up to 25% in Sahelian zones</li> <li>• Increase in the intensity and frequency of droughts<sup>8</sup></li> <li>• Increased risk of drought and water stress</li> <li>• Sharp increase in flow coefficients</li> <li>• Drop in aquifer recharge</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated management of water resources (control of the resource: knowledge of availability, flows, quality, demand, uses)</li> <li>• Construction of retention basins</li> <li>• Seawater desalination</li> <li>• Water transfer</li> <li>• More boreholes</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated management of water resources (control of the resource: knowledge of availability, flows, quality, demand, uses)</li> <li>• Construction of retention basins</li> <li>• Seawater desalination</li> <li>• Water transfer</li> <li>• More boreholes</li> </ul>

<sup>7</sup> IUCN, 2004  
 nal (IPCC, 201  
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SECTOR	IMPACTS AND VULNERABILITY BY SECTOR		PRIORITY ADAPTATION MEASURES	
	Current impacts - 2°C scenario	Future impacts - 4°C scenario	Current impacts - 2°C scenario	Future impacts - 4°C scenario
<b>Biodiversity</b>	<ul style="list-style-type: none"> <li>• Fragmentation of ecosystems and loss of habitats</li> <li>• Declining forest area for certain species</li> <li>• Decline in the productivity of ecosystem services</li> <li>• Natural vegetation in the Niayes ecosystem declined by around 57% between 1972 and 2012.</li> <li>• Reduction in gallery forest area of around 22% in Casamance and 50% in eastern Senegal between 1972 and 2012.</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of certain ecosystems and related ecosystem <sup>services<sup>9</sup></sup></li> <li>• Loss and/or risk of extinction of certain species</li> <li>• Risk of an increase in bush fires</li> <li>• Decline in the productivity of ecosystem services</li> <li>• Development of invasive species</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthening the knowledge base on biological diversity in relation to the impacts of climate change</li> <li>• Strengthening the resilience of ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthening the knowledge base on biological diversity in relation to the impacts of climate change</li> <li>• Strengthening the resilience of ecosystems</li> </ul>

<sup>9</sup> Sr15\_spm\_final (IPCC, 2018)

SECTOR	IMPACTS AND VULNERABILITY BY SECTOR		PRIORITY ADAPTATION MEASURES	
	Current impacts - 2°C scenario	Future impacts - 4°C scenario	Current impacts - 2°C scenario	Future impacts - 4°C scenario
<b>Health</b>	<ul style="list-style-type: none"> <li>• Changes in the geographical distribution and incidence of vector-borne diseases ;</li> <li>• Increase in airborne diseases, particularly acute respiratory infections (ARI);</li> <li>• Exacerbation of concentrations of allergenic substances ;</li> <li>• Increase in water-related diseases ;</li> <li>• Appearance of breeding grounds for serious diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Changes in the geographical distribution and incidence of vector-borne diseases</li> <li>• Increase in airborne diseases, particularly acute respiratory infections (ARI)</li> <li>• Increase in water-related diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthening integrated epidemiological surveillance ;</li> <li>• Prevention and control of climate-sensitive diseases in areas prone to climatic risks</li> <li>• Strengthening vector control</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthening integrated epidemiological surveillance ;</li> <li>• Prevention and control of climate-sensitive diseases in areas prone to climatic risks</li> <li>• Strengthening vector control</li> </ul>



SECTOR	IMPACTS AND VULNERABILITY BY SECTOR		PRIORITY ADAPTATION MEASURES	
	Current impacts - 2°C scenario	Future impacts - 4°C scenario	Current impacts - 2°C scenario	Future impacts - 4°C scenario
<b>Flood risk and disaster management</b>	<ul style="list-style-type: none"> <li>• Loss of life,</li> <li>• Destruction of infrastructure (roads, bridges, homes) ;</li> <li>• Slowdown in economic activity</li> <li>• Emergence of water-borne diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Increase in the frequency and intensity of intense rainfall in several regions<sup>10</sup> including the inter-tropics</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation of the national regional development plan and master plans</li> <li>• Urban restructuring and rehousing in priority areas</li> <li>• Strengthening sanitation infrastructure and rainwater drainage systems in towns and cities</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation of the national regional development plan and master plans</li> <li>• Urban restructuring and rehousing in priority areas</li> <li>• Strengthening sanitation infrastructure and rainwater drainage systems in towns and cities</li> </ul>

