



**REQUEST FOR CEO APPROVAL
PROJECT TYPE: MEDIUM SIZE PROJECT
TYPE OF TRUST FUND: GEF TRUST FUND**

PART I: PROJECT INFORMATION

Project Title: Promoting SLM practices to restore and enhance carbon stocks through adoption of Green Rural Habitat initiatives			
Country(ies):	Senegal	GEF Project ID: ¹	5802
GEF Agency(ies):	UNEP	GEF Agency Project ID:	01283
Other Executing Partner(s):	UNFCCC Focal Point of the Department of Environment and Gazetted Areas (DEEC), Ministry of Environment and Sustainable Development	Re-Submission Date:	September 23, 2016
GEF Focal Area (s):	Land Degradation /Climate Change	Project Duration(Months)	48
Name of Parent Program (if applicable):		Project Agency Fee (\$):	125,365

A. FOCAL AREA STRATEGY FRAMEWORK²

Focal Area Objectives	Expected FA Outcomes	Expected FA Outputs	Trust Fund	Grant Amount (\$)	Cofinancing (\$)
Land Degradation -3	Integrated Landscapes: Reduce pressure on Natural Resources from competing land use in wider landscape	Outcome 3.1: Enhanced enabling environments between sectors in support of SLM. Outcome 3.2: Good management practices in the wider landscape demonstrated and adopted by relevant economic sectors.	GEF TF	794,521	3,600,000
Climate Change-5	Promote Conservation and enhancement of carbon stocks through sustainable management of Land-Use Change and Forestry	Restoration and enhancement of carbon stocks in forests and non-forest lands, including peatland Indicator: Hectares restored GHG emissions avoided and carbon sequestered Indicator: Tons of CO2 equivalent	GEF TF	525,114	2,845,000
Total project costs				1,319,635	6,445,000

¹ Project ID number will be assigned by GEFSEC.

² Refer to the [Focal Area Results Framework and LDCF/SCCF Framework](#) when completing Table A.

B. PROJECT FRAMEWORK

Project Objective: To support scaling up of SLM practices in land use planning and promote technology that enhance carbon stock, reduce emission either from forest destruction for services or building materials production and generate revenue for local communities through increase productivity and green jobs

Project Component	Grant Type	Expected Outcomes	Expected Outputs	Trust Fund	Grant Amount (\$)	Confirmed Cofinancing (\$)
1. Scaling up SLM practices and enhancing Carbon Stock to boost productivity	TA	Increased land productivity and sequestration potential through development and implementation of local policy frameworks which integrate SLM practices and carbon stock enhancement	<p>3 Municipal Lands uses plans (3) with good SLM practices , poverty and environment initiatives and Carbon stock monitoring and enhancement, developed and implemented to support conservation and promotion of ecosystem services</p> <p>At least two Integrated Natural Resources Management (INRM) Technologies with improved livelihood potential (e.g. Voute Nubiennne, Agroforestry) developed, adopted and disseminated</p> <p>3 SLM practices (Agroforestry, water harvesting technics controlled grazing) demonstrated to improve productivity, reduced erosion and enhanced carbon stock</p> <p>3 NGO /or CBO, Local Extension services and rural development local administration personnel and 120 private individuals including from rural areas are capacitated to promote and disseminate INRM technics (e.g. Voute Nubiennne) and green job</p>	GEF TF	400,000	1,700,000
2. Green and energy efficient rural housing	TA/INV	Stakeholders adopt Proven energy	30 VN communities	GEF TF	700,000	3,500,000

		efficient housing technology and INRM practices	buildings as demonstration sites in 3 pilot municipalities to avoid 84 tCO ₂ eq emission and deforestation 500 VN constructed under community revolving funds to support INRM to avoid 1400 tCO ₂ eq emission and deforestation and create green jobs.			
3. Knowledge management and advocacy	TA	Adequate awareness and policy support for INRM	Policy brief to promote INRM developed and disseminated 1 National and 3 regional forums on rural habitat and INRM Guideline for upscaling of VN and sustainable natural resources management	GEF TF	99,666	500,000
Subtotal					1,199,666	5,700,000
Project Management Cost (PMC) ³				GEF TF	119,969	745,000
Total project costs					1,319,635	6,445,000

C. SOURCES OF CONFIRMED COFINANCING FOR THE PROJECT BY SOURCE AND BY NAME (\$)

Please include letters confirming cofinancing for the project with this form

Sources of Co-financing	Name of Co-financier	Type of Cofinancing	Amount (\$)
National Government	DEEC/Ministry of Environment and Sustainable Development	In-Kind	20,000
National Government	DEEC/Ministry of Environment and Sustainable Development	Cash	800,000
National Government	Agence Nationale des Ecovillage/Ministry of Environment and Sustainable Development (ANEV)	In-Kind	3,000,000
CSO	AVN Projects	Cash	375,000
National Government	Ministry of Environment and Sustainable Development/Programme of sustainable and participative use of traditional and substitution energies (PROGEDE)	Cash	750,000

³ PMC should be charged proportionately to focal areas based on focal area project grant amount in Table D below.

National Government	Agence National des Ecovillages/Capacity building for the control of land degradation et promoting of their valorization in degraded soils zones	Cash	1,500,000
Total Co-financing			6,445,000

D. TRUST FUND RESOURCES REQUESTED BY AGENCY, FOCAL AREA AND COUNTRY¹

GEF Agency	Type of Trust Fund	Focal Area	Country Name/ Global	(in \$)		
				Grant Amount (a)	Agency Fee (b) ²	Total c=a+b
UNEP	GEF TF	LD	Senegal	794,521	75,479	870,000
UNEP	GEF TF	CC	Senegal	525,114	49,886	575,000
Total Grant Resources				1,319,635	125,365	1,445,000

¹ In case of a single focal area, single country, single GEF Agency project, and single trust fund project, no need to provide information for this table.

PMC amount from Table B should be included proportionately to the focal area amount in this table.

² Indicate fees related to this project.

E. CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:

Component	Grant Amount (\$)	Cofinancing (\$)	Project Total (\$)
International Consultants	10,000	50,000	60,000
National/Local Consultants	147,000	450,000	597,000
Total	157,000	500,000	657,000

F. DOES THE PROJECT INCLUDE A “NON-GRANT” INSTRUMENT? No

(If non-grant instruments are used, provide in Annex D an indicative calendar of expected reflows to your Agency and to the GEF/LDCF/SCCF/NPIF Trust Fund).

PART II: PROJECT JUSTIFICATION

A. DESCRIBE ANY CHANGES IN ALIGNMENT WITH THE PROJECT DESIGN OF THE ORIGINAL PIF⁴

A.1.National strategies and plans or reports and assessments under relevant conventions, if applicable, i.e. NAPAS, NAPs, NBSAPs, national communications, TNAs, NCSA, NIPs, PRSPs, NPFE, Biennial Update Reports, etc.

Alignment to national strategies and plans and assessments under relevant conventions:

The project falls within the international conventions on environment and sustainable development which Senegal is subscribed to. It is in line with the national strategic and sectoral policies extending those conventions at national level.

At an international level, the project is aligned to two conventions, namely: (i) The United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol are at the heart of international efforts for an effective integration of climate change issues. In Article 2, the Convention aims to "stabilize the concentration of greenhouse gases (GHGs) in the atmosphere at a level that would prevent dangerous anthropogenic interference with

⁴ For questions A.1 –A.7 in Part II, if there are no changes since PIF and if not specifically requested in the review sheet at PIF stage, then no need to respond, please enter “NA” after the respective question.

the climate system."; and (ii) The United Nations Convention to Combat Desertification and its National Action Plan (NAP/CAD) which became known as NAP/CAD/SLM through the Global Mechanism.

What the two conventions have in common is the fight against climate change with two complementary approaches: mitigation and adaptation.

- The Inter-governmental Panel on Climate Change (IPCC) which observed in their fifth assessment report of 2014 that: "In 2010 the building sector is responsible for 32% of the final energy consumption and 19% of greenhouse gases emissions related to energy consumption. This energy consumption and associated emissions are expected to double and even potentially triple by mid-century, because of several key trends. A very important trend is the increasing access of millions of people in developing countries to adequate habitat, electricity and improved cooking facilities", particularly in least developed countries, including Senegal.

The 3rd National Communication on Climate Change finalized in July 2015 and Submitted to the UNFCCC in January 2016, indicated that the Building subsector constitute one of the most dynamic economic sector in the country. The growth in the sector is maintained to 13% in 2005 and 2015. However, important effort needed to be done to integrate climate change dimension in national Building and Public Work (BTP) policies in terms of energy efficiency during building through adoption of norms and utilization of materials for isolation. On forestry subsector, which constitute a sequestration mean, the analyse of mitigation option has been considered for the south Eco geographical zone in which the mitigation strategy is based on the control of bush fire and dissemination of ameliorated cooking stove which allow economy of firewood. All these national priority mitigation are in line with the planned project activities. Furthermore, according to the same 3rd National Communication, the CO₂ represent 83% of emissions. In term of sectors, the 89% of the CO₂ emission are from energy sector, followed by industrial processes (11%).

- The Ten-Year Strategic Framework (DSF) (2011) of the Global Mechanism has set up a strategic focus priority: "sustainably raise production and productivity." SLM is therefore an instrument for achieving this objective through the fight against land degradation which is a vulnerability factor for local communities;
- TerrAfrica, which defines Sustainable Land Management (SLM) as "the adoption of land use systems that enables users to maximize the benefits of land through appropriate management practices while preserving or enhancing their ecological support functions ... "

✓ At the sub-regional level

Several agreements have been signed on environmental management and SLM. Also, different sub regional guidance structures and coordination policies and strategies have been set up such as: the ECREEE center at ECOWAS to emphasize energy efficiency.

✓ Nationally

The project is aligned with several national and sectoral policies and strategies due to its multi-dimensional and multi-sectoral nature involving various stakeholders, including several state institutions. Among others, these include:

- ✓ The Senegal Emergent Plan (PES) that focuses on finding sustainable solutions to "enable people to develop a culture of prevention and adaptation to climate change." Thus, (i) Area 1 highlights the need to "integrate the principles of sustainable development into country policies and reverse the trend noted over the loss of environmental resources" into "guaranteeing a balance between development productive activities and management of the environment "; (ii) Area 2 - after realizing that "habitat and living conditions are largely influenced by the degradation of natural resources and the environment ... In cities and countryside, informal and precarious settlements are appearing ", and advocates for a "kind of perennial construction of social habitat to meet demand (10,000- 15,000 / year) along with a building material production chain (...) to improve quality by introducing local materials. "

- The aim of the Sector Policy Note on Environment and Natural Resources (LPSE), General Objective 2 (OG2), is to: "accelerate action against the current trend of environmental degradation and natural resources while respecting international conventions relating thereto ". It is based on various instruments such as: (i) the National Action Plan against Desertification (NAP /CAD) and the National Adaptation Plan of Action (NAPA), among others.

- **The Energy Development Sector Policy (LPDSE)**

The October 2012 **Energy Development Sector Policy (LPDSE)** with one of its strategic objectives consisting in promoting the control of energy and energy efficiency with the following components:

- ✓ Setting up a legislative and regulatory framework;
- ✓ Using low consumption bulbs across the board;
- ✓ Conducting home, industry and tertiary sector audits;
- ✓ Standardizing and labeling household and office appliances;
- ✓ Ensuring the sustainable management of public lighting in partnership with local governments by extending and strengthening the solar "public lighting program".

In addition to the other energy areas, the document sets out the strategic framework for 2020 to develop energy control in Senegal.

A 40% energy saving objective by 2020 was set, associated with an objective of effecting a 10-20% reduction of the Administration's electricity bill by 2015.

- The Action Plan against Desertification and Sustainable Land Management (NAP/CAD / SLM), which is the national reference document that defines the guidelines for sustainable land management s; and
- The National Strategic Investment Framework for Sustainable Land Management (CNIS / GDT), which is a consensual instrument at the national level to support the implementation of SLM.
- The other different sectorial policy briefs for the environmental sector and management of natural resources:
 - ✓ The Agricultural Development Policy Letter (LPDA)
 - ✓ The Livestock Development Policy Letter (LDPE) and the National Livestock Development Plan
 - ✓ The Fisheries Development Policy Letter, the Action Plan for the Development of Fisheries and the Aquaculture Operational Development Plan
 - ✓ The law of agro-forestry-pastoral orientation (Law No. 2004-16 of 04 June 2004)
 - ✓ The water policy
 - ✓ The policy of urban planning and habitat
 - ✓ The 3rd National Communications

- ❖ The law and regulatory framework

There are several legal texts that govern land management and habitat in Senegal. The main ones:

- ⇒ Land law (Law No. 64-46 of 17 June 1964)
- ⇒ The law of agro-forestry-pastoral orientation (Law No. 2004-16 of 04 June 2004) whose aim is to foster a better long-term development of land by protecting land tenure of smallholders and the development of private agri-business.
- ⇒ The legislation on the environment and natural resources has various codes: forestry, environment, hunting and wildlife protection, pastoral management, water, etc.
- ⇒ The Act 3 of the decentralization process is intended to "plot Senegal into viable and competitive areas that could uphold sustainable development by 2022". The act strengthens the capacity of the municipality by giving it a greater regulatory, financial and managerial autonomy to enhance the development of its territory.
- ⇒ The legislation on building and construction: including city planning codes (2008), construction (2009) and its implementing decree (2010) and the building permit issued by the Mayor of the locality, organizing and

regulating habitat and construction. In the case of NV, while the regulation remains favourable for private buildings, it is however more binding on public institutions that can house more than 51 people. Hence, there is a need for the standardization of the NV technology to remove these bottlenecks.

- ⇒ The mining legislation: Law No. 2003 -36 of 24 November 2003 creating the Mining Code, which is under reform, regulates mines and quarries in Senegal. While self-tapping of adobe housing is not specially regulated, it should be integrated into the code to regulate its large-scale exploitation and to respond to both environmental and socio-economic considerations.

The National Gender Strategy: The project is in conformity with the National Gender Strategy which objective is to reduce inequality between men and women to reach sustainable development. The strategy is operationalized with two actions plans aiming to improve population livelihood and promote sex equality. The decree No. 2008 – 1045 of 15 September 2008 has created the National Department for Gender Equity and Equality to support the strategy. The main objective of the creation of the department is to create a reference framework and an operational instrument to integrate gender issues in development objectives.

UNDAF (2012 – 2016): The project fit into actual orientations of UNDAF, particularly it outcome 8 entitled “Adaptation to climate change and promote the development of sustainable livelihoods”. Furthermore, the project anticipate the next UNDAF cycle which objectives is to promote new adaptation technologies to improve local communities resilience to climate change which is in line with the strategic objective of Senegal Emergent Plan (2015 – 2025) , which is the reference document for the national development agenda

A.2. GEF focal area and/or fund (s) strategies, admissibility criteria and Priorities

The project will contribute to the GEF LD objective 3: Integrated Landscapes: Reduce pressure on Natural Resources from competing land use in wider landscape. This contribution will be achieved through the integration of INRM in Regional/local development plans but also the implementation of good SLM practives to restore, enhance and restore carbon stock. The project will also provide financial incentives toward adoption of SLM practives. The project will also contribute to objective 5 of the GEF5 climate change strategy CC-5: Promote Conservation and enhancement of carbon stocks through sustainable management of Land Use Land-Use Change and Forestry. The INRM mainstreaming in local development plan will helt to restore, enhance and manage the carbon stock to avoid deforestation but also to conduct afforestation activities to increase the carbon stocak. The Voute Nubienne that will be promoted will help to avoid GHG emission from the cutting of trees whicjh will be otherwise used as construction materials. The avoidance of the use of cement and iron sheet will also contribute to the GHG emission as the production and transportation to the end users involved utilisation of fossil fuel thus GHG emission.

Further, the PPG established a stronger link with relevant conventions and include:

1. The project is consistent with the strategic objective of the Fund to promote climate change-compatible development options and support the MDGs under climate change conditions. The project complies with SLM rules and procedures and represents the response of the Government of Senegal to the urgent and immediate adaptation needs in terms of land degradation;
2. Senegal is a party to the UNCCD which it ratified in December 1994.
3. The country is also signatory to the Kyoto Protocol since 2001 and as required by the UNFCCC. The country submitted three national communications to UNFCCC, as well as a National Adaptation Programme of Action (NAPA) that was adopted in December 2006.
4. The project is a priority for the GoS because it is a short and long-term response to both the needs for adaptation and mitigation to climate change and land degradation affecting ecosystems and communities. The project is designed to reflect the additional costs of adapting the priority actions identified in the NAP / CAD / SLM on the one hand, and mitigation identified in the NAPA on the other hand. It is thus based on several other projects and programs that constitute the baseline.

A.3 The GEF Agency's comparative advantage:

As in PIF.

UNEP has a history of working with Senegal on various GEF and non-GEF activities. UNEP has worked with the Government of Senegal on national GEF projects and various Enabling Activities, across all Focal Areas and on 19 regional GEF projects covering all GEF focal areas. On UNCCD implementation, UNEP has supported the country during the PRAIS project. Currently UNEP is supporting the Government of Senegal in the implementation of the UNCCD Enabling Activity related to the NAP alignment and reporting. UNEP is also currently supporting the Government of Senegal in the implementation of Montreal Protocol through Ozone Programme. On climate change, UNEP supported the development of NAPA and national communications.

The project is fully in line with the UNEP role of catalysing the development of scientific and technical analysis and advancing environmental management in GEF-financed activities. UNEP provides guidance on relating the GEF-financed activities to global, regional and national environmental assessments, policy frameworks and plans, and to international environmental agreements.

More specifically, the project lies within the following areas recognized by GEF as areas where UNEP has a comparative advantage:

- *Sound science for national, regional and global decision-makers*, notably by strengthening science-to-policy linkages and by strengthening environmental monitoring and assessment;
- *Technical assistance and capacity building at country level*, notably by strengthening technology assessment, by demonstration and through innovation, and also by directly developing capacity;
- *Knowledge management*, including through awareness raising and advocacy.

The project is consistent with the objectives and expected outcomes of the current UNEP Medium Term Strategy and fits under the Ecosystem Management, Climate Change and Environmental Governance sub-programs.

A.4. The baseline project and the problem that it seeks to address:

The Global environmental problems, root causes and barriers:

In Senegal, more than 60% of the population derives their daily subsistence from natural resources particularly from land resources. Already visible negatives changes are being observed on land and vegetation productivity and many research activities have indicated that the root causes are linked with population increase, unsustainable agricultural practices and pastoral systems, the rainfall patterns and destruction of vegetation cover. The latter is primarily due to unsustainable wood exploitation both for fuel wood and services including rural house construction, charcoal production which currently represents 60% of the 4 million Cubic meter of wood exploited annually. In addition, climate change is already impacting the country and the key signs include severe and recurrent droughts, siltation of surface and underground waters, increase in coastal erosion, modification of fish populations, reduced agricultural productivity etc. The loss of agricultural productivity is currently experienced in groundnut production zone with annual rate of 3 to 5% for the millet and groundnut within 10 years⁵.

