GET.INVEST MARKET INSIGHTS

DEVELOPER GUIDE / MODEL BUSINESS CASE / CASE STUDY

GET.invest
Mobilising Renewable Energy Investments

Senegal: Renewable Energy Applications in Agricultural Value-Chains

Developer Guide

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A NOTE TO THE READER

This Developer Guide is meant to be a 'reference document' to inform early market exploration. It is a relatively long document which summarises a wealth of details. It should best be read to obtain specific facts or information. The Guide is supplemented with Case Studies and Model Business Cases accessible at www.get-invest.eu.

ABOUT GET.INVEST MARKET INSIGHTS

The first series of GET.invest Market Insights are published in early 2019 covering four renewable energy market segments in three countries, namely: renewable energy applications in the agricultural value-chain (Senegal), captive power (behind the meter) generation (Uganda), mini-grids (Zambia) and stand-alone solar systems (Zambia).

Each Market Insight package includes **a)** a 'how to' Developer Guide, **b)** Model Business Cases and **c)** Case Studies. The Developer Guide enables the reader to navigate the market and its actors, to understand the current regulatory framework and lays down the step-by-step process of starting a new project/business. The Model Business Case analyses project economics and presents hypothetical, yet realistic, investment scenarios. It hence indicates the criteria for a viable project/business to enable the reader to identify the most cost-effective project/business opportunities. The Case Study analyses the viability of operational or high-potential projects/businesses to highlight lessons learnt and industry trends.

GET.invest Market Insights therefore summarise a considerable amount of data that may inform early market exploration and pre-feasibility studies. It is recommended to cross-read all three products to gain a comprehensive overview. The products are accessible at www.get-invest.eu.

ABOUT GET.INVEST

GET.invest is a European programme which supports investment in decentralised renewable energy projects. The programme targets private sector business and project developers, financiers and regulators to build sustainable energy markets.

Services include project and business development support, information and matchmaking, and assistance in implementing regulatory processes. They are delivered globally and across different market segments.

GET.invest is supported by the European Union, Germany, Sweden, the Netherlands, and Austria, and works closely with initiatives and industry associations in the energy sector.

FOREWORD

For meeting the challenges but also realising the opportunities of Sustainable Development Goals and climate change, a transformation of energy systems is paramount. As a key element, private sector needs to be mobilised, and scarce public resources need to be channelled into enabling and leveraging private sector investment. Through innovation, further reducing costs, a focus on low-carbon and resource-efficient solutions, the private sector will have a major role to play in the transformation towards an inclusive green economy and energy access for all.

One of the key barriers remains the access to capital, and how more projects and business ventures can successfully tap into the many existing financing options. Tackling this challenge has been the focus of the efforts of the European Union and its Member States.

In this context, the EU, Germany, the Netherlands, Sweden, and Austria jointly contribute to GET.invest, in a collaborative European effort to accelerate private investment in decentralised renewable energy projects.

Information about market opportunities as well as the country- and market-segment-specific "how to do business" is an important complementary tool to more tangible support provided by GET.invest to project and business development to access financing. We therefore expect that the Market Insights publication series will be useful to both national as well as international stakeholders in developing sustainable markets for decentralised renewable energy projects.

The Sustainable Development Goals show us what challenges still lie ahead. They also show us, however, that the current moment can be an opportunity. With everyone's commitment, bringing both public and private actors to the table, we can make a difference towards the transformation to an inclusive green economy.