<sup>10</sup> Sr15\_spm\_final (IPCC, 2018)

d. Mechanism for implementing adaptation

The dynamic nature of vulnerability, which is often influenced by several factors (environmental, socio-economic, political and institutional), makes any action to adapt to climate change complex. The following points are therefore major issues that Senegal will have to address:

- **Adaptation planning at national level:** adaptation initiatives undertaken and implemented at national level generally provide responses to emergency situations. The National Adaptation Plan (NAP) currently being drawn up will make it possible to incorporate a short-, medium- and long-term planning approach into Senegal's future initiatives;
- **Proper mastery of the regulatory framework and the means for implementing the commitments:** proper implementation of the commitments will require the strengthening of technical means (regular system for collecting quantitative and qualitative data), technological means (appropriate equipment) and human means (strengthening knowledge and updating curricula). It will also be necessary to ensure that simplified legislative procedures and sectoral codes (fishing code, environment code, forestry code, etc.) are put in place to deal with climate change;
- **Implementing a multi-sectoral approach:** climate change has a cross-cutting impact on key sectors of the national economy. Effective resilience in the face of this problem requires the adoption of a multisectoral and cross-sectoral approach to strengthen cooperation between stakeholders and facilitate the establishment of a harmonised framework for future action;
- **Developing an effective communication strategy:** it is essential that political players are made aware of the effects of climate change, in the same way as the communities affected. It is therefore essential to adopt a communication strategy geared towards citizens and decision-makers, in order to better involve all stakeholders in the process initiated by Senegal;
- **Assessing the cost of adaptation:** climate change is an ongoing process. As well as defining how adaptation will be carried out, it is essential to know how much it will cost to adapt to an ever-changing climate. This assessment is often lacking due to the lack of data and modelling that would enable us to correctly identify the economic opportunity of the adaptation measures envisaged.

## IV. NDC monitoring, reporting and verification system

Under the supervision of the Direction de l'Environnement et des Établissements Classés of the Ministère de l'Environnement et du Développement Durable and with the support of the COMNACC, the NDC will be monitored and evaluated by the sectoral technical services.

Among other things, it will monitor the implementation of the activities set out in this contribution and the various CND indicators.

A capacity-building plan for the sectors concerned by the NRM will be drawn up as part of the strategy for implementing the NDC, together with the corresponding costs.

## V. Financial implementation of the CDN

The assessment of the financing needs for the actions to mitigate and adapt to the effects of climate change provided for in this NDC is based on the lists of programmes and projects identified (see appendices 1 and 2). It should be noted that the completion of the NDC is accompanied by the development of an operational strategy for the implementation and financing of the NDC.

This strategy will make it possible to establish the appropriate technical, social and financial conditions for completing the CDN within the planned timeframe.

### 1. Attenuation

Financing requirements for GHG emissions mitigation amount to approximately US\$8.7 billion, of which US\$3.4 billion is unconditional and US\$5.3 billion conditional. (See table for more details)

**Table 17: NDC financing requirements by sector in US dollars**

Sectors	Unconditional costs	Conditional costs	Total
Electricity generation	729 472 000	1928 640 000	2 658 112 000
Domestic Fuels	114 144 000	209 920 000	324 064 000
Energy Efficiency	19 090 000	619 258 000	638 348 00
Industry	42 400 866	488 414 222	530 815 088
Transport	1 582 000 000	13 120 000	1 595 120 000
Waste	648 883 026	1 185 800 000	1 834 683 026
Agriculture	255 910 688	470 802 202	726 712 890
Forestry	4 681 100	450 117 000	454 798 100
Total	3 396 581 680	5 366 151 424	8 762 733 104

## 2. Adaptation

Senegal's financing needs for adaptation to climate change over the period amount to approximately US\$4.3 billion, of which US\$1.4 billion is unconditional and US\$2.9 billion conditional (table 4).