In urban areas 94% has no access to a sustainable home⁶. 30% of the entire population (and 50% in rural areas) are roofed with ligneous resources (wood, thatches)⁷; the other 50% uses imported materials (tin, cement). The national demand for housing is estimated at 200 000 with an annual increase of 10 percent⁸. Taking into consideration the fact that to build a simple dwelling, 4 to 5 trees need to be sawn, housing result in increased deforestation. Other available option related to the use of imported tin or cement for building results in generating Green House Gas emissions - due to their production, their transportation, but also their use as CO2 emissions from residential buildings and

⁵ Vulnerability of agricultural production to climate change in Senegal DEEC, 2001

⁶ Based on UN-DESA figures, found in the UN-Habitat report on Senegal 2008-2009: There are no such detailed studies for the 60% (almost 8 million) of people living outside « urbanized areas ». <http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=2713>

⁷ AVN's market observations on the field in 2013, and last report in Senegal National statistics, 2002,

http://www.ansd.sn/publications/rapports_enquetes_etudes/enquetes/RGPH3_RAP_NAT.pdf ;

⁸ Centre for Affordable Housing Finance in Africa (<http://www.afrbiz.info/content/housing-supply-in-senegal>)

commercial and public services reached 0, 44 million metric ton in 2005⁹. According to a McKinsey study, the highest return rate on investment for climate mitigation relies in the building sector in Africa, where the annual demand for construction materials is growing by 8% a year¹⁰. “*The building and construction industry is considered a key player in sustainable development, with the potential to significantly impact society and the environment*” (Shelter Initiative for Climate Change Mitigation – UN-Habitat/UNEP). According to the National Second Communication for Climate Change, 2010, the main problem related to mitigation in building sector is energy efficiency but also the related industrial process which is linked to emission in cement production (through the clinker) and SO₂ emitted by the clay use in cement production. Therefore any technology which will lead to the reduction of cement utilization will lead to emission reduction for the country. The Nubian Vault (Voute Nubienne) technology will contribute toward both the objective of energy efficiency though reduced of power need for electricity and the reduced of avoidance of cement in construction sector. The building need in the project sites is estimated at 168,750 housing units for the next 10 years. This demand is an equivalent of 810,000 tons of Co2 emission.

*The Nubian Vault Technique*¹¹:

The Nubian Vault (NV) technique is an age-old method of timberless construction, originating in Upper Egypt. It uses only earth bricks and earth mortar. Nubian vaults built over 3,000 years ago at the Ramesseum mortuary temple, Luxor, are still standing.

During the last ten years, the Nubian Vault Association (AVN) has successfully introduced a simplified, standardized version of this ancient technique in Burkina Faso, Mali, Senegal, and Zambia. This standardized technique is:

- Ecologically sustainable – no corrugated iron roofing sheets, nor timber beams, rafters, or supports;
- Carbon neutral – none of the construction materials are manufactured, or transported long distances, nor do any trees need to be cut down;
- Economically viable – only locally available raw materials (earth, rocks, and water) are used, favouring local economic circuits and self-sufficiency;
- Comfortable – due to the excellent thermal and acoustic insulation properties of earth construction;
- Durable – NV buildings have a far longer lifetime than those with corrugated iron or timber roofs and maintenance is simple;
- Modular – applicable to a wide range of buildings (houses, schools, health centres...) of different styles (flat terrace roofs, two-storey buildings, courtyard buildings...) of which are easily extendable.
- Vernacular – incorporating traditional practices and aesthetics of earth architecture.

The AVN strategy results in systemic, holistic, change because it is completely integrated into local economic circuits, relies entirely on locally sourced, often freely available, raw materials, and is creating autonomous markets in NV housing through the activity of increasing numbers of trained NV builders and entrepreneurs. Spreading the NV technique all over Senegal (in the regions where the technical concept is appropriate) will reverse the housing situation, generating profits at the “bottom of the pyramid” through the market generated by millions of local NV entrepreneurs. The housing alternative proposed by AVN is fully integrated in the Senegalese context and is socially, environmentally, culturally and economically sustainable.

AVN’s simplified and standardized version of the technique has been adapted to the climatic conditions and traditional know-how of the Sahel region, making it easy to learn on-the-job:

- Roofs are exclusively vaulted (no domes), and can incorporate a traditional flat roof-terrace;
- Vaults are a standardized width (3.25 metres) made from mud bricks of a standardized size;
- Walls are a standard thickness, and openings for doors and windows a standardized size;
- Plastic sheeting is incorporated in the roof to reduce water penetration and erosion.

The major cost element in using the VN method is labour, often provided by family members and neighbours on an exchange barter/self-build basis, thus keeping cash in the local economy; the raw materials (earth, rocks, water) are locally available and ecologically sound; construction with mud bricks and mortar is traditional in Sahel region – the innovation of vault construction can easily be incorporated into existing practice.

⁹ IEA Statistics © OECD/IEA, <http://www.iea.org/stats/index.asp>)

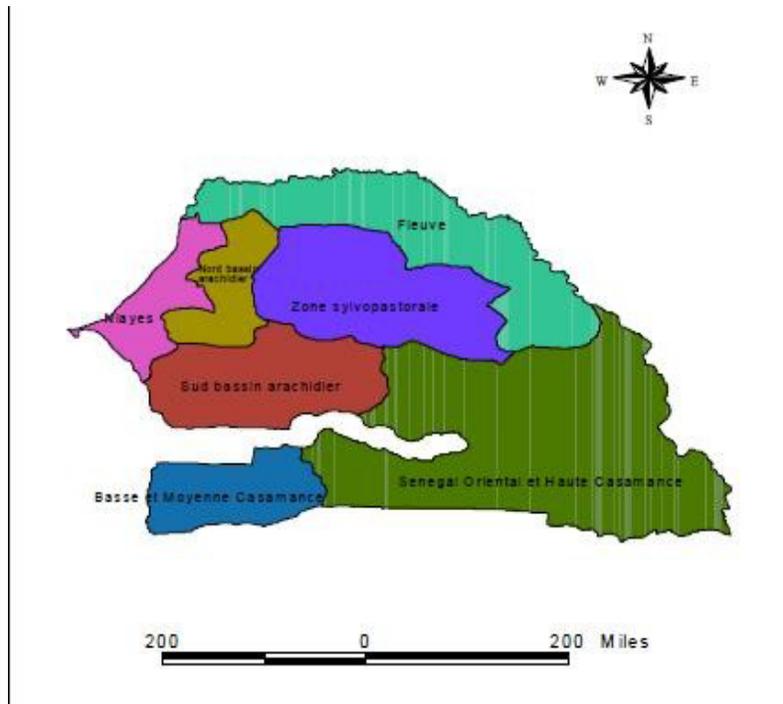
¹⁰ Africa 2050 – Growth, Resource Productivity and Decoupling. Mark Swilling

¹¹ <http://www.lavoutenubienne.org/en/nv-technique>

The Second National Communication indicated also that LULUCF is still not a source of emission for the country when all the related LUCUCF actions are combined, however the sequestration potential is drastically reducing mainly due to forest fires and bush burning. The country will therefore gain more in establishing a system that will allow reversing the tendency and establishing monitoring system for a long term monitoring and that will be achieved through the Land Used Plan planned to be developed in this project.

Senegal is a Sahelian country badly affected by climate change and land degradation which occurs with more or less variable intensity in six agro-ecological zones. This ranges from coastal erosion, loss of soil productivity and the resulting deterioration of the living environment caused by rise in temperatures, flooding, etc.

Fig. 02: Map of agro-ecological areas of Senegal



Source: National Action Plan for Climate Change Adaptation (MEPN)

Beyond ecological impacts, climate change and land degradation seem to be a real threat to food and energy security as well as the development of the country because of their adverse impacts on production and the lives of populations.

As an illustration, economic losses due to loss of fertility in the primary sector between 1990 and 2000 are estimated about 140 billion CFA francs per year or 4.5% of GDP in 2000 (Study: Economic Evaluation of the Environment - DEEC).

Moreover, the habitat sector has experienced an economic boom for many years with the rapid substitution of imported materials with local materials thereby depriving the majority poor of a decent roof. The situation is exacerbated by climatic events (storms, floods, etc.), encouraging people to undertake self-construction without any technical and technological expertise.

Given the scale of these events and urgency to act, the GoS has prioritized climate change adaptation and sustainable land management as the prerequisites for achieving its emergence objectives which are embedded in the Senegal Emergent Plan.

Gender situation in Senegal¹²:

Senegal exhibits many areas of gender disparities. According to the Global Gender Gap Index, Senegal ranks 102nd out of 134 countries. Neighbouring countries hold positions at 75 (The Gambia, up from 95 in 2007), 119 (Mauritania), and Mali (127). The index measures the relative position of women to men in terms of outcomes in four areas: economic participation and opportunity, educational attainment, political empowerment, and health and survival. A second index, the Social Institutions and Gender Index (SIGI), ranks Senegal 52nd out of 102 countries in its composite index, a more positive ranking than its neighbours of Gambia (69) Mauritania (61), Guinea (68), or Mali (99). The ranking is based on measures of gender inequality in five areas: the family code, physical integrity, son preference, civil liberties, and ownership rights. It is evident from the information presented above that although Senegal remains a poor country with significant gender inequalities, but it is both economically and socially better off than many of its neighbours in the region, since only the Gambia scores higher on one of the measures.

Senegal provides a positive environment for donor programming on gender equality because it has a relatively gender equitable legal infrastructure and history of both political support for women by its national leaders and an active community of women's and human rights in civil society. It is also a challenging environment because gender inequalities persist, maintained by cultural and religious beliefs and practices that limit girls' and women's opportunities to participate in the nation's economic and political life, and which can also rigidly structure boys' and men's life choices

Some encouraging trends are evident. The age of first marriages is increasing in urban areas, and the near parity of girls in primary school holds promise that age of first marriage in rural areas will also decrease as girls' education increases. Data show that in Senegal 20% of women with a primary school education married before 18, compared to 36% without a primary school education. Levels of Female Genital Cutting (FGC) are decreasing in most of the affected regions of the country. There is attention to gender at multiple levels of activity in the country. There is a Donor Coordination Group on Gender comprised of a forum of donors and international agencies such as international NGOs that develops plans and strategies and disseminates information among donors and partners. UNIFEM plays a coordinating role for this group.

At the national level, the 2001 Senegalese constitution upholds the principle of equality for all citizens, regardless of sex. It promotes secularism and affirms equality between men and women, stating "... [The] Constitution prohibits the creation of political parties based on religious, ethnic, or gender affiliation." The Government of Senegal (GOS) has ratified numerous international agreements related to gender equality and human rights, including the Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW). The National Ministry of Gender developed the National Strategic Plan on Gender, known as *la Stratégie Nationale d'Équité et d'Égalité de Genre* (SNEEG 2005). The GOS also uses a system of Gender Focal Points located in each Ministry who are supposed to review gender integration in ministry programs.

Despite the encouraging legislative and policy environment, women and men in Senegal face very different sets of opportunities in most spheres of life. This is due, in part, because although the international laws (when ratified) are supposed to take precedence over the national ones, in practice customary law is still strong and widely implemented particularly in rural areas. Cultural beliefs typically support the dominance of men in social life, and women are first and foremost expected to be good wives and mothers. Thus, women do not yet have equal rights with men and many, especially in rural areas, are struggling under the burden of significantly greater domestic responsibilities, lack of access to productive assets, and both educational and health disparities that constrain their ability to maximize their social and economic potential.

¹² Analysis integrally taken from USAID 2010 Study on Gender Assessment in Senegal by Deborah Rubin, Team Leader, Cultural Practice LLC with assistance from Oumoul Khayri Niang-Mbodj, DevTech Systems, Inc.

It is widely noted that implementation of the various international and national laws on gender equality and women's rights is weak and that the government lacks an adequate plan to enact its policies. With few exceptions, donors have not provided funding to support the positions of the Gender Focal Points or the budget of the Ministry of Ministry of Family, Female Entrepreneurship, and Microcredit, which are charged with responsibilities for integrating gender issues into government policy and programs. The responsibilities of the Gender Focal Points are not always well-defined, and in several cases, the people in those positions are not all well qualified. The leadership in the Ministry itself has undergone many changes, as has its portfolio, leading to a lack of continuity in staff and vision.

Other gaps between legislation and practice are common in agriculture, particularly in access to and control over productive resources such as land and credit. By law, women may join agricultural cooperatives but, in practice, they tend to be less well represented in mixed-sex associations currently being facilitated by donor interventions.

There are a number of laws in Senegal which affect men's and women's opportunities to participate in agriculture and economic growth. Inheritance laws, for example, do not treat men and women equally. Senegalese customary law among most ethnic groups does not allow women to inherit property directly; a man must act as an intermediary. An individual is allowed to choose whether to follow Islamic or French law in inheritance, and under the more popularly chosen Islamic law, women inherit only a portion of what men do

The land laws in Senegal allow for both men and women to own land equally, but socio-cultural patterns of lineage and political authority combine to make it more difficult for women to obtain and control agricultural land for commercial endeavours. There are two relevant laws: the law on national domain, passed in 1964 and still active and another law entitled "*la loi d'Orientation Agro-Sylvie Pastorale*" passed in 2004. The laws confer similar rights to land to men and women, noting in the latter law, "*Ce statut est conféré de façon identique aux hommes, aux femmes et aux jeunes en âge de travailler qui exercent les métiers de l'agriculture.*" Fatou Diop Sall at the University of Gaston Berger has found that women across Senegal typically have smaller plots of land, which are less fertile or less conveniently situated than the plots on which men cultivate. Women also have less knowledge of their legal rights.

A 2007 study reported that women own about 13% of all agricultural lands, but that figure seems high in relationship to interviewees' comments during the assessment. Although the formal laws entitle women to inherit land, they are generally unable to benefit significantly from this legislation because of their marginalization by customary practices. Women also have lower incomes and have greater difficulty in accessing credit than do men, limiting their options for land purchase. Widows can either marry their husband's brother to maintain custody of their land, a process known as levirate or return to their natal family where they are given land by their fathers or brothers. Men can also exert control over women's access to land by controlling her expenditures.

In rural areas, local allocation systems that previously allowed women access to, if not ownership of land, for farming in many regions limited the use of such land for marketed production. During the last thirty years, there has been a growing individualization of land holdings that, depending on circumstances, are alternatively marginalizing women who cannot afford to purchase land OR offering those with resources more options for gaining land.

Key gender-based constraints facing women in the agriculture and economic growth sector are:

- Limited access to and control over land because of discriminatory inheritance and land allocation practices;
- Social beliefs about women's primary roles as mothers and wives;
- Limited access to credit and/or cash the constraints purchase of agricultural inputs;
- Limited literacy and numeracy skills among rural women; and,
- Limited opportunities for business development training or access to agricultural extension.

Gender and Climate change in Senegal: Climate change and climate variability are already changing the agricultural practices and opportunities of rural smallholders in Senegal. It may soon change the crop mix appropriate for cultivation. New crops will likely shift farm and household labour patterns of allocation, possibly reduce household investments in agriculture, and/or result in an even greater level of migration to urban areas within and outside of Senegal. While men and women may both seek non-farm opportunities, socio-cultural and historical patterns suggest that men will first seek off-farm employment. All of these shifts have gendered consequences that call for greater involvement of women in the study of agricultural sciences and agri-business. Other issues frequently associated with climate change include the impact on women's work and their access to energy sources.

Recommendations for programs to lessen the impact on women include establishing reforestation projects and supporting research into alternative energy sources.

Project intervention areas / sites

1.1. Site selection

The demonstrative nature of the project made the choice of representative sites quite problematic in terms of land degradation and sustainable habitat. However, the integrated approach of the project requires reconciling the two issues.

The choice of project sites thus considers two key concerns:

- The need to consider the close links between SLM and NV whose activities are carried out on the same sites with the same beneficiaries of the adaptation technologies (CC) in the productive areas and mitigation (CC) at the habitat level. This will make the project to have an integrated approach that should at the same time be reflected in the technical, technological and spatial choices.
- The need to place special emphasis on supply of and demand for technologies for the project to play a real administrative role at the beginning for scale up. The below approved criteria emanate from the triangulation of SLM and NV criteria in such a way as to incorporate productive activities and habitat:
 - Availability of NV building materials (stable soils, non-flood zones with rainfall ranging from 900 to 1000mm, enough water, available adobe (clay), available plant fibers, among others);
 - The presence of easily mobilized local labour;
 - A high density of villages and communities to facilitate replication;
 - The different types of constructed stocks with building practices at site level to facilitate ownership;
 - The nature and level of land degradation requiring SLM such as: (i) shrubby steppes where wood resources are nearly absent; (ii) growing areas where wood resources are low; (iii) forest areas where wood resources remain abundant but are regulated (forest gazetted forests, national parks and other protected areas);
 - Reduction of thermal discomfort and low final electricity consumption;
 - Reasonable rate of rural electrification;
 - The level of poverty that guides the targeting of beneficiaries with high vulnerability in grassroots communities particularly disadvantaged groups including women and youth;
 - Soil depletion;
 - Degradation of the plant cover;
 - Decline in rainfall;
 - Bushfires;
 - Salinization;
 - The identification of intervention sites of project and programs operating on similar SLM and NV issues such as ANEV or the Partnership NGO, in order to facilitate synergy and operationalize co-funding agreements with partners.

Table of site selection criteria:

The table below contains analysis of the key criteria for a successful project. The situational maps on the following page position each region to a corresponding criterion.