Signed collectively,
the supporters of GET.invest

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ABBREVIATIONS

AEEP	Africa-EU Energy Partnership
AEME	Agence Nationale pour l'Economie et la Maitrise d'Energie (National Agency for Energy Efficiency and Management)
AEZ	Agro-ecological zones
AFD	Agence Française de Développement (French Development Agency)
AfDB	African Development Bank
AI	Aménagements Intermediaires (medium scale irrigation faculties)
ANER	Agence National pour les Energies Renouvelables (National Agency for Renewable Energy)
ANEV	Agence National des Ecovillages (The National Agency for Ecovillages)
ANIDA	Agence Nationale pour l'Insertion et le Développement Agricole (The National Agency for Agricultural Integration and Development
ANIPL	Association Nationale pour l'Intensification de la Production Laitière (The National Association for the Intensification of Dairy Production
ANSD	Agence Nationale de la Statistique et de la Démographie (National Agency for Statistics and Demography)
APIX	Agence de Promotion des Investissements et Grands Travaux (National Agency for Investment Promotion and Major Projects
ASER	Agence Sénégalaise D'Electrification Rural (Senegalese Rural Electrification Agency)
ASN	Association Sénégalaise de Normalisation (Senegalese Association for Standardisation)
ASPRODEB	Association Sénégalaise pour la Promotion du Développement à la Base (Senegalese Association to Promote Grassroots Development)
BCE	Le Bureau d'Appui à la Création d'entreprise (Business Creation Support Centre)
BCEAO	Banque Centrale des Etats de l'Afrique de l'Ouest (Central Bank of West African States)
BL	Bills of Lading
BOAD	Banque Ouest Africaine de Développement (West African Development Bank)
BOT	Build, Own and Transfer
BMN	Bureau de Mise à Niveau (Senegalese Office for upgrading businesses)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (The German Federal Ministry for Economic Cooperation and Development)
CERER	Centre d'Etudes et de Recherche sur les Energies Renouvelables (Research and Study Centre for Renewable Energy)
CFA	Franc de la Communauté Financière Africaine (West African CFA Franc)
CIDR	Centre International de Développement et de Recherche (International Centre for Development and Research)
CIFRES	Centre International de Formation et de Recherche en Energie Solaire (International Centre for Research and Training in Solar Energy)
CNAAS	Compagnie nationale d'assurance agricole du Sénégal (National Agricultural Insurance Company of Senegal)
COCC	Code des obligations civiles et commerciales (Civil and Trade Obligations Code)
COOPEC	Coopérative d'épargne et de crédit du RESOPP (Savings and Credit Cooperative of RESOPP)
COPERES	Conseil patronal des énergies renouvelables du Sénégal (The Association of Renewable Energy Sector Developers
CRSE	Commission de Régulation du Secteur de l'Electricité (Electricity Sector Regulatory Commission)

CSE	Centre de Suivi Écologique (Ecological Monitoring Centre)
DAAD	Deutscher Akademischer Austauschdienst (The German Academic Exchange Service)
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EIA	Environmental Impact Assessment
ERIL	Electrification Rurale d'Initiative Locale (Local Initiative for Rural Electrification)
ESCO	Energy service company
EU	European Union
EUEI PDF	European Union Energy Initiative Partnership Dialogue Facility
EUR	Euro
FAO	Food and Agriculture Organisation of the United Nations
FCFA	Franc de la Communauté Financière Africaine (West African CFA Franc)
FER	Fonds d'Electrification Rurale (Rural Electrification Fund)
FONGIP	Fonds de Garantie des Investissements Prioritaires (Priority Investments Guarantee Fund)
FONSIS	Fonds Souverain d'Investissements Stratégiques (Sovereign Fund for Strategic Investment)
Ft	Foot (unit)
GA	Grands Aménagements (Large scale irrigation facilities)
GCF	Green Climate Fund
GDP	Gross Domestic Product
GGGI	Global Green Growth Institute
GIE	Groupement d'Intérêt Economique (Economic Interest Group)
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Development Agency)
GNI	Gross National Income
GOANA	Grande Offensive Agricole pour la Nourriture et l'Abondance (The Great Agricultural Offensive for Food and Abundance)
GOGLA	Global Off-Grid Lighting Association
GWh	Gigawatt hour
ha	ISO code for hectare (equivalent to 100 ares, or 10,000 square meters)
HDI	Human Development Index
IEA	International Energy Agency
IFC	International Finance Corporation
IPAR	Initiative Prospective Agricole et Rurale
IPP	Independent Power Producer
IRD	Institut de Recherche pour le Développement (institute for Research and Development)
ISRA	Institut Sénégalais de la Recherche Agricole (The National Agricultural Research Institute)
JICA	Japan International Cooperation Agency
km	Kilometre
kVA	Kilovolt-amps
kW	Kilowatt
kWh	Kilowatt hour
LFP	Local Financial Partner
LOASP	Loi d'Orientation Agro-Sylvo-Pastorale (Agro-Sylvo-Pastoral Law)
LPDSE	Lettre de Développement du Secteur de l'Energie (Energy Sector Development Policy Letter)
MEDD	Ministère de l'Environnement et du Développement Durable (Ministry of Environment and Sustainable Development)
MEDER	Ministère de l'Energie et du Développement d'Energies Renouvelables (Ministry of Energy and Renewable Energy Development)
MEPA	Ministère de l'Elevage et des Productions Animales (Ministry of Livestock and Animal Production)
MFI	Microfinance Institution
MSMEs	Micro, small and medium-sized enterprises