**Table 18: Financing requirements for adapting to climate change**

FINANCING REQUIREMENTS (US dollars)			
Sectors	Unconditional (1)	Conditional (2)	Total (1+2)
<b>Agriculture</b>	169 366 600	513 581 286	682 947 886
<b>Breeding</b>	150 721 824	251 305 352	402 027 176
<b>Fishing</b>	39 800 000	238 200 000	278 000 000
<b>Water Resources</b>	317 043 200	537 735 200	854 778 <sup>40011</sup>
<b>Coastal zones</b>	158 951 052	504 618 800	663 569 800
<b>Biodiversity</b>	15 490 000	202 540 000	217 490 000
<b>Health</b>	325 653 347	175 351 803	501 005 200
<b>Flooding</b>	213 086 800	504 618 800	717 705 <sup>60012</sup>
<b>Total</b>	1 387 112 823	2 927 951 241	4 315 064 064

All in all, CDN's financial requirements amount to US\$13 billion, broken down as follows:

- **Unconditional: \$4.8 billion**
- **Conditional: US\$8.2 billion.**

**Note:** This estimate does not cover capacity building. These are estimated at US\$100 million over the period 2020-2030.

This capacity-building needs assessment will be detailed in the NDC implementation strategy.

<sup>11</sup> This amount does not include costs related to capacity building, the MRV system and strategic analysis, estimated at FCFA 208,000,000.

<sup>12</sup> The cost of adaptation needs for the flooding sector was calculated using 1\$ = 600 FCFA

## VI. Macro-economic impact

### a. Relationship between the NDC and the PES 2 Priority Action Plan (PAP)

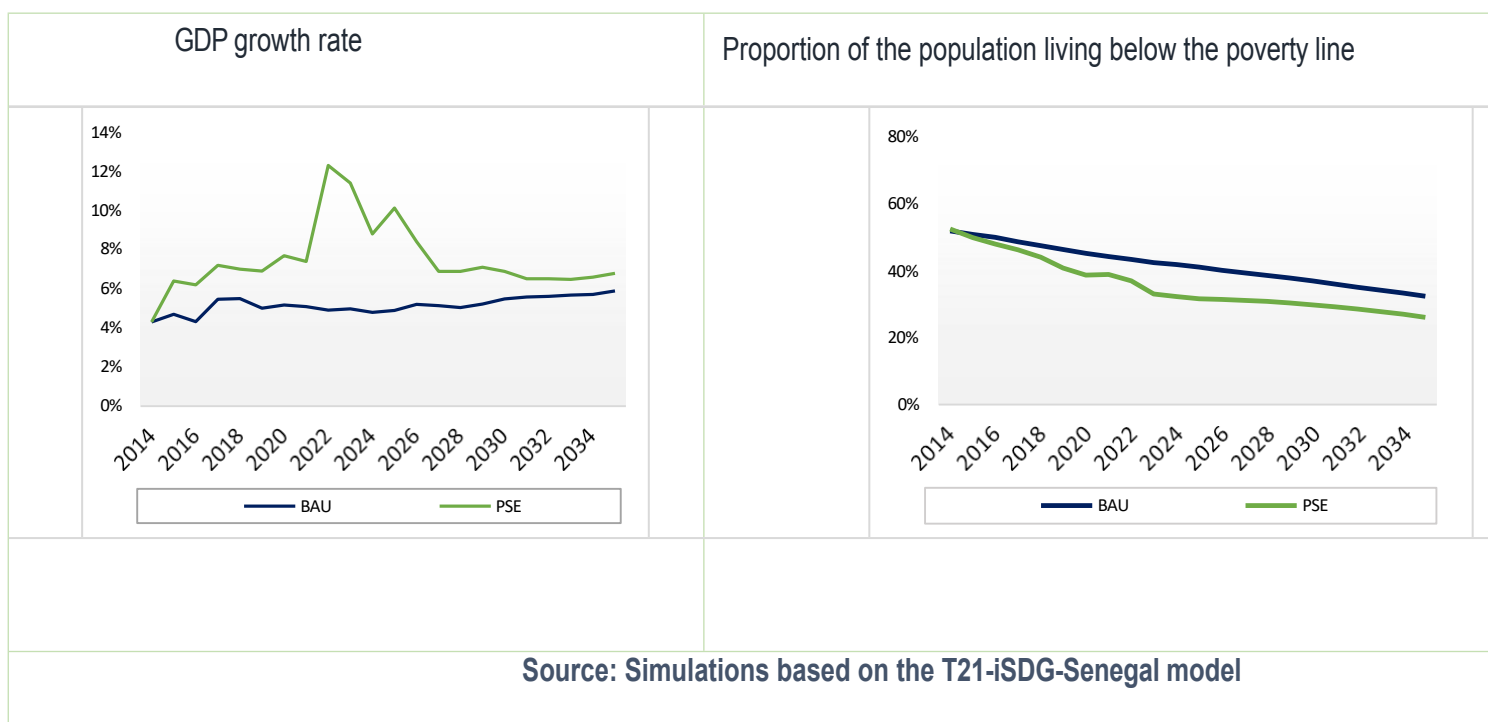
As part of the integration of climate change into public development policies, a simulation of the level of consideration of NDC options in the PAP-PSE 2 has been proposed. The simulation makes a comparative analysis between the cost of unconditional adaptation/mitigation NDC actions and the cost of low-carbon and climate-resilient projects/programmes in the PES2 PAP. The analysis led to the following conclusions:

- The implementation of the PAP-PSE2 "climate" projects will enable Senegal to meet its commitments under the unconditional NDC. As proof of this, the overall cost of the PAP-PSE2 climate projects is estimated at CFAF 3162 billion, whereas the unconditional NDC is CFAF 2734 billion;
- This simulation of how climate is taken into account in the PES2 shows that significant progress has been made in the process of greening our public policies. It is important to continue the momentum noted in certain sectors (energy, flooding, industry, etc.) and to improve the way others (coastal erosion, livestock farming, health, etc.) are taken into account in the PES2.

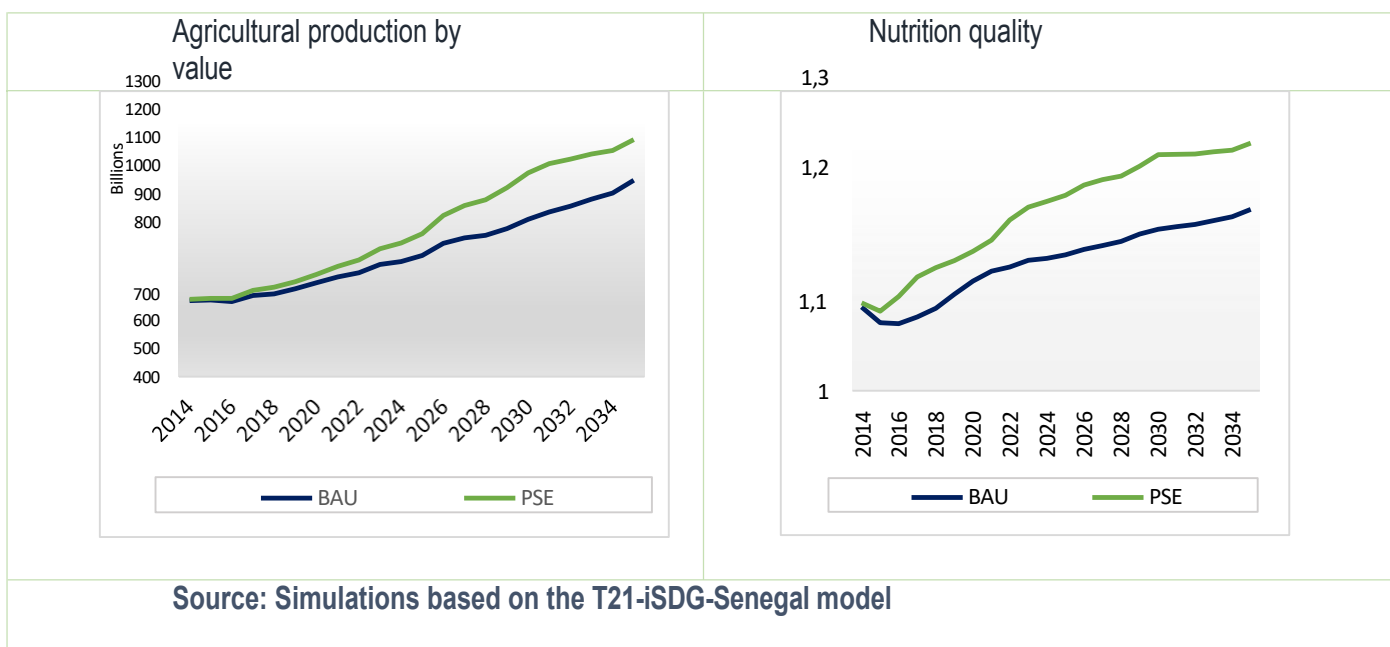
### b. Socio-economic impact of planned measures