Groups of criteria	Criteria	Evaluation
Technical criteria	<ul style="list-style-type: none"> - Rainfall < 1,000 to 1,200 mm/yr - Stable soils, non-flooding areas, - Availability of construction land - Availability of water - Soil depletion - Degradation of plant cover 	<ul style="list-style-type: none"> - If construction of Nubian Vault is not possible in areas receiving 1000-1200 mm/yr in rainfall (e.g.: Banfora, Burkina Faso: 1086mm/yr), the project could stick to the 900-1000 mm/yr rainfall areas, which rules out the

	<ul style="list-style-type: none"> - Decline in rainfall - Soil salinity - Bush fire 	<p>regions of Ziguinchor, Sedhiou, Kolda and Kedougou.</p> <ul style="list-style-type: none"> - For comparison: Boromo, Burkina Faso: 871 mm, West-Africa's highest concentration of Nubian vault buildings - Some sandy soils make it difficult to access (very deep) land: e.g.: The Niayes area, - the region of Louga, etc.
Demographic and socio-economic criteria	<ul style="list-style-type: none"> - % of adequate rural population (rural project) - Adequate population density and villages to facilitate awareness and dissemination, - Types of constructed stocks and characteristics of construction markets that could facilitate local ownership (use of adobe, local labour, etc.) - Level of poverty: targeting of beneficiary populations 	<ul style="list-style-type: none"> - This excludes the Dakar region from the project implementation as the region is nearly purely urban; The Thiès region not among the best choices - The forest grazing area (Louga, Matam, Tambacounda) and the region of Kedougou have a low density of population, which is not favourable to the spread of the technology - The River Valley has a high population density, but only along the river over more than 700km and 30 to 50 km wide, which is a constraint but can be overcome in terms of dissemination or spread of the technology - Population density is high in the Groundnut Basin - The territory along the Fatick – Kaolack – Kaffrine– Tambacounda axis would potentially increase in density in the coming years - The Southern Senegalese regions below are prioritized as the populations most in need for decent habitat: - Fatick, Kaolack, Kaffrine, Tambacounda, Ziguinchor, Sedhiou, Kolda, Kedougou
Comfort and energy efficiency criteria	<ul style="list-style-type: none"> - Reduced discomfort during cold seasons - Reduced discomfort during hot seasons and reduced final consumption of electricity - Rate of rural electrification 	<ul style="list-style-type: none"> - Considering climate data, all the populations of Senegal need improved comfort during the hot period, but less of this for the regions of Dakar and Thiès.
Implementation criteria	<ul style="list-style-type: none"> - Considering the historical background of the deployment of Nubian Vault: - Making the best of work done and existing well-informed/trained actors either by replicating/duplication/knowledge transfer - Searching synergies with sustainable land management practices - Presence of specific stakeholders to involve. 	<ul style="list-style-type: none"> - Actors deploy the Nubian Vault and the SLM technologies in the regions of Saint-Louis, Thiès, Diourbel, Fatick et Tambacounda. - Nubian vault buildings were constructed mainly in the Senegal River Valley and the Groundnut Basin. - SLM operations address the different types of land degradations noticed on each site.

Environmental criteria	- Choice of sites according to the availability of plant fiber (wood, straw) as building material and to the level of soil and plant cover degradation	3 types of areas: - shrubby steppes et savannah - farming areas - wooded savannah
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Based on this multi-criteria analysis, the regions of **Saint-Louis, Tambacounda, Kaolack and Kaffrine** (and to a lesser extent, the regions of **Thies and Matam**) offer a good potentiality for the implementation of the project through the integration, ownership and dissemination of the both SLM and NV technologies by the various concerned parties.

St – Louis region is located in north Senegal and is characterized in agro – ecological terms by the Senegal River ecosystem. Land degradation due to wind and water erosion fully justifies the establishment of SLM program. The region constitutes one of the main food baskets of Senegal. In the housing sector, availability of water and clay provides an important basis to promote NV, especially as culturally there are many banco constructions in this area. NV models will be available to promote multiplication and up scaling of these types of housing.

Tamba region, in the east of the country is a very large territory where natural resources degradation due to massive deforestation and the strong pressure of extensive agriculture and livestock have deeply contributed to reduce land productivity. Hence the importance of the program in land rehabilitation and revival of agro – forestry production. As for the NV, it finds its justification in the tradition of clay building and promoting rural housing and fit into an area where energy efficiency is very important due to poor infrastructure and equipment.

Kaolack region and by extension Kaffrine region are located in central Senegal. This is an area with high rural and urban population density, therefore with high demand of social housing but also degraded by strong pressure on land. The SLM program will be very beneficial especially in the recovery of polluted soil and improving soil fertility. Furthermore, technology NV will be an extra in the light of significant needs in this area.

Thies region is also central. It has particularity of being close enough to the capital Dakar region with which it shares the location of the three cement industries of the country and some other zinc, tile and concrete block factories. The interest to develop the NV lies in the high urbanization of the area and therefore the potential for extension of the technology with some private partners developing large programs of social housing. It could be an important gateway to the reliability of the technology to the public and its up scaling.

Matam region is located in the north. It is still very rural. It still has viable traditions in matters of constructions with clay. That constitutes a pledge of technology penetration, despite the development of cement buildings due to fallout from the emigration. It could be an interesting way to integrate technology by combining cement if needed, especially in energy efficiency by reducing electricity costs in a region where infrastructure and basic social services are still deficient.

1.2. Site characterization: causes and manifestations of land degradation and energy inefficiency in the field of habitat

a) In the area of SLM

Types of Degradation and SLM Technologies used in the areas

Most of the soils in the project area are characterized by high sensitivity to erosion. The main factors of degradation including natural ones such as anthropogenic factors exert direct mechanical action on soils, causing direct and indirect environmental, economic and social impacts.

At the national level, the first four indirect factors of land degradation are in the order of importance: poverty, demographic pressure, unsuitable governance and the deficit in information and training, and often a mixture of all four.

The system of production is affected by these degradations in virtually all of the five counties (Thies, Matam, Tambakounda, Fatick and Kaolack) in the targeted regions (See below). But the level of degradation varies across regions with different forms. The table below gives the impacts per type of degradation.

Table 1: Impacts of the different types of degradation

Types of degradation	Impacts
➤ Biological degradation	Reduced plant cover and biomass generally, increased parasites/diseases, deteriorated habitat and loss of biodiversity.
➤ Chemical degradations <ul style="list-style-type: none"> • salinization • alkalization • acidification 	Decrease in fertility and strong reduction in the contents of organic matter; appearance of salt flats, reduced arable lands
➤ Physical degradation <ul style="list-style-type: none"> • Wind erosion • Water erosion 	Loss of fertile layer of soils, decreased fertility

These three types of degradation are interdependent and are found in the zone. They are aggravated by – and at the same sustain - erosion.

It is known in Senegal that the degradation of soils is very high and among the major concerns of the rural population whose livelihoods largely depend on land.

b) In the domain of habitat

According to UN Habitat and ANSD (Agence Nationale de la Statistique et de la Demographie), the majority of materials used in buildings in Senegal come from national resources: cement, sand, aggregates, some of the wood, vegetable fibers and of course adobe. The exploitation of these resources (with the exception of adobe) is responsible for most of the major environmental impacts. To address market demand and because the resource is becoming scarce and protected, timber is imported. Metal (steel, aluminium, among others) is also imported before being turned into construction products in Senegalese units. The "Habitat Sector Profile" study (UN Habitat, 2012) provides a detailed status of construction materials used in Senegal.

Local materials commonly used are: (i) cement, which is one of the main construction inputs; (ii) increased exploitation of beach sand, dunes or crushed stones quarries and its harmful effects on the environment; (iii) timber, which is often subjected to excessive felling; (iv) plant fibers equally overexploited (straw, bamboo, palm leaves,...) (v) concrete and its derivatives; and (vi) raw earth, also known as adobe, which is still used in some areas for construction of adobe brick walls, even if that is quickly decreasing and tends to disappear. Adobe is the main resource used in Nubian Vault construction. Other materials are imported (wood, steel, concrete, aluminium, glass, etc.) and often pose a problem of availability and affordability for communities.

Senegal's building stock is characterized in general by cement walls (72%), 53% among them in rural areas, against 29% for adobe and 14% for straw and stalk. Roofs are mostly made of zinc (40%), thatch (38%) and concrete slabs (only 9%).

The situation in the project intervention area is provided by the tables below:

“Population distribution outside Dakar” depending on the roof						
POPULATION OUTSIDE DAKAR	Zinc	Concrete	Thatch/ Straw	Tile /Slate	Others	TOTAL
2002	3,237,165	708,323	2,889,720	687,163	167,796	7,690,168
2013	5,209,338	1,586,745	2,851,633	572,290	154,147	10,371,519
Evolution 2002-2013	1,972,173	878,422	-38,088	-114,873	-13,649	2,681,351
	61%	124%	-1%	-17%	-8%	35%

Excluding the special case of the Dakar region, there is a high increase in zinc-corrugated iron or steel deck roof, and concrete roof slab, between 2002 and 2013. Conversely, the number of thatched/straw roof remains virtually stable between 2002 and 2013, despite the increase in population.

Population distribution outside Dakar depending on the nature of the walls

Population distribution outside Dakar depending on the type of walls						
POPULATION OUTSIDE DAKAR	Cement	Mud	Thatch /Straw	Wood	Other	TOTAL
2002	3,388,691	2,412,177	1,505,196	225,183	156,753	7,690,168
2013	6,661,082	2,330,494	1,098,993	134,400	161,292	10,371,519
Evolution 2002-2013	3,272,391	-81,683	-406,203	-90,783	4,539	2,681,351
	97%	-3%	-27%	-40%	3%	35%

Source : RGPFAE 2013, ANSD / Consultant computations, 2015

The number of cement wall buildings has doubled in the 2002-2013 period, from 46% to 64% of the built stock. Despite the increase in population, the number of adobe buildings remained nearly stable, while the number of straw wall buildings decreased by nearly 30%.

The measures taken, their limitations and shortcomings

1.1.1. AT THE POLICY AND INSTITUTIONAL LEVEL

a) Policies and strategies:

Senegal has developed several policies and strategies for land management and especially in the area of improving energy efficiency in habitat. They are reviewed in Annex A2.

b) Projects and programs

In the domain of SLM:

Several land degradation initiatives have been taken in the past, with some being pursued through various ongoing projects such as:

- ❖ **Project to Support Small Local Irrigation (PAPIL 2006-2011, 2011-2015)** funded by the African Development Bank (AfDB, UA 16.28 million), the Islamic Development Bank (IDB 14.47 million US \$) is very active in the field of food security, particularly through the construction of hydraulic structures for water control and the fight against land salinity.
- ❖ **The Project to Build Catchment Basins and Leverage Boreholes (BARVAFOR, 2001-2016 - \$12,000,000** in which 95% funded by the Kingdom of Belgium) is active in the Groundnut Basin to undertake irrigation schemes, including anti-salinization dykes to protect and recover salty lands.
- ❖ **The DIAMA anti-salt dam (OMVS)** regulates the intrusion of salt water in Senegal River to ensure the availability of drinking water for multiple needs, including agriculture throughout the year.
- ❖ **The Senegal-Japan Capacity Building to Control Land degradation, Recover and Develop Degraded Soils (CODEVAL / 2011-2016- Japan \$5,000,000** operates in the counties of Fatick, Foundiougne, Kaolack and Nioro. The CODEVAL Project focuses on the implementation of ecological or rural sanitation; the recovery of salty land with groundnut shell spreading and erection of bunds against water erosion.
- ❖ **PROGERT** (funded by the UNDP to the tune of 600,000 USD, the GEF for 4,005,728 USD and the government of Senegal for 1,680,734 USD). The PROGERT activities have helped to implement eleven (11)

local development plans mainstreaming SLM; boost farming over 200 ha following the environmentally sustainable farms models, recover 587 hectares of salty land with innovative and appropriate technologies to implement five pastoral units covering over 60,000 ha; develop participatory development plans for 7,500 ha of forests and 200 km of firewall and create quality gender quarters (deep involvement of women in SLM).

- ❖ The **National Eco-village Agency (ANEV)**: In the domain of sustainable land management, the activities of the National Eco Villages Agency have helped to develop 206,353 ha of community natural reserves, of which 15,800 ha are newly created; 40 training sessions are organized annually in all eco-village centers.
- ❖ The **National Agency of the Great Green Wall (ANGMV)**: The achievements of the Agency have facilitated the reforestation of 5200 ha since 2018, and set up 1,340 km of firewalls in enclosure zones;
- ❖ The **Sustainable Land Management Pilot Project**: The activities of the pilot project have developed 20,000 ha under different SLM technologies and reached 17,000 beneficiaries.

These projects are technically and technologically supported by national institutions specialized in land management research in general and in salty lands in particularly such as:

- ❖ The **National Institute of Soil Science (INP)** develops models to fight against salinization of land using local materials for the construction of dikes, phosphogypsum and peanut shells to facilitate desalinization and improve soil structure. It is also active in the supervision of producers in the field of information and training on good preventive and corrective practices against salinization of lands.
- ❖ The **Senegalese Institute of Agricultural Research (ISRA)** develops research on the restoration and agro-forestry-pastoral recovery of land degraded by salinization. Beside the establishment of anti-salinity structures, experts have introduced halotolerant exotic species (*Melaleuca aphylla* Tamarix, etc.) and selected salt-tolerant grain (rice, sorghum) as well as fodder varieties.
- ❖ The **Ecological Monitoring Centre (CSE)** that regularly monitors parameters related to the evolution of natural resources in the areas of forestry, animal husbandry and agriculture using modern techniques such as satellite data.
- ❖ The **Directorate of Water Resources Planning and Management (DGPRE)**, which monitors more than 147 hydrological stations to map and watch water resources in the country with the installation of a Geographic Information System
- ❖ The **Directorate of Waters, Forests, Hunting and Soil Conservation (DEFCCS)** undertake SLM actions in the different eco-geographical areas of Senegal. The DEFCCS works in the Peanut Basin to improve the plant cover by introducing trees in the farming system with the development of Kad (Wolof word for *Faidherbia Albida*) and palm tree (*Borassus aethiopum*) parks. Forest programs also developed agroforestry technologies (hedges, windbreaks and wooded covers) in individual and community farms. The soil defence and restoration as well as water and soil conservation techniques developed have led to the recovery of new land and formerly decommissioned plots for the benefit of populations.

In the field of habitat

The analysis of the national, sub-regional and international regulatory and institutional frameworks highlights an increasing consideration of mitigation and adaptation to climate change particularly in habitat through the dissemination of energy efficiency measures and the use of local materials with low environmental impact. Beside the "Nubian Vault Association" and "The Partnership Association" already mentioned in the PIF and which play strategic and operational roles, several other effective and high potentiality initiatives exist in this context, including:

Individual private initiatives in some sites and likely to facilitate the spread of NV technology;

Local Governments: The counties of Podor, Richard-Toll, Kaoloack and Thiès, and the municipality of Sinthiou Bamambé, have piloted the technology through the construction of community buildings. These local governments will serve as models for the adoption and dissemination of the NV technology among those institutions which are among the project's main targets.

Projects and programs

- The ANEV through its eco-villages has a significant renewable energy control component that could be a good basis for replication of the NV technology through the incorporation of the green habitat component in its program.
- The Typha project named after the *Typha australis* plant is also active in the fields of energy efficiency, and the leveraging of domestic fuel as well as building materials. Possible connections with the NV technology through the use of typha products and derivatives are under discussion and will be further explored.
- The PNEEB project: The Senegalese National Program against greenhouse emissions through Energy Efficiency in the building sector is a favourable framework for the promotion of NV through: (i) adapting the building legislation, (ii) promoting the use of GHG-efficient materials, (iii) building the technical and institutional capacities of stakeholders, and (iv) disseminating good practices for energy efficiency.

AT TECHNICAL AND TECHNOLOGICAL LEVEL

In the field of SLM

Many efforts have been made through SLM guidelines, approaches, techniques and practices proven by research institutions. However, their use yielded mixed results. These practices are divided into four categories (LADA 2008) and are intended to (i) improve water and soil management; (ii) increase land productivity; (iii) ensure sustainable environmental, social and economic management.

- *Agronomic measures*: These are good agricultural practices aimed at increasing production and minimizing the risks of land degradation.
- *Structural measures*: These are firstly aimed at developing physical facilities in a bid to reduce runoff and its ripple effects on the topsoil, and secondly at making water infiltration easier to limit gullyng.
- *Management measures*: These actions are geared toward adopting community rules to establish and sustainably protect reserve areas.
- *Vegetative measures* in the form of plantations likely to supplement and reinforce SLM mechanical works; revegetation, water flow slowdown, soil fixation by roots and reducing soil saltiness.

The following table shows the strengths and weaknesses of each technology.

Table 2: Strengths and weaknesses of the various technologies

Measures	Mechanisms	Area	Strengths	Weaknesses
Structural measures	Combating erosion (stony cordon, bunds, embankment)	Thies, Matam, Tamba, Fatick	Improved water retention capacity Increased sedimentation	Unavailability of materials Need for labour; Drudgery
Vegetative measures	• Recovering saline lands	Fatick, Kaolack	Increased water absorption Soil fixation by roots Restore vegetation	Stray animals Low plant recovery rate
	• Reforestation	Thies, Matam, Tambakounda, Fatick, Kaolack		
Management measures	• “No go” areas • Implementing forest management plans	Thies, Matam, Tambakounda, Fatick, Kaolack	Restoring vegetation Wind speed reduced due to the fence	Slow plant growth Stray animals

Measures	Mechanisms	Area	Strengths	Weaknesses
			Improving livelihoods through non-timber forest products	
Agronomic measures	<ul style="list-style-type: none"> • Crop rotation • Hedgerow farming on sloping lands 	Kaolack, Fatick	Increased production Improved livelihoods	Limited availability of organic conditioners
	<ul style="list-style-type: none"> • Fallow 	Matam		
	<ul style="list-style-type: none"> • Assisted Natural Regeneration (ANR) 	Thies, Matam, Tambakounda, Fatick, Kaolack		
	<ul style="list-style-type: none"> • Organic conditioning (ECOSAN approach, composting, spreading groundnut shells) 	Thies, Matam, Tambakounda, Fatick, Kaolack		

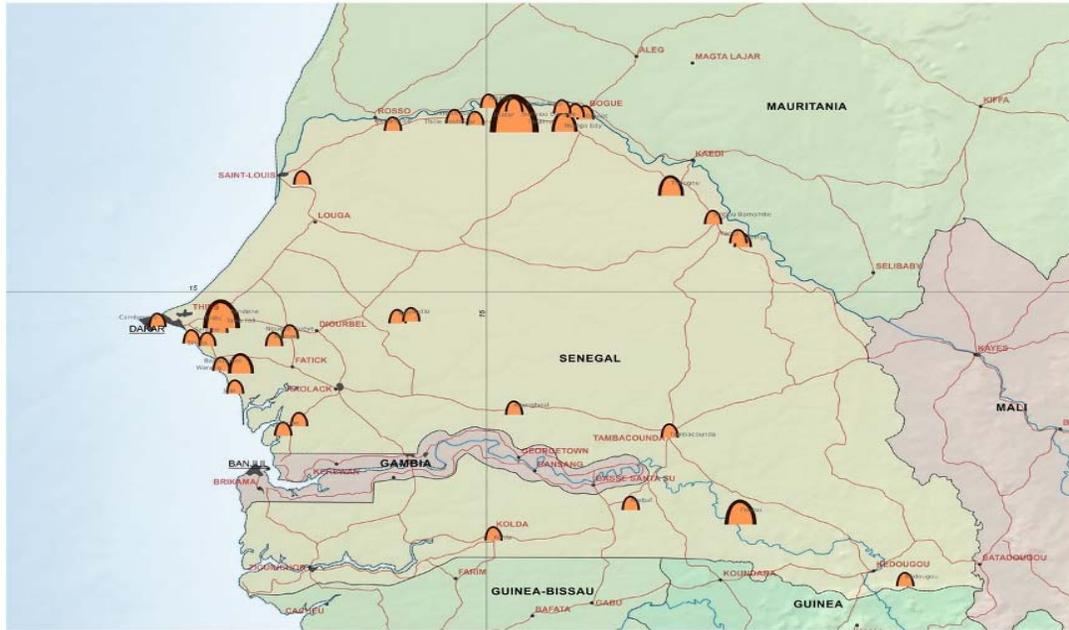
Generally speaking, while these SLM technologies have helped effectively combat land degradation, their impact have remained low, mainly due to their small scale and dispersed use by a limited number of producers resulting from the absence of a clear technological package incorporating various complementary technologies.

In the field of habitat

Nubian Vault Technology: Its benefits have been widely shown in the PIF. This technology can make a significant contribution in the search for energy efficiency in buildings. According to the Nubian Vault Association website, the technology helps construct buildings with vaulted roofs using basic tools, simple skills and local materials based on adobe, water and stones for the foundations. Furthermore, the materials used for the production of Nubian vaults are almost always available and close to the sites, except for water which depends on areas and seasons. However, it is possible for masons and customers to take this issue into account when planning works.

The advantages of the technology compared to usual majority technologies made of concrete blocks and sheet metal are more affordable, more comfortable (reduced temperature fluctuations) and strong non-relocate employment provider, modular structures (roof terraces, non-slab floors, and release fewer greenhouses gases. The NV technology has been present in Senegal since 2007 but is still used for demonstration purposes. About 57 building projects have been implemented, representing approximately 5,000 square meters in 41 areas, mainly in the counties of Dagana and Podor, Mbour, Thiès and Bambey. Customers mainly consist of wealthy private people who use them as houses, headquarters for associations, NGOs as well as local groups and local communities for service purposes. The diverse and multi-purpose use of the technology reflects the need to establish a sample of demonstrative buildings with a view to further disseminating the technology through the project. Many other potential uses of the technology exist especially in agriculture and the educational and health sectors, but also for congregate habitat, particularly residential allotment.

Mapping of key Nubian Vault areas in Senegal



Mapping of Nubian Vault constructions as of 31st July 2014

Source: Nubian Vault Association (2014)

The following table shows a certain level of technology penetration. Nubian vault buildings in Senegal can be indeed used in various interesting ways, which demonstrative buildings can assist to further disseminate the technology.

Types of uses of NV buildings in Senegal as of July 31, 2014

PURPOSES	NUMBER OF BUILDING PROJECTS	PURPOSES	NUMBER OF BUILDING PROJECTS
Rural housing, farmers	11	Henhouse	3
Dwellings, merchants, civil servants	8	Workshop, factory/plant	2
Dwellings, expatriates, Diaspora	8	Health facilities	2
Accommodation, hotel	5	Classrooms, literacy center	2
Offices	3	Others	11
Mosque, prayer room	3		

Source: Nubian Vault Association

Long term solutions expected:

- Senegal's vision of SLM

In accordance with the guidelines of the Plan Senegal Emergent – Senegal Emergence Plan (PSE), component 2, the solutions adopted are expected to fit within Senegal's vision of SLM. Indeed, it is stated that: "*By 2026, the favourable political, legal, institutional, technical and financial environment should enable Senegal to sustainably reverse the trend and put an end to land degradation in all ecosystems for sustainable productivity and well-being of its people.*"

Activities carried out as part of this project are consistent with – and will help achieve - that vision through the removal of constraints and barriers related to land degradation, particularly through its components 1 and 3.

- Senegal's new vision of habitat

Component 1, section 3.1.3 of the PSE devoted to "*Social Habitat and construction ecosystem*" highlights the need to create a "*sustainable social habitat dynamics to meet demand (between 10,000 to 15,000 Houses / year) and to structure a production chain for building materials (...) improve quality by introducing local materials.*" Moreover, **Section 3.2.6 of component 2 is devoted to "habitat and living environment" and establishes the connection with the environmental impact: "Habitat and the living environment are largely influenced by the degradation of natural resources and the environment. In both cities and the countryside, houses are spontaneously and precariously built."**

The project is aimed at contributing to the achievement of these priorities through components 2 and 3.

Based on the above-mentioned guidelines, the recommended and long-term solution is to ensure effective prevention of climate change risks and develop mechanisms and appropriate technologies for GHG mitigation and adaptation for better energy efficiency and sustainable land management with a view to improving food and energy security. This objective should be based on: (i) a better understanding of the causes and consequences of land degradation and climate change processes in order to better monitor and assess the level and extent of the phenomenon, (ii) capacity building of various stakeholders, particularly technical departments, local authorities, communities, NGOs, among others, (iii) the adoption and dissemination of appropriate and effective SLM and energy efficiency techniques and technologies in key sectors of degradation and emission including agriculture (broadly defined) and habitat, respectively; (iv) the socio-economic leveraging of the technologies by creating green jobs and incomes to promote food security and improve the income of communities on the one hand, and living conditions of people by promoting green habitat (NV) on the other.

It is in this perspective that the project will make a significant contribution, particularly through the promotion of adaptive land management sustainable practices in a context of climate change. The effectiveness of the project approach, however, requires the removal of some latent constraints and barriers.

Barriers and constraints

These are, among others, the *weak skills to scale up SLM practices and enhance carbon stock to boost productivity* because of the magnitude and complexity of land degradation. This lack of capacity in skills has led to:

- (i) reduced arable land following abandonment of degraded land, resulting in a redistribution of arable land at the expense of vulnerable groups such as women and young people whose access to the main production factor, namely land, is increasingly difficult and uncertain. Despite their important roles in production as main workforce in the family exploitation, women do not have property rights and they generally own small farms and also operate small livestock production. Furthermore, the women exploited farms are generally not fertile and not really interested by men
- (ii) reduced agricultural yields, resulting in reduced production, food-deficit resulting in food insecurity;
- (iii) lower revenues resulting from a reduced share of cash crops;
- (iv) increased unemployment among young men and women resulting in rural exodus (job loss) and reduced local workforce.

Low deployment of Green and energy efficient rural housing technology and INRM practices: It may also be noted that: (a) NV technology is not standardized enough, which guarantees neither a transfer of skills nor ownership by the state, local authorities and technical services; (b) rural populations are yet to take ownership of the technology due to:

(i) relatively high capital costs compared to other private (small and medium) home construction techniques; (ii) poor use of self-construction (manufacturing of materials, supply of free workforce) to finance the construction in kind; (c) the lack of local manpower knowledgeable of the NV technology. (Currently, 25 apprentices are being trained in Senegal with the support of Malian and Burkina Faso nationals, to ensure skills transfer, but only 2 Senegalese masons master *The Nubian Vault construction technique*. Three construction companies were involved in the construction of community / public buildings. In terms of training and skilled local workforce, results are well below the identified construction needs. The narrowness of the current NV market indicates that despite the list of potential customers, supply is likely to remain well below demand. Indeed, the annual growth rate of 40-60% required for a wide dissemination of the NV technology by 2040 (within 25 years) will not be achieved. Such achievement requires greater involvement of the state and local authorities (as with a small scale initiative since 2011 in the counties of Dagana and Podor with the completion of several community pilot projects) given the poor dissemination of the technology, to balance supply and demand

The major constraint is inadequate technical capacities to spearhead local energy efficiency initiatives.

In addition, expertise in this area is limited and there is need to implement training and capacity building plans to support national energy efficiency development.

Energy efficiency service supply is also limited and there are inadequate companies or offices specializing in the implementation of energy efficiency projects, while control and the necessary tools across the chain is lacking.

In fact, expertise is very often limited to a technology, component or a few types of measures.

Furthermore, most energy efficiency technologies are not under control and often result from innovations in the country. Technology transfer is not implemented across the board, raising many issues regarding the sustainability of actions (access, technology, maintenance, repair, etc.).

As part of this study, final home energy consumption forecasts will be limited to LPG and kerosene. In addition, electricity demand will be anticipated and leveraged in energy production.

Based on the findings, the corresponding GHG emissions will be identified using the GACMO method.

Consumption is forecast to 2035 with 2010 as the baseline.

a) **SENELEC Network Final Electricity Consumptions**

For the electricity subsector, SENELEC forecasts demand to 2035 as a basis for developing its production plan as well as investment program.

Such forecasts were based on an analytical model with the following methodology:

➤ **Defining Geographical Areas**

Areas with even consumption were identified based on socio-economic criteria as well as the administrative statuses of the country's localities. The areas are the following: the region of Dakar, the other urban centers (other cities or municipalities of the country), rural areas.

The **region of Dakar** groups the sectors of Dakar, Pikine-Guediawaye and Rufisque with a high household electrification rate in 2010 estimated at **99.5%** and high population density as well as economic development way faster than the national average.

The other urban centers have an estimated 2010 electrification rate of **84.7%**.

The **rural areas** electrification rate (the SENELEC grid) was **21.8%** in 2010, against the national average of **56.2%**.

➤ **Forecasts**

Area-specific electricity demand was forecast based on the developing country electricity demand forecast (PVDE) model articulated around three files:

- ✓ The **home file** grouping the residential and public lighting sector;
- ✓ the **industrial file** consisting of the industrial sector, major services, shops and informal business;
- ✓ **Major projects** identified in the various geographical areas over the study period. The energy and power needs that are provided by the relevant promoters and departments.

b) Total Final Electricity Consumptions

Total final electricity consumption is obtained adding up the SENELEC grid final consumption and off grid consumption as determined above.

Following are the findings:

Diagram: Final Residential Consumptions by 2035

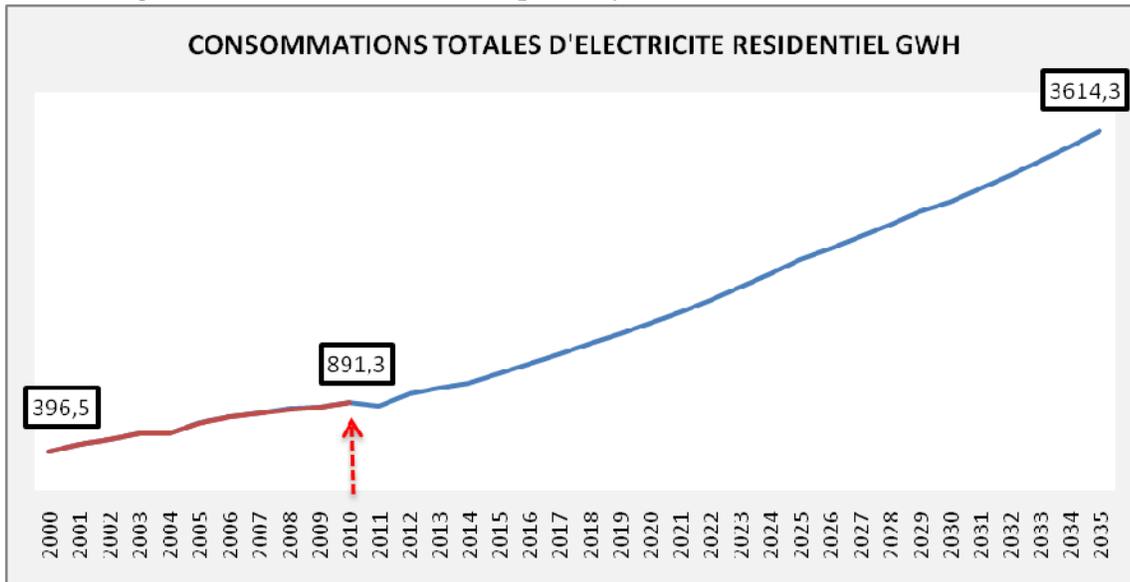
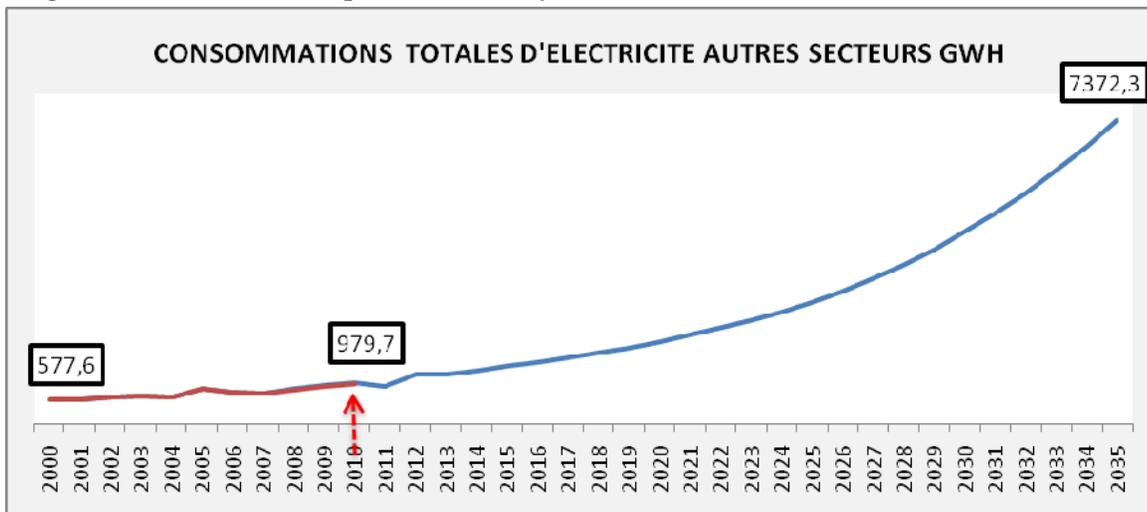
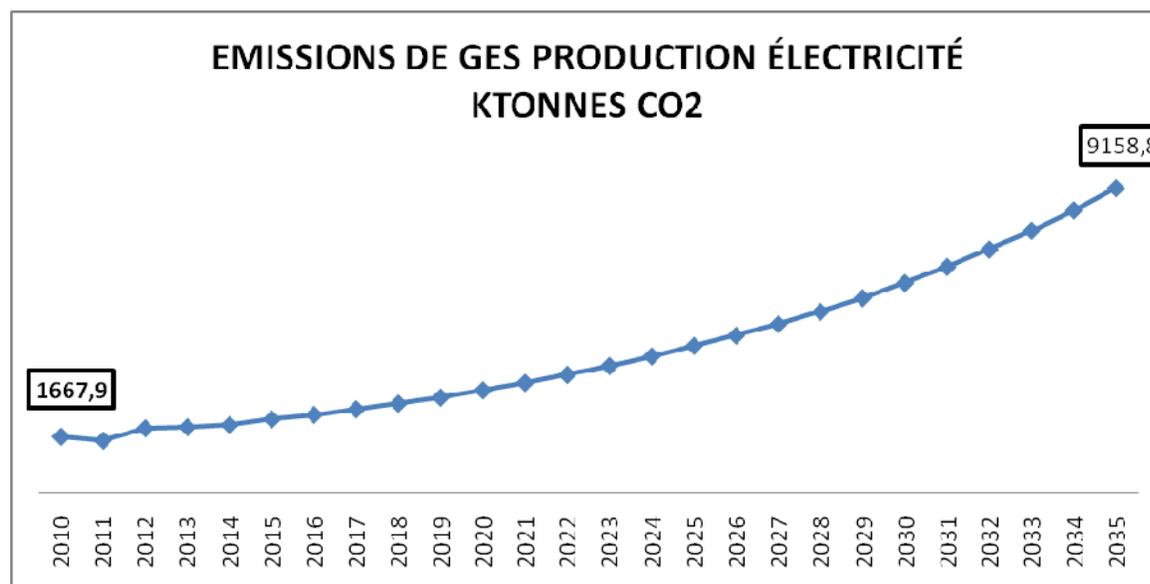


Diagram: Total final consumptions, Others, by 2035



a) **Emissions from Residential and Other Electricity Production**

At this level the country's electric grid yield was used to come up with final gross electricity consumption for the residential and other sectors. Based on those findings and the average emission factor of 700 g of CO₂ per kWh from the grid, GHG emissions have been identified as follows:



b) **Emission from existing projects & programmes on energy efficiency (EE) Business as Usual**

The existing, ongoing or finalized investment projects and programs (after 2013) are as follows:

Table 3: List of existing projects (BAU scenario) and mitigation

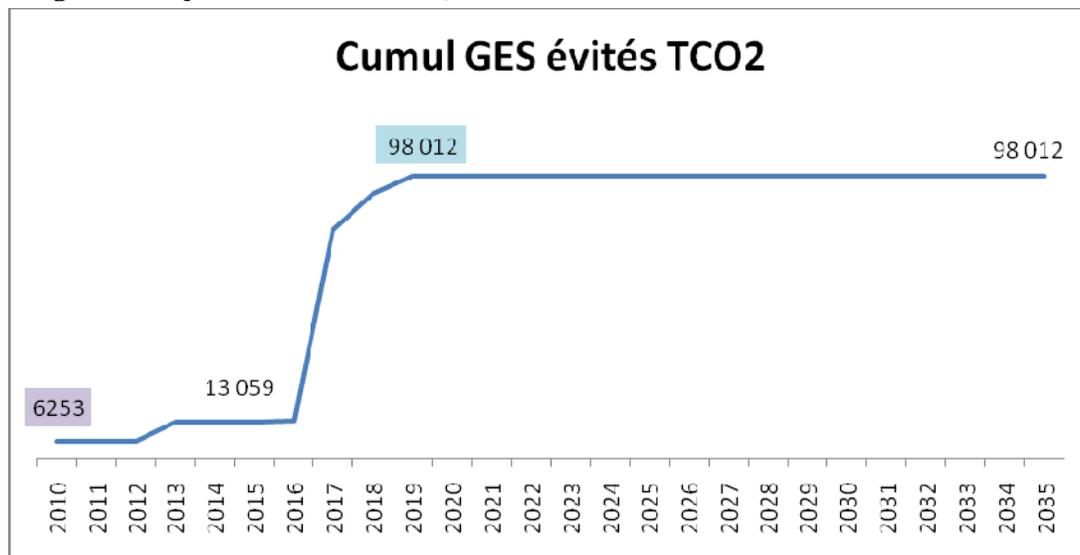
Projet/Programme	Institution	Starti ng period	End of project	Level of implemen tation	Statut of finance	CO2 Abatement	
Pilot project on EE in administratives buildings	AEME/PERA COD	2015	2016	On going	available	175	TCO2
Pilot project on EE in small enterprises/small manufactories and other productives sectors	AEME/PERA COD	2015	2016	On going	available	35	TCO2
Campaign of communication and sensibilisation	AEME	2014	2017	On going	available	140	TCO2
Efficient lighting for households	Senelec programme of urgency	2010	2013	Realised partially	Partially	53970	TCO2
Communication on energy efficiency	Senelec programme of urgency	2010	2013	On going	available	9380	TCO2
« Promotion des effacements de clients à la pointe »	Senelec programme of urgency	2010	2013	Realised	available	3679,2	TCO2