The T21-iSDG-Senegal model, an integrated medium- and long-term planning tool, is used to analyse the impact of the planned options. Its systemic approach integrates multiple economic, social and environmental variables into a single coherent framework. A major strength of T21-iSDG-Senegal is that the tool reproduces the complex network of causal interdependencies and numerous important feedback loops that drive growth and development. To achieve this, two scenarios are considered: the baseline scenario (BAU) and the PES scenario, which fully integrates the options set out in the NDC (see section 4).

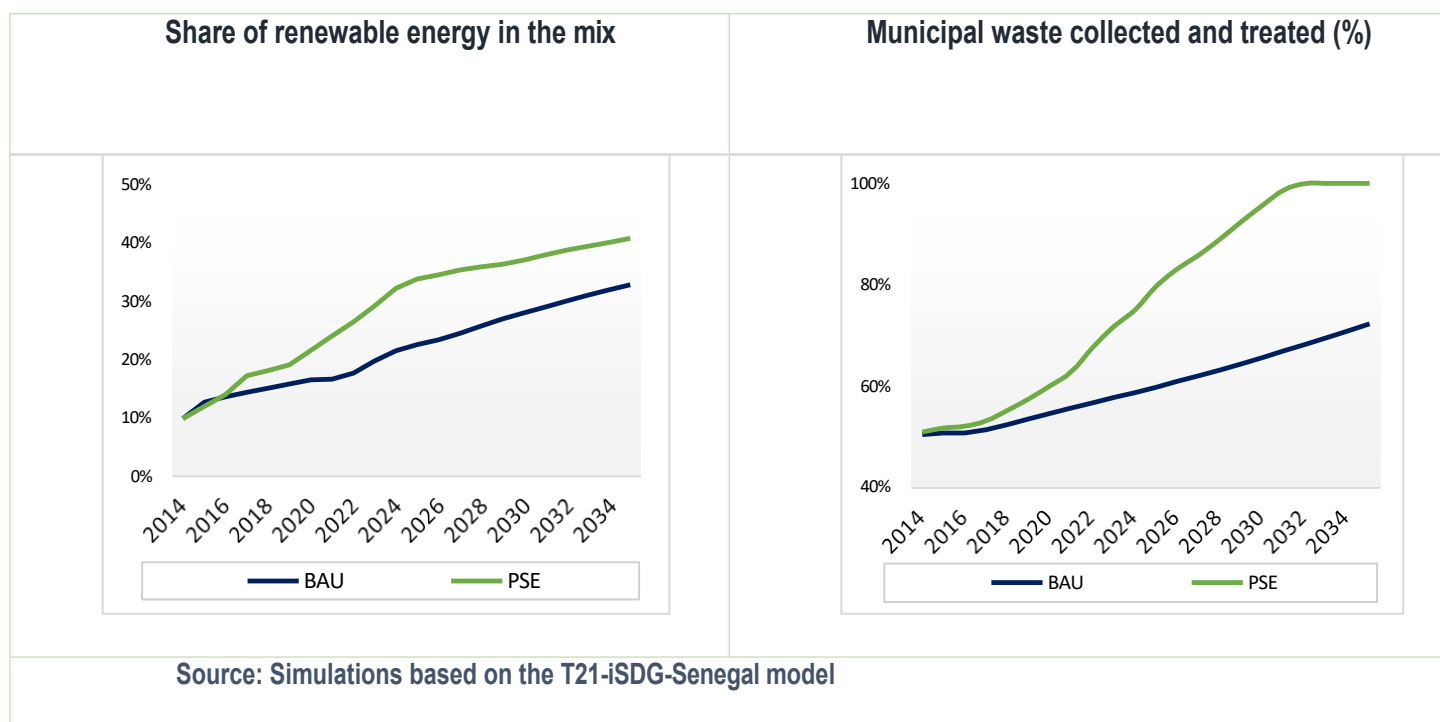
The implementation of the adaptation and mitigation measures planned by Senegal as part of the PES, in phase 2, should generate significant socio-economic benefits in several sectors. At macroeconomic level, these investments should stimulate economic growth, create jobs and reduce poverty. In terms of production, simulations indicate an average annual growth rate in gross domestic product (GDP) of 9.1% over the second phase of the PES (2019-2023) and 7.9% by 2035. This increase in wealth will also be accompanied by an improvement in the standard of living of the Senegalese people. In line with the options set out in the PES, the incidence of poverty should fall by 9.4 percentage points compared with the reference scenario in 2023 and 6.3 in 2035.