EE in buildings, project PNEEB-TYPHA	MEDD	2013	2017	On going	available	7 300 directs et 22 000 indirect	TCO2
Transfer of productive technologies in the area of termic isolation materials on typha basis in Senegal	MEDD	2013	2017	On going	available	4 620 et 143 541 en 2026	TCO2
Promotion of sustainable soil practices to restore et improve carbon stocks through adoption of green habitat initiatives in rural area	MEED	2015	2019	Approbati on phase	available	2088 ; 94135 en 2030	TCO2
Program of enhancement of social habitat(PSE)	PSE	2014	2018	On going	On going	12600 TCO2	TCO2
Chaise of Dépôt and Consignation	Joint-venture PPP PSE	2015	2019	Not started	available	4200 TCO2	TCO2

**The electrical grid emission factor of 700 g of CO2/kW/ h was used to estimate avoided GHG emissions*

With such data, annual distribution of GHG emissions to 2035 have been estimated as follows:

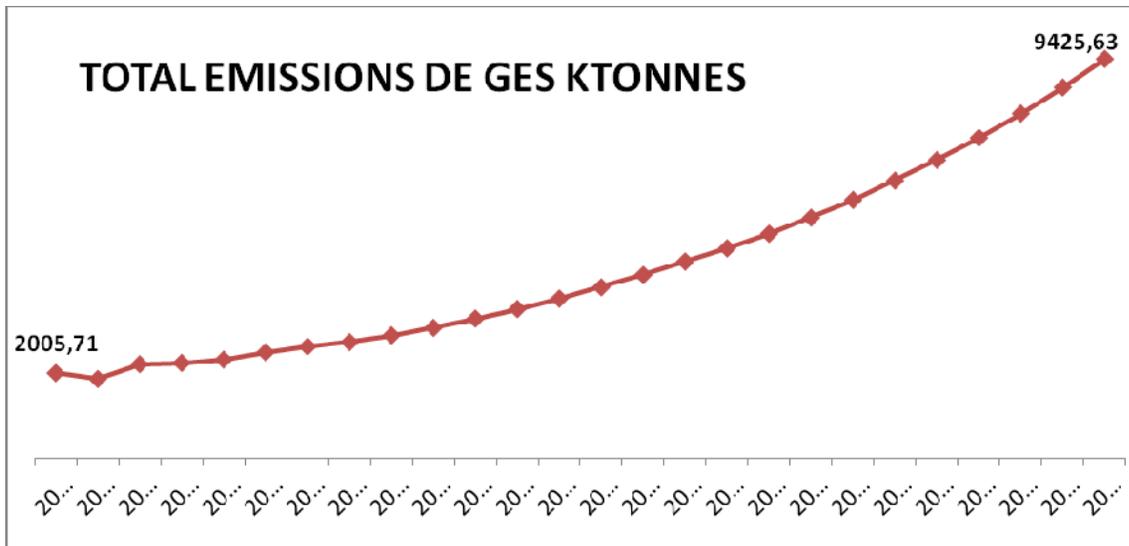
Diagram: Project GHG Emissions, BAU scenario



a) Overall Trajectory of Projects GHG Emissions

The overall trajectory of GHG emissions reflects those from LPG, kerosene, electricity production and ongoing projects for the residential and other sectors as follows:

Diagram: Overall GHG Emissions, BAU Scenario



Inadequate knowledge management and advocacy: This has generated the following consequences: (i) poor stakeholders intervention synergy, which reduces the effectiveness of the activities and efficiency of resources; (ii) insufficient involvement of local communities; (iii) insufficient organization and mobilization of producers; (iv) inadequate legal and regulatory framework in relation to SLM and NV, which is poorly reflected in the legal arsenal, particularly in the field of community investments with failure to standardization of NV building; (v) inadequate community financial resources; (vi) weak involvement of local communities who are unfamiliar with SLM and NV issues when it comes to planning and funding related activities.

A. 5. Incremental /Additional cost reasoning: describe the incremental (GEF Trust Fund/NPIF) or additional (LDCAF/SCCF) activities requested for GEF/LDCAF/SCCF/NPIF financing and the associated global environmental benefits (GEF Trust Fund) or associated adaptation benefits (LDCAF/SCCF) to be delivered by the project:

The project is building on the baseline constituted by the activities of Government and its partners through corporate activities and projects implementation. The main baseline activities which will be financed by the cofinancing from the Government and partners include the (i) PROGEDE 2 which will finance the Sustainable Participative Forest management and restauration of severely degraded land. This investment will support implementation of the Community Land Use Plan which will be updated with the project support. Furthermore, the baseline include the work of National Agency of Ecovillage with financial support from Japanese Cooperation Agency and which investment will support the project management in Ecovillage Communes and the assessment of building mitigation potential. In addition, the Ministry in charge of environment through the Department of Classified Domains (DEEC) is support the Project Management Unit by providing necessary facilities and support but also will provide opportunities to pilot the NV through supporting the construction of Regional Department of Environment buildings. DEEC also through its regional departments will provide logistic support.

The overall goal of the GEF support is to contribute in promoting and disseminating good SLM and climate-resilient habitat practices through the dissemination of a green habitat model called "Nubian Vault" which stimulates the local economy and green jobs.

Achieving this goal requires a development policy incorporating mitigation of GHG emissions, vulnerability risk reduction and adaptation to climate change.

As part of mitigation efforts, Senegal has embarked on several programs and projects aimed at avoiding and absorbing GHG emissions, in addition to the clean development mechanism (CDM) and new market mechanisms currently being developed. It is in this context that the Global Environment Fund (GEF), with technical support from

the Ministry of Environment, has initiated the project called "Promoting Sustainable Land Management Practices to restore and enhance carbon stocks through adoption of Green Rural Habitat initiatives".

The project is expected to produce a least 30 community building and 500 others in partnership with many other partners during the four years as impact of dissemination and scaling up of the community models. These buildings will well contribute to reduce CO2 emissions. For instance, according to a study elaborated by AVN, for only 276 NV, the contribution of reduction emission of CO2 is 822 tons CO2 eq and for the 530 VN on the 3 years of project duration 1484 tons CO2 eq. The forecast on CO2 reduction over 25 years will be very important for global environment. (See forecast board in page 38).

Therefore, In the light of the sahelian climate of Senegal, strongly affected by the elevation of the temperature during the time, the development of the construction of type "Nubian Voute" constitutes a solution for the Habitat Polity, adapts to climate change and favorable to the reduction of the Gas greenhouse effects and a global environment benefit.

The project includes three complementary components:

1. Component 1: Scaling up good sustainable land management practices and enhancing carbon stocks to increase productivity.

This component focuses on adoption and dissemination of successful SLM technologies among producers for a more sustainable use of resources while preserving the carbon stock. The expected outcome is: *Land productivity and the sequestration potential are increased through the development and implementation of local policy frameworks incorporating good SLM practices and the enhancement of carbon stocks.*

From PIF:

Building on the baseline activity of NGO "Le Partenariat", which supports integration of sustainable housing in the Regional Council Development Plans, through this component, the foundation for a Sustainable Integrated Natural Resources Management will be achieved by supporting the municipalities to either promote integration of Integrated Natural Resources Management (INRM) in existing Local Development Plan or support develop of Local Development Plans which integrate natural resources management. The natural resources management in these plans will emphasize on promoting practices which will enhance soil fertility and enhanced rangelands management. These practices will include agroforestry which will focus on introducing nitrogen fixing species and thereby will lead to reduction of fertilizers which consequent reduction in GHG. The species will be also selected using the dual objective of great sequestration potential and enhancement of soil fertility. This approach is in line with the priority mitigation actions identified in the second national communication. Furthermore, water harvesting technologies which will enhance vegetation cover thus increasing sequestration potential and controlled grazing will be developed, adopted and disseminated. The controlled grazing has the potential of increasing biomass production and control of animal foot print; all these will contribute to mitigating climate change and will increased land productivity. The policy support and institutional and individual capacity building will create an enabling environment for the INRM. This component will mutually be reinforcing with component 3 and will provide framework for the execution of component 2. The component will build on the ongoing municipal development actions plans and will support the country to implement the UNCCD/NAP and the National Communication on climate change as requested by Act 3 of Decentralization Decree.

The outputs which will be delivered include:

Output 1.1. 3 Municipal Development Plans / Land Use and Tenure Plans with good SLM, poverty alleviation, environmental management and carbon stock monitoring strategies are updated and implemented to support the conservation and promotion of ecosystem services through inclusion of climate change mitigation measures (including through promotion of NV) and INRM.

Output 1.2.: At least 2 integrated natural resource management technologies with a potential for improving the lives of communities (Nubian vault, Agroforestry) are developed, adopted and disseminated

Output 1.3. 3 SLM technologies (Agroforestry, water mobilization, grazing management) are tested to improve productivity, reduce the erosive action and improve the carbon stock.

Output 1.4. 3 NGOs / CBOs, Extension Agents and staff of the local administration for rural development and 120 private persons including in rural areas are trained as trainers to promote and disseminate techniques for the Integrated Management of Natural Resources (For example: Nubian Vault) and green jobs.

- The scaling up of good SLM practice and enhancement of carbon stock will be conducted by i) first adopting relevant criteria to identify the SLM practices, ii) rating the technologies in term of strength and weaknesses and iii) carbon sequestration potential of the practice. In terms of the criteria, the following will be considered: Potential for income generation or employment: The technology should help contribute in improving people's lives through creating additional resources;
- Adaptability of the practice: The technology should help fight effectively against degradation;
- The economic cost of the technology: The cost of the technology should be as low as possible;
- Sustainability / replicability: The technology must be easily replicable and sustainable.
- Base on the outcome of the selection of the practices using the above mentioned criteria, the promising practices are then rated based on the different measures identified in the table below:

Table 4: Classification of technologies

Measures	Mechanisms	Potential of income and employment generation	Adaptability of the practice	Economic cost	Sustainability / replicability	Total	Rank
Management measures	Grazing ban	3	4	4	3	14	1
	Reforestation	3	4	2	4	13	2
	Assisted Natural Regeneration (ANR)	2	3	4	3	12	3
	Organic conditioning (ECOCAS composting, Spreading of groundnut shell)	3	2	3	4	12	3
Agronomic measures	Cultivation techniques (slope cultivation, crop rotation)	2	3	3	3	11	5
	Forestry management	3	3	2	2	10	6
Physical structures	Combatting erosion (Stony cordon, bunds, embankment)	2	2	1	4	9	7
Vegetative measures	Recovering salty lands	2	2	2	3	9	7
	Fallow	2	2	3	1	8	9

The classification shows that the technologies most likely to be widely disseminated are agroforestry technologies such as: reforestation, grazing bans, Assisted Natural Regeneration (ANR) and organic conditioning complemented by other technologies such as firewalls, improved stoves for their contribution to reducing carbon emissions and Soil Defence and Restoration/Water and Soil Conservation technologies for rehabilitation of borrow sites (transforming quarries located in retention basins particularly for vegetable gardening production).

- The adopted practice/technology base on the rating, are then consider in term of their potential for carbon sequestration. The adopted technologies are expected to contribute to increased carbon sequestration by the

soil which is a significant reservoir. It contains almost double the amount of carbon present in the air and 2.5 times that of the Earth's biomass. (EDC, 2000). The mechanism of photosynthesis will help strengthen the soil carbon stock as evidenced by Lufafa et al. (2008) which shows that staying 50 years without clearing the land eventually results in carbon gains ranging from 200 to 350% in the vegetation (without fertilization) and from 270 to 483% in the soil (with little amount of fertilizers used).

In Senegal studies were conducted in the field of sequestered carbon estimation.

Based on the CENTURY model, Liu et al. (2004) estimated the loss of carbon stock in soils and vegetation at 37% in a century in South-central Senegal. Other studies in the Groundnut Basin estimated soil carbon stocks at 20 tC / ha for sandy soils and 40 tC / ha for clayey soils in cultivated areas of the Saloum Oriental groundnut basin. Stocks are estimated at 31tC / ha (sandy soil) and 64 tC / ha (clayey soil) for uncultivated soil in the same area (Touré 2002).

The CENTURY predictive model could be used to determine the baseline to estimate carbon sequestration gains and monitor their evolution following the intervention of the project. This is possible given that the model is as accessible as other similar tools such the TARAM (Tool for Afforestation Reforestation Approved Methodologies).

The following table shows the sequestration potential of SLM technologies adopted within the framework of the project.

Table 5: Sequestration potential of the various technologies

Technologies	Area (ha)	Carbon potential in tc/ha/an	Sequestered quantity in tc/ha/an
Reforestation	90	8	720
Grazing ban	250	1.49	372.5
ANR	50	1.2	60
Organic Conditioning	10	0.52	5.2
Total	400		1157.7

Assuming that the project will be implemented over 400 ha; the carbon sequestration potential is estimated at 1157, 7 tons per year.

It is also worth noting that the emission assessment by ANEV could also be used as a reference to better understand issues relating to carbon footprint in the project area. Indeed, studies have been conducted in this field throughout the Ecovillages located in the project area.

Table 6: Values of CO₂ emission sectors in ecovillages

Eco Village	Residential Area	Agriculture	Mvt of people	Food	LULUCF	TOTAL
Ndick	46	13,170	23	610	10,441	24,290
ToubelBali	0	10,072	35	94	-12,175	-1,974
Kack	3	2,669	16	54	1,306	4,048
Thiasky	0	5,891	562	305	7,766	14,524
Mbakombel	3	2,669	16	54	1,306	4,048
Kouar	36	7,973	12	93	2,014	10,129
Dar Salam	31	1,251	266	25	17,876	19,449
DindéFélo	23	1,936	281	318	6,905	9,464
Mansariko	42	1,713	34	102	2,981	4,872
Mbam	46	13,170	23	610	10,441	24,290
Loumpoul	84	5,080	97	161	9,214	14,636

Source ANEV 2014

2. Component 2: Green and energy efficient rural housing.

From PIF:

The project will build on the current experience with UNDP Typha project and will complement this project in two ways: a) economic analysis of available techniques of building particularly at rural level to come up with more accessible techniques both in term of cost and capacity of local individual to use the technology; ii) analyse of how the NV technology will provide a solution for the roofing aspect which is not considered in the typha project. Also the project will help to address the shortcomings related to dissemination and capacity building at appropriate levels. To support INRM at local and municipal level there should be incentives via pilot demonstration to show case but also by providing opportunities to create a system that will facilitate access to financial resources based on established criteria that will give due consideration to linking incentive with adoption of INRM. The anticipated actions in this component will help to achieve three specific objectives i) demonstration, adoption and dissemination of NV building technologies as it is environmentally friendly since it provide GHG sequestration and avoidance potential, but also contribution to energy efficiency in building, ii) support local entrepreneurship and poverty eradication as it is anticipated the NV building technique will create a new set of local entrepreneurship with possible financial private sector involvement. Discussions have recently been initiated with the Bank of Africa Group Holding on how they can support the system and it financially sustainable. These partnership will be further discussed including with local stakeholders so that whatever option is envisaged it has the buying –in of all key stakeholders; and iii) social wellbeing by providing decent habitat in local level with low or no cost in energy use. The system to be established will be sustainable and integrated into the global local institutional capacity building envisaged in component 1.

The component is to build the capacities of stakeholders to the mastery of the NV technology and ensure its wide dissemination. The people to be trained will be consider as trainers who in their turn will trained many others so that more interested stakeholders are trained. After the implementation of the component, it is expected that the *“Stakeholders have adopted energy-efficient technologies and best integrated natural resources management practices” (Outcome 2).*

The related outputs which will be generated include:

Output 2.1.: 30 VN communities’ buildings as demonstration sites in 3 pilot municipalities to avoid 84 tons CO_{2eq} emission and deforestation

Output 2.2.: 500 VN constructed under community revolving funds to support INRM to avoid 1400 tons CO_{2eq} emission and deforestation and create green jobs

This relies on the existence of vibrant partners such as the Partenariat Association and the Nubian Vault Association which have proven experience in in the sub-region and Senegal, and are considered both as implementing actors and key relays in the scale up process. The Nubian Vault Association program called "For Earth Roofs in the Sahel" and its logic called "A roof + an occupation + a market" are part of the participatory and inclusive approach of the project:

- ROOF is the gateway to popularizing a new environmentally sound technology;
- OCCUPATION enables people to master the technology through training, ensures its replicability while sustaining investments using the maintenance capacities offered, in addition to job creation.
- MARKET enables to disseminate and therefore sustain the technology.

The NV technology is expected to be disseminated based on a scale of intervention enabling the following:

- Local management of the project implementation;
- Ensuring access of a sufficient number of beneficiaries;
- The construction of a sufficient number of buildings;
- The establishment of a sustainable building market demand;
- The involvement of key actors in the territories;
- Sustainability and replicability through the establishment of the revolving funds

The VN technology will permit to reduce deforestation. Each VN will contribute to save at least 4 trees. The total number anticipated objectives by the project area will lead to safeguarding 675 000 trees as effect and impact of the project. Given the 0, 8 tons of CO₂ avoided per m² of VN, the estimated 500 VN over the 4 years project period will give a total estimate of 10,400 tons CO₂ avoided.

The method of calculation of the NV performances is defined by the study done by Bruno Jarno (2015) entitled: « Etude portant sur la technologie Voûte Nubienne comme modèle de construction, rapport final » which gives the bellow data:

For a housing of 25 m², it is estimated that the NV technology can avoid 20, 5 tons CO₂ equivalent in comparison with housing constructed in another material like cement for example.

- 3, 4 tons of CO₂ equivalent avoided in the construction phase because of using materials that have little environmental impact like clay
- 7,1 tonnes de CO₂ equivalent avoided during the building utilisation which will not require using air – conditioning and still ensure comfort and acceptable thermal level (< 32 °C)

Given the 0.8 tons of CO₂ per square meter avoided for a Voute Nubienne, the estimated 500 Voute Nubiennes representing 13,000 square meters over the 3 years project period will give a total estimate of 10,400 tons of CO₂ avoided. Furthermore, as 1 Voute Nubienne constructed saves at least 2 trees, the total number anticipated in project area will lead to safeguarding 1,060 trees. Using the 25 kg of CO₂ sequestration potential of Tropical Tree, we will have an estimate of at least 26,500kg of CO₂ sequestration potential.

Many NV housing already have been constructed in Senegal in many sites like the area of St – Louis. Their economical competitiveness in comparison with traditional technologies like cement can be evaluated through the following considerations: (i) the availability of the technology through training of local technicians as future trainers; (ii) Availability and low cost of the necessary local materials in the targeted areas. These advantages made NV technology more competitive than the other technologies and more accessible to poor communities.

The project implementation in villages and municipalities seems to face many constraints in light of these criteria and previous experience disseminating the Nubian Vault technology. The implementation in counties and regions seem to be the most relevant with an emphasis on identified areas (one or more counties or municipalities, a set of pilot villages, among others).