In the agriculture and land management sector, the planned investments should improve soil yields and increase production. Agricultural production is expected to grow at an average rate of 3.3% over the period 2019-2035. This performance will increase the availability of food and contribute to greater food and nutritional security. The nutrition quality index is expected to rise by 27.5% in 2035 compared with the baseline scenario.



In the energy and waste management sector, the options set out in the NDC should reduce CO<sub>2</sub> emissions through the promotion of renewable energies in the energy mix and the collection and treatment of waste in urban areas. The share of clean energy should reach 40.7% of overall electricity production in 2035 in the PSE scenario, compared with 32.8% in the status quo. These measures will make it possible to extend access to energy to the population and improve the well-being of households. They are also expected to make a significant contribution to the country's energy independence. In addition, the use of modern forms of energy in homes and the sustainable management of urban waste will make it possible to limit atmospheric pollution and consequently reduce the harmful effects on people's health.



For sectors linked to adaptation, the expected impacts are as follows:

#### Soil and Agriculture

- Reducing the incidence of poverty ;
- Contributing to better food and nutritional security ;
- Strengthening resilience ;
- Job creation ;
- In 2035, an increase in average agricultural yields to 3.2 tonnes for the BAU trend scenario vs. 4.2 tonnes for the proactive soil policy scenario.

### Fishing :

- Creation of added value of USD 9,200 million in the sector by 2035;
- Better economic and social contribution from the sector, through sustainable fisheries management (crisis and climate management).

### Coastal zones :

- Reducing the socio-economic risks that have a negative impact on the economic performance of the tourism sector in the most degraded areas;
- Combating the reduction in fishing yields and the direct costs to coastal infrastructures. Water resources

:

- Limiting the rural exodus and its harmful effects;
- Obtaining "productive water" that generates added value in agricultural regions thanks to the facilities put in place;
- Creation of job opportunities in the areas affected by the works;
- Groundwater recharge ;
- Contributing to the fight against salinisation problems ;
- Helping to combat flooding;
- US\$9.08 million in benefits from adaptation to the risk of marine submersion in Saint-Louis ;
- Reduction in the net present cost (NPCC) of coastal erosion, estimated by the World Bank at 688 million US dollars.

### Health

- Reduction in the cost of deteriorating health, estimated at US\$2,400 million by 2035.

### Flooding

- The socio-economic benefits expected from flood prevention correspond to the losses and damage avoided;
- Reducing the risk of proliferation of water-borne diseases (diarrhoea, dysentery), malaria and skin diseases;
- Reducing the risk of school drop-out due to the occupation of schools by disaster victims or the impossibility of getting to classrooms during the rainy season



## Conclusion

Senegal's stated contribution reflects the government's strong commitment to reducing GHG emissions in all sectors of the economy. These reductions are greatest in the energy and agriculture sectors, which currently contribute the most to CO<sub>2</sub> emissions recorded at national level.

It also sets out a number of specific adaptation measures, given the impact of climate change on key areas of the Senegalese economy. This unprecedented effort is a prerequisite for the success of the Plan Sénégal Émergent (PSE), which is why Senegal's political decision-makers are heavily involved in defining and monitoring this contribution.

Success will also depend on the willingness of all the countries involved in the fight against climate change to work together and pool their resources.