The technology dissemination potential remains substantial if one refers to construction needs. In addition to the program of 15,000 low budget homes a year planned by the State as part of the PSE, there are also the growing needs related to expected population growth to 26.6 million by 2040, against 13.5 million in 2013. In addition, the last general population census (2013) shows that 47% of rural households live in uncomfortable zinc roof houses, while 38% of households live in unsustainable straw roof dwellings.

The "2013 National Report on the Status of Education" by the Ministry of Education shows that 11.5% of 42,203 classrooms (Elementary schools) in Senegal are reported to be in poor condition, hence the need to rehabilitate school infrastructure. Added to these is the necessity to build new classrooms to replace the existing 4,815 temporary shelters. These need trends are generally apply across all regions, despite some notable differences among them.

According to the Ministry of Health and Prevention "Senegal Health Map updated in 2010", the following was recorded in 2010 throughout the national territory:

- 1240 health posts with an expressed need of 320 new posts;
- 89 health centers, including 20 health posts used as health centers.

In agriculture, the strategic guidelines for security and food self-sufficiency necessarily involve the construction of agricultural infrastructure for the storage and preservation of food for food processing activities. These needs are concentrated in agricultural and agroforestry areas.

A business model of the NV concept will be elaborated and based on the appropriation of the NV building alternative by local population and by the creation of a self-sustainable and autonomous market: The project will build 500 others buildings by dissemination of the technology through the contribution of many other partners.

The table below includes a qualitative prioritization of needs at national level. These priorities are likely to significantly change in localities whose needs can also be found in Local Development Plans.

Qualitative needs	Need Prioritization
Private housing	Very high needs
Educational buildings	High needs

Classrooms, literacy rooms, Teacher rooms, etc.	
Health buildings Dispensaries, maternity hospitals, health huts, etc.	High needs
Farm buildings Silos for storing grain, vegetable gardening products, seeds.	Relatively High
Office building Offices, services,	Needs vary according to the place.
Cultural buildings Multi-purpose rooms, Youth centers, etc.	
Places of Worship Mosques, prayer rooms, churches, etc.	
Other Workshops, plants/factories, shops, hotels, tourism building	

The establishment of the revolving funds will ensure the sustainability and replicability of the approach. Preliminary discussions are conducted with Bank of Africa Holding Group (BOA) to explore the possibility of their involvement in the establishment and management of the revolving funds. The Bank may potentially serve as Trustee and also the initiative can be the embryo of the establishment of Green Rural Habitat Funds in Senegal –GRHFS (Fonds Vert pour l’Habitat Rural au Senegal - GRHS). The GRHFS can be an exit strategy for the project at the end of project stage. Whatever will be established for the revolving funds and then the GRHFS the mechanism will be discussed and decided with local stakeholders.

Assessing mitigation opportunities

In order to identify mitigation opportunities, a situational assessment of planned projects and programs will be used, and projects of high implementation and interest will be considered for the next phases in the measurements.

A number of mitigation opportunities will be identified for the use of electricity. Those are mostly technologies and measures identified during previous studies and that are still reflected in sector policies.

The choice of opportunities was driven by the implementation likelihood of certain identified projects but also their mitigation potential. In addition, their feasibility as well as access to the proposed technologies will be studied and taken into account.

The following projects will be taken into account:

Table: List of projects in the mitigation scenario

Project/Programme	Objectives	Activities	Starting period	End	Budget (millions)	CO2 abatement (tonnes)
Efficient lighting	Improvement of lighting equipment	Diffusion of 3 millions of LEDs in households, administrations and smalls enterprises	2014	2017	12 500	100660
EE in Industry and services buildings	Improvement of energy efficiency in services and industry buildings	Diffusion of solar equipments for air condition, and other energy efficients equipements	2018	2030	50 261	404 091

Promotion of equipments for cold performance	Enhance the use of energy efficiency performance equipments in households	Change of 95% of actual equipments around 552 324 en 2014,	2016	2030	36 100	558 289
Promotion of energy efficiency equipments in professional services	Increase of energy performance equipments in professional activities	Mechanism of information and assessment	2018	2020	5 484	117390
Development of energy control Center for public	Promotion of energy consumption control for households	Development of tools for diagnostic support	2018	2035	1 275	286020
Management of air condition in Administrative service	Automatic air condition equipment	Legislation defined Réimplacement of 19 958 sites, Monitoring system	2018	2025	12 432	73 080
Efficient public lighting	Improve lighting source	Reimplacement of 75 000 public lighting	2016	2025	22 500	20 132
Communication on energy efficiency control	High level on communication on energy efficiency	Development of communication tools in order to inform all territories on management of energy efficiency in buildings, equipments performance,	2018	2035	8500	445 060
TOTAL					149 052	2 004 722

The methodology and assumptions used in studying the above-mentioned projects have been chosen to assess avoided energy consumptions. Based on such information, GHGs were assessed using the electricity grid emission factor of 700g. For the measurements, the GACMO program was used to assess GHGs.

Consideration of the above-mentioned projects resulted in the following avoided GHG emission trajectory over the study review period:

Diagram: Avoided GHG Emissions by 2035

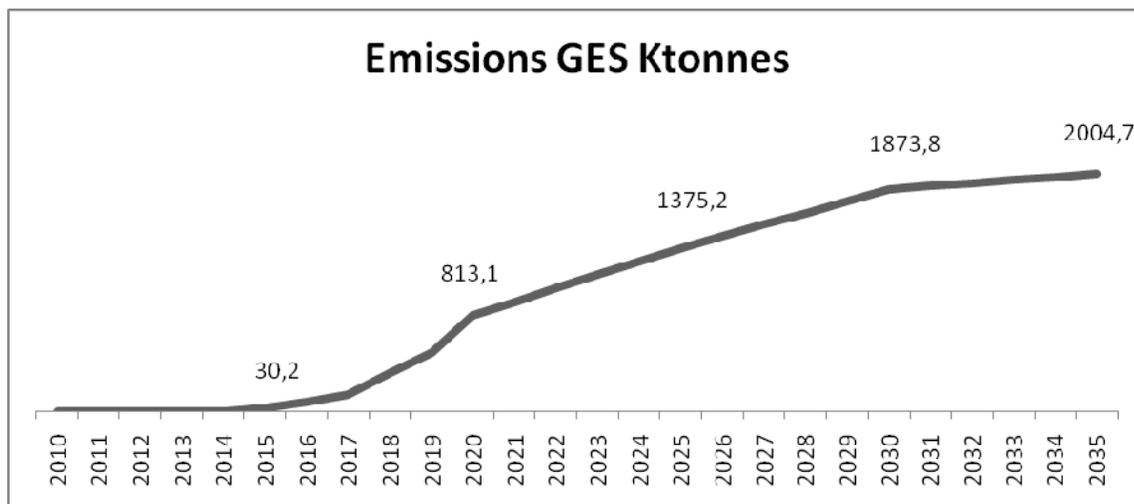
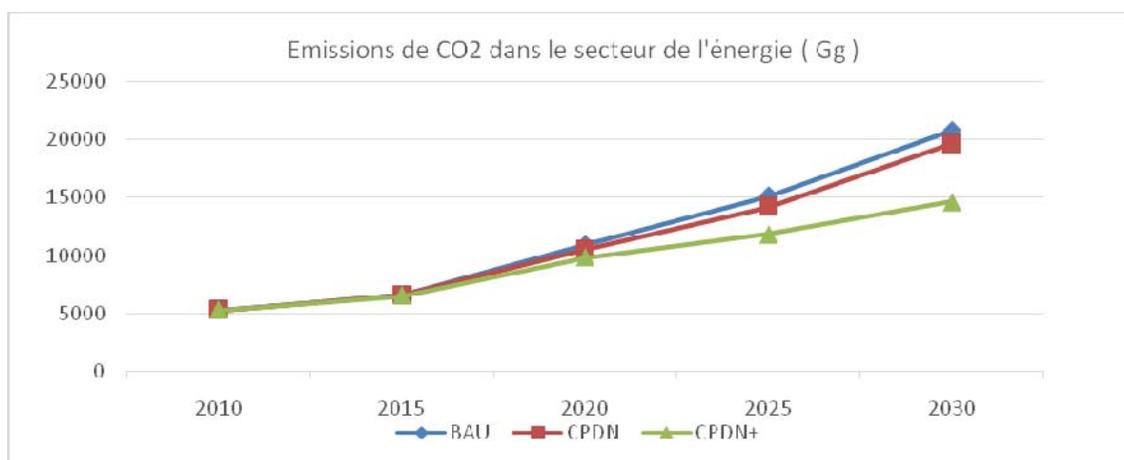


Diagram: Mitigation Scenario by 2035 (GHG in KTONs)

Groupe	Energie					
Emissions de CO2						
	Année	2010	2015	2020	2025	2030
Evité	BAU	5283	6594	10956	15165	20809
	CPDN	0	16	450	994	1208
Evité	CPDN+	0	43	1113	3369	6199
	Emissions	5283	6578	10506	14171	19601
Emissions	CPDN+	5283	6552	9843	11796	14610
	Moyens	CPDN			522 108 433 176	
Moyens	CPDN+			295 313 979 314		
	CPDN	0%	0%	4%	7%	6%
	CPDN+	0%	1%	10%	22%	30%



Forecast analysis

Forecast of Nubian Voûte buildings (implementation and scaling up)

By implementing the project, the number of professional technicians trained on NV construction and eco – buildings will grow. Therefore, the growth of national temperature which already is about 1°C in project areas will permit to more appreciate the thermic comfort of NV buildings.

Regarding to the actual policy of Energetic Efficiency in buildings and Senegalese engagement about implementing agreement of Paris in the area of Climate Change Convention, and according with Determined National Contribution define under 2030, the objective of a rate of 20% of Eco habitat as the VN will reduce more than a million tons of CO2 eq equivalent to 15.000 users / householders concerned.

Therefore, In the light of the sahelian climate of Senegal, strongly affected by the elevation of the temperature during the time, the development of the construction of type “Nubian Voûte” constitutes a solution for the Habitat Polity, adapts to climate change and favorable to the reduction of the Gas greenhouse effects.

Forecast on 25 years

The following board analyse results and impacts which can be obtained during 25 years according to three growing scenario of the NV technology market.(average annual growth rate of built areas).

- Annual growth of 20 %
- Annual growth of 40 %
- Annual growth of 60 %

INDICATORS	EXPECTED RESULTS ON 4 ANS	FORECAST ON 25 ANS (2040)		
		Annual growth of 20 %	Annual growth of 40 %	Annual growth of 60 %
Number of buildings	135	15 527	234 540	2 940 091
Constructed surfaces (m ²)	7 695	878 544	13 270 014	167 041 983
Number of NV	276	31 060	469 080	5 904 740
Beneficiaires / users ⁽¹⁾	3 375	134 002	1 990 502	25 056 297
Total population of Sénégal ⁽²⁾	16,1 Millions	26,6 Millions		
Estimate cost of VN foundations (Millions FCFA)	308	35 142	530 801	6 681 679
Estimate cost of VN foundations(Millions \$ US) (*)	0,506	58	872	10 979
Ovoided emissions (tonnes CO2 eq sur 30 ans)	822			

Final non consumed electrical energy (MWh ef /an)

Final non consumed electrical energy taking account of «

suppressed Demand » (calculated on ventilation basis)

Final non consumed electrical energy taking account of « suppressed Demand » (calculated on acclimatization basis)

0,0	0	0	0
46,9	5 349	80 799	1 017 098
343,6	39 229	592 533	7 458 768

1 151 924	17 399 131	219 019 017
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3. Component 3: Knowledge management and advocacy:

From PIF:

The sensitization will be an important role in adoption of the VN technique and also the mainstreaming of INRM in local and national production sectors. The project will support the awareness and advocacy through engaging both the public and policy makers. It is foreseen that the Government of Senegal by the end of project will revise its policy on habitat to facilitate access to more citizens but also to integrate natural resources management in building industry. The project will support this effort by developing policy brief and organization national and local forums to address the issue in order to come up with key recommendation and action toward that direction.

This component aims at improving the institutional, political, legislative, financial and communicational environment of the project to promote greater awareness of environmental issues and sustainable development for behavioural change and knowledge sharing. Following the implementation of the component, it is expected that “Sustainable natural resource management methods are owned by policymakers, as well as construction and training stakeholders and the local population” (Outcome 3).

Through this component, the outputs to be generated are:

Output 3.1: Policy briefs are developed and disseminated to promote integrated natural resource Management (advocacy);

Output 3.2: 1 National Forum and 3 County Forums on suitable and sustainable habitat and sustainable management of natural resources;

Output 3.3: Guidelines for scaling up Nubian vault and sustainable natural resource management are issued

The table below summarises the changes made, and the rationale for these changes, to the components and outputs in the PIF.

	PIF	GEF CEO ER	Rationale
Components	N/A	N/A	N/A
Outcomes	N/A	N/A	N/A
Outputs	2.1 70 VN communities buildings as demonstration sites in 3 pilot municipalities	2.1. 30 VN communities buildings as demonstration sites in 3 pilot municipalities to avoid 84 tCO _{2eq} emission and deforestation	In-depth analysis of the current cost of labour and others items conducted during the PPG, reveals that with the available resources only 30 VN can be constructed for communities building
	2.2. 168,750 VN constructed under community revolving funds to support INRM to ensure 16,875,000 kg of CO ₂ sequestration potential maintained and green jobs created.	2.2. 500 VN constructed under community revolving funds to support INRM to avoid 1400 tCO _{2eq} emission and deforestation and create green jobs during the project period.	The 168,750 VN targeted in the PIF was for a period of 10 to 15 years. During the PPG there was agreement to focus on possible realization during the project timeframe. Consequently, 500 VN was considered to be the most reasonable possible achievement

The Project Logical Framework is appended in ANNEX A of the GEF CEO ER.

Incremental Reasoning:

Without the GEF project

The baseline has shown that Senegal and its partners have taken many initiatives to promote land management and green habitat. Despite all those initiatives, diverse barriers remain, limiting the development of technologies. Without the GEF funding, the many initiatives will remain limited in time and dispersed only at certain sites, reducing their up-scaled effect on the country’s economy. In this case, the make-believe tactics often denounced in the approach to local development would be pursued without sufficiently representative models largely replicable in the different regions of the country to ensure a real and sustainable ecological, social and economic impact. Furthermore, the harmonization of policies and coordination of interventions among the different stakeholders may be very poor without measures to boost frameworks for consultation (among stakeholders), coordination and action. The legislative and regulatory framework would not be in line with the specific nature of land management and Climate Change which need to be mainstreamed in statutes for improved management. The technological, material and financial capacities needed for the adoption and scaling up of technologies would not be available. In addition, tools for advocacy toward decision-makers and communication to network the different stakeholders and therefore facilitate the dissemination of good practices would still need to be developed. Finally, linkages and synergies among conventions, which need to be founded on an integrated approach, would not be highlighted in the implementation of activities.

With GEF Project

The GEF funding will help alleviate the different above-mentioned barriers and consolidate achievements by: (i) strengthening the technical capacities of stakeholders in developing and disseminating good sustainable land management and NV practices (appropriate technical and technological packages); (ii) mainstreaming sustainable land management and green habitat in the development plans of counties and local governments, which are the project strategic partners; (iii) mainstreaming sustainable land management and green habitat in the regulations governing these areas to facilitate their implementation; (iv) supporting grassroots’ access to the financial resources necessary for disseminating the technologies; (v) contributing in setting up a network for climate change information sharing and dissemination of good sustainable land and climate management practices.

The GEF support is supporting the government of Senegal to address the priority GHG emission that the CO2 and the most important producer of this CO2. According to the Senegal 3rd National Communication to UNFCCC submitted in 2016, in 2005 which is the reference year, the CO2 represent 83% of emissions. In term of sectors, the 89% of the CO2 emission are from energy sector, followed by industrial processes (11%). By addressing energy efficiency in energy in building and CO2 emission reduction through less use of wood and less fossil fuel consumption for energy generation particularly in rural area, the project is addressing priority areas for GHG emission in the country.

Components	Baseline Scenario B (Business As Usual)	Alternative Scenario A (with project interventions)	Increment (A – B)
1	<ul style="list-style-type: none"> ▪ Senegal has developed several policies and strategies for land management and especially in the area of improving energy efficiency in habitat ▪ Low agricultural yields ▪ Low carbon sequestration 	<ul style="list-style-type: none"> ▪ Municipal Development Plans / Land Use and Tenure Plans with good SLM, poverty alleviation, environmental management and carbon stock monitoring strategies are developed and implemented to support the conservation and 	<p>1200 ha under SLM</p> <p>Senegal contributes in realizing food security and exchanges within the ECOWAS and UEMOA sub-regional agricultural and environmental programs.</p>

Components	Baseline Scenario B (Business As Usual)	Alternative Scenario A (with project interventions)	Increment (A – B)
	<p>rates against emissions</p> <ul style="list-style-type: none"> ▪ Low mastery of SLM practices and technologies ▪ Existence of territorial climate plans in the regions of the Ferlo Understanding (TACC) ▪ Existence of employment and income assistance projects often with poor mainstreaming of SLM practices ▪ The technologies are currently used at limited scale, and are not integrated ▪ The SLM technologies currently used are not systematically evaluated to determine their impacts on production, environmental protection and the carbon footprint for their wide dissemination ▪ Natural Resource Integrated Management of natural resources still on the drawing board and yet to be owned and implemented 	<p>promotion of ecosystem services.</p> <ul style="list-style-type: none"> ▪ At least 2 integrated natural resource management technologies with a potential for improving the lives of communities (Nubian vault, Agroforestry) are developed, adopted and disseminated ▪ 3 SLM technologies (Agroforestry, water mobilization, grazing management) are tested to improve productivity, reduce the erosive action and improve the carbon stock. ▪ 3 NGOs / CBOs, Extension Agents and staff of the local administration for rural development and 120 private persons including in rural areas are trained to promote and disseminate techniques for the Integrated Management of Natural Resources (For example: Nubian Vault) and green jobs. 	<p>Senegal will be a model of integration among different conventions, fostering a more appropriate response reflecting the concerns of communities on one hand, and ensuring the effectiveness of actions and efficiency of resources mobilized on the other hand.</p> <p>Promoting SLM will significantly contribute in meeting the national strategic objectives of environmental preservation and economic and social development.</p> <p>Environmentally: Through carbon sequestration in agriculture and forestry, which are among the major sources of emission, by promoting and disseminating good natural resource preservation practices?</p> <p>SLM will also contribute in preserving agricultural and forestry biodiversity through the adoption of integrated technological packages ensuring diversified use of natural resources for sustainability.</p> <p>Increased productivity and productions, contributing to food security but also to the creation and/or consolidation of green agricultural jobs, which is one of Senegal's major priorities because the agricultural sector is considered a structuring sector for the country's</p>

Components	Baseline Scenario B (Business As Usual)	Alternative Scenario A (with project interventions)	Increment (A – B)
			economy as part of the PSE.
2	<ul style="list-style-type: none"> ▪ Energy-efficient technologies and best practices for SMNR are still poorly implemented at large scale due to technical, material and financial constraints ▪ The NV technology is still poorly disseminated due to the lack of pilot community buildings that can serve as demonstration sites ▪ NV construction has been so far funded by private stakeholders especially wealthy individuals ▪ Only 30 Senegalese apprentices and masons are being trained to the NV technology ▪ No Senegalese NV foreperson ▪ There is an ongoing program called PNEEB with a thermal regulation project 	<ul style="list-style-type: none"> ▪ Community Nubian vault buildings are constructed in pilot municipalities ▪ Output 2.2.: Community revolving funds have supported the construction of Nubian vaults. 	<p>135 building projects spanning 7700 m²;</p> <ul style="list-style-type: none"> • Including 84 private houses and 51 office buildings; • With an average growth of 55% over the three years of the project or about 1,520 NVs (PIF); • About 3,400 beneficiaries who are regular users of the constructed buildings <p>Increased energy efficiency in the habitat sector, considered one of the major GHG emitters, by promoting green habitat. The same approach will also strengthen SLM by reducing pressure on natural resources from high demand for timber.</p> <p>Promoting a new trade and promising market in light of the ambitious 15,000 low-budget houses per year program as part of the PSE by 2035, in addition to individual and community initiatives from local governments.</p> <p>Reduce construction costs and extend populations' access to housing, contributing in alleviating poverty of households, which have always imposed high expenditures on the state budget.</p> <p>Senegal contributes in enhancing carbon sequestration capacities and greenhouse gas reduction</p>

Components	Baseline Scenario B (Business As Usual)	Alternative Scenario A (with project interventions)	Increment (A – B)
			through the development and replication of appropriate NV-based SLM and green habitat technological models in accordance with conventions in force.
3	<ul style="list-style-type: none"> ▪ The level of information and awareness of various stakeholders on sustainable NR management remains low ▪ Advocacy on Integrated Management of NR remains very low, because the approach is still essentially limited to the technical community ▪ No existing Forums SLM and sustainable resources management 	<ul style="list-style-type: none"> ▪ Policy briefs are developed and disseminated to promote integrated natural resource Management (advocacy); ▪ 1 National Forum and 3 County Forums on suitable and sustainable habitat and sustainable management of natural resources; ▪ The different parties are trained in SNRM techniques and technologies ▪ Guidelines for scaling up Nubian vault and sustainable natural resource management are issued 	<p>Behavioural change (through education) and improved resource management capacities (through training).</p> <p>The global benefit will be the adoption of appropriate technologies for the sustainable management of land and promotion of green habitat and employments as well as their large-scale dissemination in the form of good practices and lessons learnt at the intervention sites in the country and the sub-region and also for future projects.</p> <p>Through such initiatives, the project will contribute in promoting women and youth emancipation, because SLM will help mobilize and assign new land (fallow and waste land made productive), while affordable habitat will foster trades (entrepreneurship in forestry and construction, among others) and/or changes in trades (farmer turned NV mason, housewife turned vegetable farmer, among others) in addition to improving the living environment.</p> <p>The project will help create new local development opportunities that will</p>

Components	Baseline Scenario B (Business As Usual)	Alternative Scenario A (with project interventions)	Increment (A – B)
			<p>contribute in curbing youth and women rural exodus, which are draining rural workforce and undermining the country's development.</p> <p>Development of a certain level of South-South cooperation through cross-border dissemination of technologies among the communities of neighbouring countries facing the same living conditions.</p>

In response to the gender analysis above, the project will consider the recommendation from 2010 USAID study which identify possible entry points to use formation and operation of producer groups to:

- Conduct gendered value chain analyses, with attention to actual farm budgets and the costing of women's labour;
- Improve women's access to farm inputs (e.g., improved seeds, fertilizer, irrigation);
- Build women's technical capacity and literacy;
- Establish savings and credit programs;
- Work with Rural Councils to find suitable land holdings for cultivation by women and women or mixed groups;
- Supply farm equipment;
- Create horizontal and vertical linkages;
- Identify new opportunities for women's entry into agricultural value chains outside of their historically common crop choices; and
- Support rural women's entry into processing, bulking, sorting, and transport opportunities

A.6 Risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and measures that address these risks:

Table of risks and mitigation

Risk Statement	Level	Mitigation
Water shortage during construction	Low	The necessity to complete the buildings before the end of rainy season. The awareness raising and capacity building activities will include this in the programme.
Degradation of wetlands biodiversity as result of mud extraction for VN construction	Low	Ensure that the mud as construction materials is collected at the right time. The awareness raising and capacity building activities will include this in the programme.
Annual building maintenance to ensure	Low	The users will be sensitized accordingly for the use of

durability.		adequate protection measures.
Establishment of good quality building	Low	Good monitoring activities by AVN and adequate measures to ensure client satisfaction.
Political decision against the methodology as result of lobbying from the cement and iron sheet dealers	Moderate	Sensitization of public and opinion leaders on the benefits of the VN.
Coordination difficulties and poor activity monitoring capacities	Medium	Revitalizing consultative and coordination frameworks (COMRECC, COMNACC among others) and ensuring that they are affiliated to competent authorities and official bodies at national, county and local levels.
Inadequate financial resources for communities and supervisory bodies	Medium	In addition to the project, getting integrated in ongoing programs (joint funding), developing MoUs with certain stakeholders and developing faire-faire and brokerage
Increased impact of climate change	High	Building on climate change information monitoring programs and developing appropriate technological capabilities (Research and development) Leveraging lessons learnt
Psychosocial reluctance to the NV technology which uses adobe, or to the SLM, which are sometimes labour-demanding.	Medium	Involving organizations of youth and women, who are often more open to changes and making demonstrations on project sites (visits). The project will lean on women and youth groups to test and disseminate NV housing by construction of the headquarters of the groups and the SLM good practices through by implementing community farms. Developing sustainable income generating activities related to the technologies.
Conflicts resulting from land tenure	Medium	Building on the decisions of municipal councils in community areas and also tapping private estate.

A.7. Coordination with other relevant GEF financed initiatives

A.7.1. Coordination with other GEF projects:

N/A

A.7.2. Coordination with other projects

Coordination with other projects will be based on MoUs with certain stakeholders as part of cofinancing letters for cross-fertilization in the intervention areas or through brokerage with communities to address areas not directly implemented by the project. (Income generating activities, markets, among others);

In addition, as part of their activities, projects may relay the dissemination of good practices for the GEF project.

Finally, participation to the same consultative and coordination frameworks will favour the creation of a network for knowledge transfer and dissemination of good practices which will be beneficial for the project.

Table of projects that can establish collaboration with the GEF project

Project title	Major donor	Length	Intervention areas	Goals
Projet d'Appui à la Sécurité Alimentaire (PASA LOUMAKAF)	IFAD	2015-2018	Louga Matam Kaffrine	OVERALL GOAL: To improve food security as well as rural income by targeting three vulnerable regions in Senegal that are highly exposed to weather vagaries, while improving access of smallholders, women and their organizations to diversified agricultural and pastoral infrastructure, especially water control, storage and opening up as well as adequate technologies, services and trainings.
Projet d'Appui aux Filière agricoles (PAFA)	IFAD	2010-2016	Kaolack Kaffrine ; Bambey Diourbel (Diakhao Niakhar Fatick) Colobane Ouadiour Gossas), Foundiougne	OVERALL GOAL: To sustainably improve incomes and livelihoods of family holding in the Peanut Basin through the integration of profitable and diversified sectors
Agence nationale des Eco villages (ANEV)	Government equity and UNDP/GEF, JICA funding	-	Kaolack Fatick Kaolack Diourbel Thiès Louga Matam	Overall goal : To ensure sustainable food and energy security while contributing in alleviating climate change and environmental preservation both locally and globally by providing better life quality to half of Senegalese central villages
Bassins de Réention et de Valorisation de Forages (BARVAFOR)	Kingdom of Belgium	2010 – 2015	Kaolack Fatick Kaolack Diourbel Thiès	Overall goal : To strengthen agricultural, forestry and pastoral production in the rural areas located in the regions of Diourbel, Fatick, Kaffrine, Kaolack, and Thiès through sustainable access to productive water
Arbre locaux pour un Monde meilleur (ARLOMOM)	UNDP/GEF	2012-2014	Kaolack Fatick	Goal: To foster the rebuilding of the plant cover in order to contribute in carbon sequestration and improve the livelihoods of rural populations by the marketing of ecosystem services gained from plant regeneration.
Programme d'Aménagement et de Développement Economique des Niayes (PADEN)	Canadian cooperation	2010-2015	Thies, Louga	OVERALL GOAL: To contribute in bringing a 50% reduction in the Senegalese household poverty incidence by 2015 through strategic support for Senegal's poverty reduction strategy based on MDG 1.
Agence Grande Murielle Verte (GMV)			Louga Matam Tambacounda	To contribute in leveraging natural resources in Sahel-Saharan areas as part of sub-regional desertification and poverty alleviation to recover and protect degraded land.
Projet d'Appui au Développement Economique de la	The Government of Canada	Avril 2010 Mars 2015		Overall goal: To contribute in reducing household

Project title	Major donor	Length	Intervention areas	Goals
Casamance (PADEC)	7,936,457,200 F CFA The Government of Senegal 634,916,400 F CFA			poverty incidence in Casamance 2015
Projet d'Appui au Développement Agricole et à l'Entreprenariat Rural (PADAER)	IFAD FFE (Spanish Trust Fund) The Government of Senegal	Six years	Kédougou Kolda Matam Tambacounda	Overall goal: To contribute in reducing rural poverty and boosting economic growth in the intervention area while improving sustainable food security and the income of smallholders and herders, to create sustainable jobs for rural populations, youths and women.
Projet de Renforcement des Capacités pour le Contrôle de la Dégradation des Terres et la Promotion de leur Valorisation dans les Zones de Sols Dégradés (CODEVAL)	JICA	1st Phase : March 2011 – March 2016	Fatick et Kaolack	Overall goal: Activities to control the degradation and promote the leveraging of land are implemented in the project target area.
Projet d'Appui à la Petite Irrigation locale (PAPIL)	AfDB	2010-2015	Tambacounda Kolda Fatick	To promote small irrigation at local level through rural communities and producer associations who will be the direct actors of operations and will be supported in implementation.
Programme of sustainable and participative use of traditional and substitution energies (PROGEDE)	World Bank			is to contribute to promote diversified energy sources through sustainable land management. Therefore; It will support the project activities in the area of SLM and the way of enhancing carbon stock. It also contributes to reinforce Municipalities capacities to implement their land use plan and support communities to generate revenues from forestry activities in SLM.

The project will also coordinate with UNDP projects TACC and INTACC which are supporting climate change mainstreaming in local municipal plans.

B. ADDITIONAL INFORMATION NOT ADDRESSED AT PIF STAGE:

B.1 Describe how the stakeholders will be engaged in project implementation.

In its approach, the project builds a partnership with several stakeholders expected to directly contribute in the participatory planning, implementation, monitoring and evaluation of activities through different mechanisms

defined as part of implementing the project.

The diverse stakeholders, as well as their roles and responsibilities in implementing the project, are defined in the table below.

Table of roles and responsibilities of the Project SLM and NV actors

Actors	Roles in the project
Ministry of Environment and Sustainable Development (MEDD), DREEC DEFCCS, DFVP, DPN, DPVE, CILSS, COMNACC, CSE	<ul style="list-style-type: none"> - Coordination, piloting, monitoring, evaluation; - National and regional focal points; - Verifying and upholding the sustainable management of resources, energy efficiency in buildings; - Local communication on climate change.
Association Voûte Nubienne (AVN)	<ul style="list-style-type: none"> - Awareness, communication, support, monitoring and evaluation, coordination, piloting, competence transfer of NV; - Technical expertise and Nubian Vault program (15 years in existence); - Expertise in supporting the development of the rural markets of private buildings
Association Le Partenariat (VN)	<ul style="list-style-type: none"> - Awareness, communication, support, monitoring and evaluation, coordination, piloting, competence transfer; - Technical expertise and Nubian Vault program (15 years in existence); - Expertise in supporting the development of the rural markets of private buildings
Civil society organisations, local associations, CBOs	<ul style="list-style-type: none"> - Project implementation, support for developing the rural markets of private buildings - Awareness, communication, support, monitoring and evaluation, coordination, piloting, competence transfer; - Role of relay and watchdog
Organisation pour la Promotion du Développement Autonome de Dialacoto (OPDAD)	<ul style="list-style-type: none"> - Project implementation, support for developing the rural markets of private buildings in the region of Tambacounda
Association Développement Gembloux (ADG)	<ul style="list-style-type: none"> - Potential involvement in agricultural issues/construction of agricultural buildings
Local government and local elected officials (Counties, municipalities, Association of Local Elected officials...)	<ul style="list-style-type: none"> - Public/community building contracting; - Communication, awareness; - Political, institutional and financial support (co-financing) for implementing project activities; - Social mobilization of populations and local elected officials around the project objectives.
Technical chapters of local governments ARD, CADL, technical departments, GIC,	<ul style="list-style-type: none"> Project implementation: public building component Organizing and monitoring construction works, monitoring buildings; Awareness-raising toward local elected officials, communication; Ownership of Nubian Vault referential

	project implementation:
Ministries and government ramifications	Theme-based involvement; Urban planning, construction, training, employment, education, local development, among others, Potential clients for the implementation of administrative buildings.
Private clients	Corporate clients, the cottage industry and Masons
Masons	Mainstreaming/taking ownership of Nubian Vault, training
Training bodies, construction training centers, regional training centers, among others	Building linkages between formal and informal training; Communication toward potential apprentices.
Technical bodies, research centers and universities, the Architects Association, the Construction engineers Association Association Sénégalaise de Normalisation (Senegalese standardisation Association), École Polytechnique (the Polytechnic School),	Technical research and tests, technical referential for the codification and official recognition of Nubian Vault building
Banks and Micro finance institutions	Brainstorming and designing financial products opening access to build housing
Agencies and projects related to Habitat and energy efficiency	- Seeking synergies if applicable : PNEEB project, PNB Program, PERACOD Program, ANEV agency, AEME Agency.
Consultative frameworks (COMNACC, National Land management Committee, among others)	<ul style="list-style-type: none"> • Coordination/Support for the project in mainstreaming land management in plans and programs/Scaling up lessons learnt and experiences from the project
The private sector	<ul style="list-style-type: none"> • Brokerage with local populations • Model farmers for the implementation of certain technologies; • Implementing certain activities (“let them do” approaches in which private and populations are the main actors and not the project)
Projects	<ul style="list-style-type: none"> • Concerted approach with the project/co-financing; • Scaling up project activities and sharing lessons learnt.
Community radios	<ul style="list-style-type: none"> • Outreach and larger scale dissemination of climate information and project outcomes/participation in workshops and forums to disseminate project outcomes in the form of reportages and documentaries
Research and training institutions	<ul style="list-style-type: none"> • Direct beneficiaries and major stakeholders of the project with municipalities/Relays for scaling up and replicating project activities

PROJECT STRATEGIC APPROACH: MAINSTREAMING SLM AND GREEN HABITAT

The purpose of SLM and NV technologies is admittedly to promote sustainable management of the environment and natural resources, but also to promote green jobs. However, these two technologies have in common a focus on knowledge and local know-how reinforced by relevant and appropriate inputs. Moreover, it establishes a relationship between production considered as SLM’s main area and habitat, as each element is a medium and an end for the other. Indeed, concerns related to production / consumption and habitat are intimately linked for local communities, particularly because of their important role in the household budget and their required strong workforce mobilization. SLM will enable the development of a market for NV. Conversely, the distribution of the NV technology will reduce pressure on natural resources and strengthen SLM as a result. The management of this interface between SLM and the

NV technology results in the establishment of an integrated climate change adaptation strategy based on the two components that best mobilize technological, material, human and financial resources.

Technologically, the project strategy is to develop and disseminate technological packages to reduce the negative environmental impact of production and housing activities that require a high level of natural resource and energy consumption.

The technologies NV and INRM are relatively recent. Therefore, it is necessary to develop a relatively long penetration period in connection with : (i) the scientific requirements of the technologies; (ii) the level of perception of the advantages of the technologies by the beneficiary communities; (iii) the offer level in connection with the quantity of technical specialized and available (masons and technicians of rural development); (iv) the market which determinate the demand of technology that depend of financial resources for the demand side and financial sustainability for the offers of services.

For all these reasons, the project has developed an implementation strategy which may be described in three phases:

- An implantation phase which corresponds to the project start the and with realistic objectives making emphasis in demonstrative aspect by implementing pilot sites (municipal NV buildings and communities lands for INRM);^
- A consolidation phase which corresponds to the third year of the project with the up scaling of the new technologies. It is the evaluation phase of the first impacts of the project pilots building and SLM activities.
- An extension phase which corresponds to the end of the project and extension of NV and INRM technologies impacts in PSE plan whose duration is 25 years and which provides for 15 000 social buildings and development of extensive rural productions areas.

Institutionally, the project will build on and strengthen the existing baseline through support for the lifting of barriers to scaling up the identified appropriate technologies.

The Decentralization Act 3 empowers local authorities (municipalities and regional council) in natural resource and soil management. Therefore, they will have real power in the areas of NV and SLM witch are the basis of the project activities. These local authorities will be able to finance the 30 communitarian buildings in their territory as demonstration sites. They will also contribute to cover the construction of 500 NV buildings in the framework of integral communalization which aims to reinforce means of municipalities to make them able to better manage urban and rural development. In this framework, it will be possible to promote NV technology in the expected PSE annual national program of 15 000 social buildings.

Financially, the project will use existing direct or parallel co-financing, while helping support local communities in their quest for resources to adopt and disseminate technologies. This will include establishing models with the support of local authorities (for community or administrative buildings) or projects and programs in the SLM field. These stakeholders will then act as relays to disseminate the technologies among private partners.

Finally, the project strategy results in systemic, holistic, change because it is completely integrated into local economic circuits, relies entirely on locally sourced, often freely available, raw materials, and is creating autonomous markets in NV housing through the activity of increasing numbers of trained NV builders and entrepreneurs. Spreading the NV technique all over Senegal (in the regions where the technical concept is appropriate) will reverse the housing situation, generating profits at the “bottom of the pyramid” through the market generated by millions of local NV entrepreneurs. The project housing alternative is fully integrated in the Senegalese context and is socially, environmentally, culturally and economically sustainable.

The project business models entirely based on the appropriation of the NV building alternative by local population and by the creation of a self-sustainable and autonomous market:

- By relying on earth as the main element for building, the Nubian Vault (NV) technique compensates the growing lack of wood resources (timber, straw). Most importantly, it limits the use of imported materials like iron sheets, cement or wood rafters coming from African coasts. The relevant know-how on earth architecture is widely spread among the population, thus the simple NV building technique can be easily transmitted from

skilled masons to apprentices of the village. Earth is available and ready to be used without any need of complex and expensive industrial processes. Its various technical possibilities (thick walls, bricks, filling) involve know-how and organisation models that any development policy would enhance: a ground on which economy can make the best of human and material local resources. Labour sharing and self-provision of earth-bricks allow to markedly reduce the price of these durable and comfortable houses, even to the 25% of total price. Another quality of earth architecture is its flexibility: from the simplest single-vaulted house to very complex and modular buildings, NVs can cover many kinds of very different buildings. Either rural style or involving more sophisticated technique, earth architecture can help to develop local craftsmanship and entrepreneurship.

Several types of partnerships with the other stakeholders can be considered.

- MoUs for the implementation of the project activities in exchange for institutional support can be established with regional technical departments of the state, research institutes, and training institutions, among others, in their respective areas of competence, particularly for technical supervision of local populations;
- Contracts-plans will be established with the governing organizations supported by the project to support producer groups.
- Letters of co-financing will be signed with partner projects and programs to support common or complementary programs established among the parties.
- Co-development will be promoted through the involvement of migrants in the financing of development activities for their leadership role or for replication of pilot actions implemented by the project.
- The project will develop brokerage to link local communities with other stakeholders involved in areas not covered by the project.

The use of local operators approach shall be prioritized as much as possible to ensure the involvement of all stakeholders the resulting sustainability of activities and replicability. This is to improve what is already being done, using the project's value added to support ongoing interventions.

B.2 Describe the socioeconomic benefits to be delivered by the Project at the national and local levels, including consideration of gender dimensions, and how these will support the achievement of global environment benefits (GEF Trust Fund/NPIF) or adaptation benefits (LDCF/SCCF):

AT SLM MANAGEMENT LEVEL

Following are the major benefits expected from the project:

- Ecosystem services are improved and leveraged through innovative technologies;
- Pressure on first resources is relieved;
- Greenhouse gases are reduced;
- The land degradation trend is reversed;
- The partnership and sustainable population livelihoods are promoted;
- Social and environmental vulnerabilities are reduced and communities' climate resilience is increased.

AT GREEN HABITAT LEVEL:

Environmentally:

In the basic scenario (Scenario A in which the building is constructed and used without ventilation or air conditioning) NV will help considerably reduce CO₂ emissions from the baseline of 1366 t released in 30 years to 544 t in the same period in Senegal, a reduction of 822 t.

In scenario B when the building is ventilated, there is a gain of 1329 CO₂ or more than 144% over scenario A.

In Scenario C in which the building is air-conditioned, there is an even more substantial gain of 3091 ton eq. or 468% over the baseline scenario A.

Such energy efficiency of buildings has direct influence in terms of reduced pressure on natural resources through considerable reduction of wood extraction. In addition, it will reduce competition between household thatch use (for habitat), productive agricultural activities (mulch) and cattle breeding (fodder) or even create income for women and youths (fodder sale). Finally, reduced wood extraction will reversely contribute in strengthening carbon sequestration beyond SLM and therefore boost the energy efficiency of buildings as part of mitigation.

Socio-economically

NV will contribute in reducing construction costs especially through:

- Reduced consumption of high environmental impact construction materials such as: cement and steel to the tune of 39% (Manufacturing Industries and Construction) ;
- Reduced emissions related to the cement production process (de-carbonization) to the tune of 36% (Industrial Processes) ;
- Reduced wood extraction for construction, gaining more thatch, timber and services the tune of 18% (LULUCF);
- Reduced transport costs to the tune of 7% due to most products used being self-provided at local level;
- Reduced burden of construction works for women and youths in light of their key contribution in self-provision of local materials in traditional construction models;
- Employment creation with the new trade of NV mason and an emerging market with an extensive actual and potential construction demand.
- Behaviour change through education and improvement of management capacities by training;
- Easier access to land due to rehabilitation of new land by SLM and their allocation to women and young which constitute the most active workforce.
- Reduction of rural – urban migration of women and young which constitute the most active workforce and the less endowed with the means of production
- Increased empowerment of women especially in decision making by reinforcing their roles and responsibilities through strengthening of their purchasing power (development of income generating activities such as gardening and increased participation in financing needs for family.

Such reduction of costs result in increased income that can henceforth be dedicated to other expenditure items in the household budget.

In addition NV technology improves the comfort of communities by reducing household energy expenses (ventilation and air conditioning). Therefore it falls within the national energy saving strategy (at local level) through the “energy mix”.

The cost reduction is disaggregated in the three project regions, reflecting the specific situations of each in relation to materials availability.

Table of cost of emission reduction gains per region

Sectors	Kaffrine	Saint-Louis (Podor)	Tambacounda	Project
Manufacturing industries and Construction	40 %	42 %	36 %	39 %
Industrial processes	29 %	43 %	35 %	36 %
LULUCF	27 %	6 %	22 %	18 %

Transport	4 %	9 %	7 %	7 %
TOTAL	100 %	100 %	100 %	100 %

There is a low emission reduction gain (6%) in the LULUCF sector for the region of Saint-Louis because the region has little or no more wood resources and therefore no constructions can use the resource. In contrast, the percentage is high in the regions of Kaffrine (27%) and Tambacounda (22%) because the resource, though scarce, is still available there (even if tapped illegally) and thatch roof underlain by structure is a still widely used traditional technique.

Based on these comparative advantages, 135 buildings are expected over the four years of the project, spanning about 7700 m² including 84 private houses and 51 private buildings, with an average growth of 55%. Based on a progressive dissemination, ownership and replication approach, there are plans to build the interest of 3400 beneficiaries who are regular users of the constructed buildings. The major works are estimated at 308 million FCFA (0.51 million USD).

B.3. Explain how cost-effectiveness is reflected in the project design:

The GEF funding requested as part of the project falls within the priority areas defined in the NAPA of Senegal and NAP/CAD /SLM. It aims at complementing and strengthening ongoing baseline initiatives, especially to overcome persisting socio-economic challenges as well as technical and institutional barriers limiting possibilities to adopt, scale up and disseminate good SLM and carbon sequestration practices to ultimately ensure the sustainable and integrated management of natural resources and the climate. Emphasis will be on enhancing individual and collective (information, training and awareness), institutional (financial, legislative and regulatory, etc.), systemic (policies, plans and programs), technical and technological capacities, which are still inadequate. In so doing, the project will significantly contribute in the national and local efforts by the diverse stakeholders including the central and local governments, grassroots communities, the private sector and NGOs, among others, to increase community and ecosystem resilience (adaptation) and enhance carbon sequestration (mitigation) in both areas of agricultural (SLM) and habitat (CC) in particular, which have high emission potentials. The outputs financed by GEF and that co – financed are indicated.

Therefore through the project, external partner funding will contribute in covering incremental or additional costs especially related to: (i) Improving and aligning sustainable land management and Green Habitat (Nubian vault) techniques with standards, supported by research and development institutions (Outputs 1.2 and 1.3); (ii) disseminating and scaling up those techniques and technologies in all project intervention areas and beyond (Output 1.4); (iii) providing technical and institutional support to state technical departments, local governments as well as consultative and coordination frameworks to enhance their capacities in planning and sustainable management of land and climate (Output 1.1); (iv) enhancing the material and financial capacities of local communities to facilitate planning, adoption and implementation of new technologies generating green employment, income and a decent living environment (Output 2.1) ; (v) conducting advocacy, information, education and communication for the dissemination of lessons learnt as well as good SLM and Green Habitat practices, particularly on NV, at various national, sub-regional and international levels through the setting up of a knowledge-sharing network. (Outputs 3.1 and 3.2).

More specifically, the disaggregated additional cost of the project for which LDC funding is requested is detailed through the different components of the project budget.

Funding will amount to 1,319,635 USD over 3 years.

Co-financing, which is a necessary condition to fulfilling the project objectives, is provided by the contribution of other national and international stakeholders, namely the Government, projects and programs, Local Governments, NGOs and socio-professional organizations active in SLM and Green Habitat.

Co-financing will cover expenses related to improving the lives of communities by :

- Mainstreaming new SLM and NV technologies in the country's development plans and programs at national (Government), County and local (local governments and technical support structures) levels (Output 3.2);
- Scaling up SLM practices and NV technologies across the project area and the national territory in order to address needs in those domains; (Output 3.3)
- Promoting a category of actors (green employment) and a NV technology market in order to sustain the technology (Output 2.2) ;
- Promoting income generating activities through the development of production, processing and marketing sectors resulting from the use of SLM technologies to ensure their sustainability (Output 1.3);
- Providing partial funding to – and organizing and networking - saving and credit mutualities to ensure their sustainable funding and the necessary investments to promote new technologies (Output 2.2) ;
- Investments as well as equipment and logistics, salaries and part of the project operational costs

B.4. Other additional information

B.4.1. SUSTAINABILITY AND REPLICABILITY

The project activities are made sustainable by:

- Responding to real beneficiaries' needs to sustain motivation;
- Ensuring ownership of the process by building the capacities of the different project stakeholders as part of their activities (improving the existing) and in relation to their official missions (institutional support);
- Applying a participatory approach involving different stakeholders in the project implementation at different phases: from design to implementation to monitoring and evaluation;
- Securing the tenure of investments, including in land, regulatory and economic areas, through effective ownership by local authorities and populations is another guarantee of sustainability;
- Strengthening populations' organizational and economic capacities, and coordinating technical and financial partner interventions through win-win partnerships is another condition to sustain project activities;
- Promoting the “ let them do” strategy by favouring increased engagement of NGOs and private stakeholders with state-owned bodies to ensure institutional pick-up for the project;

The establishment of the revolving funds will ensure the sustainability and replicability of the approach. Preliminary discussions are conducted with Bank of Africa Holding Group (BOA) to explore the possibility of their involvement in the establishment and management of the revolving funds. The Bank may potentially serve as Trustee and also the initiative can be the embryo of the establishment of Green Rural Habitat Funds in Senegal – GRHFS (Fonds Vert pour l'Habitat Rural au Senegal - GRHS). The GRHFS can be an exit strategy for the project at the end of project stage. Whatever will be established for the revolving funds and then the GRHFS the mechanism will be discussed and decided with local stakeholders

Replicability and scale up will be based on:

- Developing pilot actions in the form of replicable models to create a snowball effect over the whole project intervention zone;
- Building on NGOs, local governments and community-based organizations of youths and women to help replicate pilot village activities toward unsupervised villages using a concentric circle approach;
- Encouraging partnerships with projects and programs (co-financing) in similar or complementary areas around unifying programs articulated with local development plans (LDPs) that have already mainstreamed climate change.
- A communication plan and program will be implement to promote exchange of information, environmental education et communication between the different stakeholders by : (i) an institutional communication that

will be developed through coordination meetings, exchanges of technical documents, (ii) an educative communication by training technicians and local workforce (masons) on NV technologies and GDT good practices through using adaptive toolboxes; (iii) a social communication by production and large diffusion of information about NV and GDT good practices through medias (communitarian radios, ...). The concern is to promote local communication instruments as local languages in complementarity with modern instruments.

- The development of sustainable financial mechanisms in collaboration with strategic partners like BOA to promote diffusion and up scaling of the new technologies in perspective to take over the project by local municipalities, local communities and socio – professional associations into others. In this way, different activities will be linked like: (i) Creation of NV cooperatives of construction witch make together the demand of clients and the offer of constructors; (ii) the setting up of a credit line in the decentralized financial institutions to facilitate financial access; (iii) the rehabilitation of social forms of solidarity like social subscription and mutual assistance during the collective works to in housing or field works to reduce the costs.

Nubian Volte is a new and innovative concept of habitat. Therefore, it is necessary to elaborate a business model to promote implementation, sustainability, and potential aspects for scaling up.

Business model of the NV concept and sustainability approach

The business model is entirely based on the appropriation of the NV building alternative by local population and by the creation of a self-sustainable and autonomous market:

- In order to generate and develop the market, and ensure sustainable impacts, AVN has set up a dissemination methodology. AVN supports, through the involvement of **local Ambassadors** (key-persons), the emergence of a local **self-sustaining market** for NV technique. Together with AVN extension agents, they do awareness campaigns in the villages to create a demand for NV building (clients) and NV technique (apprentices). AVN will then send NV experienced masons to start the building and training process. NV artisans help AVN in raising the awareness on NV's qualities, in order to sell their skill. This **“pump-priming”** market method does not fit only into the housing sector, but also into **any other innovative technique** that needs to be vulgarized on large scale.
- The NV builders have the skills to deliver the NV technique: they are mainly subsistence farmers, trained on site as apprentices by other masons. Building activities is most often a side source of revenue outside the cropping season. They sell their know-how locally, paid 100% by their clients, in cash or in kind. They are not employed by AVN. AVN does not build for people nor make or take payments to or from clients or masons, nor does it finance construction. So there is no unsustainable charity aspect to the work; the expansion of NV building is market driven. The ultimate goal is self-sustaining, autonomous markets that expand without AVN's help, thereby creating adequate condition for sustainability and scaling up to the nearby communities.

In this way, the market is growing based on the supply and demand logic, ensuring sustainable, long term impacts. AVN recorded a 30% average annual growth rate in the number of NV built since the start of the program. In Burkina Faso and Mali, 35% of the NV market is already entirely autonomous, meaning builders find clients and apprentices on their own account, without support from AVN teams. At this stage, AVN can withdraw progressively from these areas, which is the ultimate goal of the program.

The benefit on climate change adaptation and mitigation issues are growing at the same sustainable pace as the spread of new NV constructions. The social and green entrepreneurship model proposed by AVN will bring truly transformational change and reverse the housing issues for the poorest and most vulnerable families.

For the 30 community buildings

The construction of community buildings will serve as exemplary buildings to create awareness among the population towards the many benefits of the Nubian Vault concept (more durable, more thermic and acoustic comfort, embedded in local economies, creating green jobs and improving social and economic conditions, etc.). These constructions will also increase the training of local apprentices coming from the local population and expand the market for NV masons, improving their technical and entrepreneurial capabilities. On the one hand, the majority of these buildings are for the use of target beneficiaries and, on the other hand these exemplary buildings demonstrate the value of the NV concept to local populations, promoting the development of a private NV market. At least three municipalities will be built with project technical supply some NV buildings used as offices or houses as demonstration buildings.

For the 500 NV buildings with the revolving funds and other financial mechanisms

It is necessary to indicate that the 500 NV built in project duration are constituted by 276 NV with the direct contribution of the project and the others 224 buildings through the partnership of many other operators for the dissemination of the technology model and the start of scaling up the technology. This approach is expected to permit the construction of more than 168, 700 NV over 25 years in conformity with the Senegal Emergent Plan (PSE).

Many opportunities of dissemination and scaling up the NV technology are already presented above in different sectors such agriculture, health, education, social, municipalities, in which big programs of buildings are planned in conformity with PSE program.

The forecast of NV buildings construction shows the possibility of annual growth on three progressive scenarios of 20 %, 40% and 60 % during 25 years.

It means that objectives are established in short, medium and long term to achieve the expected results and impacts of this project.

Many partners are expected to actively participate to the replication and the up scaling of NV technology such projects, municipalities, and NGO that have great experience in this area.

For example, in order to generate and develop the market, and ensure sustainable impacts, AVN has set up a dissemination methodology. AVN supports, through the involvement of **local Ambassadors** (key-persons), the emergence of a local **self-sustaining market** for NV technique. Together with AVN extension agents, they do awareness campaigns in the villages to create a demand for NV building (clients) and NV technique (apprentices). AVN will then send NV experienced masons to start the building and training process. NV artisans help AVN in raising the awareness on NV's qualities, in order to sell their new skill. This **"pump-priming"** market method does not fit only into the housing sector, but also into **any other innovative technique** that needs to be vulgarized on large scale.

The NV builders have the skills to deliver the NV technique: They are mainly subsistence farmers, trained on site as apprentices by other masons. Building activities is most often a side source of revenue outside the cropping season. They sell their know-how locally, paid 100% by their clients by cash or in kind. They are not employed by AVN. AVN does not build for people nor make or take payments to or from clients or masons, nor does it finance construction. So there is no unsustainable charity aspect to the work; the expansion of NV building is market driven. The ultimate goal is self-sustaining, autonomous markets that expand without AVN's help, thereby creating adequate condition for sustainability and scaling up to the nearby communities.

In this way, the market is growing based on the supply and demand logic, ensuring sustainable, long term impacts. For example, AVN one of the strategic project partners recorded a 30% average annual growth rate in the number of NV built since the start of the program. Today, 35% of the NV market is already entirely autonomous, meaning builders find clients and apprentices on their own account, without support from AVN teams. At this stage, AVN

can withdraw progressively from these areas, which is the ultimate goal of the program.

C. DESCRIBE THE BUDGETED M & E PLAN:

SEE ANNEX G

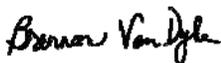
PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT(S) ON BEHALF OF THE GOVERNMENT(S): (Please attach the Operational Focal Point endorsement letter(s) with this form. For SGP, use this OPF endorsement letter).

NAME	POSITION	MINISTRY	DATE (MM/dd/yyyy)
Mariline Diara	Director Department of Environment and Gazetted States	MINISTRY OF ENVIRONMENT AND SUSTAINABLE DEVELOPMENT	03/06/2014

B. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF/LDCF/SCCF/NPIF policies and procedures and meets the GEF/LDCF/SCCF/NPIF criteria for CEO endorsement/approval of project.

Agency Coordinator, Agency Name	Signature	Date (Month, day, year)	Project Contact Person	Telephone	Email Address
Brennan Van Dyke, Director, GEF Coordination Office, UNEP		September 23, 2016	Adamou Bouhari Task Manager Biodiversity and Land Degradation UNEP/GEF	+254207623860	adamou.bouhari@unep.org

ANNEX A: Logframe (attached as separate document)

ANNEX B: Response to Review Comments (attached as separate document)

ANNEX C: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS¹³

A. PROVIDE DETAILED FUNDING AMOUNT OF THE PPG ACTIVITIES FINANCING STATUS IN THE TABLE BELOW:

PPG Grant Approved at PIF: 54,795			
<i>Project Preparation Activities Implemented</i>	<i>GEF/LDCF/SCCF/NPIF Amount (\$)</i>		
	<i>Budgeted Amount</i>	<i>Amount Spent To date</i>	<i>Amount Committed</i>
Consultants	20373	20373	0
Meetings/workshops/stakeholders consultations	27855	27855	0
Communications	2000	2000	0
Total	50228	50228	0

¹³If at CEO Endorsement, the PPG activities have not been completed and there is a balance of unspent fund, Agencies can continue undertake the activities up to one year of project start. No later than one year from start of project implementation, Agencies should report this table to the GEF Secretariat on the completion of PPG activities and the amount spent for the activities.