MW	Megawatt
MWh	Megawatt hour
NGO	Non-Governmental Organisation
OHADA	Organisation pour l'harmonisation en Afrique du droit des affaires (Organisation for the harmonisation of business law in Africa)
OMVS	Organisation pour la Mise en Valeur du fleuve Sénégal (The Senegal River Basin Development Organisation)
OPIC	Overseas Private Investment Corporation
PADEN	Programme d'Aménagement et de Développement Economique des Niayes (Programme for Land Use and Economic Development of Niayes)
PAMIGA	Participatory Microfinance Group for Africa
PANER	Plan d'Actions National des Energies Renouvelables (National Renewable Energy Action Plan)
PAP	Plan d'Actions Prioritaires (Priority Action Plan)
PASER	Plan d'Action Sénégalais d'Électrification Rurale (Senegalese Rural Electrification Action Plan)
PAYGO	Pay-As-You-Go
PDMAS	Programme de Développement des Marchées Agricoles (Agricultural Market Development Programme)
PERACOD	Programme to Promote Rural Electrification and a Sustainable Supply of Domestic Fuel
PESEREE	Programme d' Enseignement Supérieur pour les Energies Renouvelables et l'Efficacité Energétique (University Programme on Renewable Energies and Energy Efficiency in Senegal)
PIP	Périmètres Irrigués Privés (Small scale private irrigation schemes)
PIV	Périmètres Irrigués Villageois (Small scale village irrigation schemes)
PNAR	Programme National d'Autosuffisance en Riz (The National Rice Self-sufficiency Programme)
PNB	Programme National de Biogaz Domestique (National Biogas Programme)
PNIA	Programme National d'Investissement Agricole (National Agricultural Investment Programme)
PPER	Programme Prioritaire de l'Electrification Rurale (The Rural Electrification Priority Programme)
PPPs	Public private partnership
PRACAS	Programme d'Acceleration de la Cadence de l'Agriculture Sénégalaise (Acceleration Programme for the Senegalese Agricultural Sector
PREM	Programme Energétique Multi-Sectoriel (Multi-Sector Energy Programme)
PSE	Plan Sénégal Emergent (Plan for an Emerging Senegal)
PV	Photovoltaic
RCCM	Registre du Commerce et du Credit Mobilier (Registry of Commerce and Movable Assets)
REEF	Renewable Energy and Energy Efficiency Fund
RESOPP	Réseau des Organisations Paysannes et Pastorales du Sénégal (Senegalese Pastoral and Farmers Organisations' Network)
SAED	Société Nationale d'Aménagement et d'Exploitation des Terres du Delta du Fleuve Sénégal et des Vallées du Fleuve Sénégal et de la Falémé (The national agency for the development of the Senegal Delta and the Senegal and Faleme River valleys)
SA	Société anonyme
SARL	A société à responsabilité limitée
SCA	Stratégie de Croissance Accélérée (Strategy for Accelerated Growth)
Senelec	Société nationale d'électricité du Sénégal (Senegalese Electricity Utility)
SME	Small and medium sized enterprises
SOCAS	Société de Conserves Alimentaires du Sénégal (Senegalese Conserved Food Company)
SODAGRI	Société de Développement Agricole et Industriel du Sénégal (The Society for Agricultural and Industrial Development in Senegal)
SUNREF	Sustainable Use of Natural Resources and Energy Finance

UCAD	Université Cheikh Anta Diop de Dakar (Cheikh Anta Diop University/University of Dakar)
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
USD	United States Dollar
VAT	Value Added Tax
W	Watt
XOF	ISO code for the West African CFA Franc (Franc de la Communauté Financière Africaine)

EXECUTIVE SUMMARY

This Developer Guide describes the opportunity for, and steps to implement renewable energy applications in agricultural value-chains in Senegal. The guide is focussed on the international and national private sector that may wish to consider the implementation of such solutions, with interested stakeholders including farmers and their associations, project developers, investors and financiers.

The Guide was prepared by GET.invest and is one component of a series of Market Insights products on renewable energy applications in agricultural value-chains in Senegal which also includes "model business cases" and "cases studies", all accessible online at www.get-invest.eu.

Information and data used in the preparation of the Guide was gathered from a number of sources: project site visits, in-country interviews with key stakeholders and a careful review of available reports and legislation.

Nascent market opportunities for three renewable energy solutions in Senegal are examined, with the Guide providing essential background information on solar PV pumps for irrigation in the rice and horticultural value chains, solar PV cooling applications for the milk value chain and biodigesters for domestic cooking applications.

The introduction of decentralised renewable energy applications can address some of the structural barriers currently limiting the growth of the country's agricultural sector. All three opportunities having significant potential to get beyond the pilot phase to have more widespread application across the country leading to amongst other benefits — cost-savings, reduction of vulnerability and increased yields.

The key takeaways are as follows:

— Boosting agricultural productivity is one of the pillars for economic and social improvement as well as achieving food security in Senegal. The Government has, therefore, made agriculture and the promotion of a modern and diversified agribusiness sector a priority. This was highlighted in the country's Strategy for Accelerated Growth which aims at promoting more varied agricultural exports and increased trade revenues.

— The agriculture and livestock sector is a main economic activity, representing approximately 17% of GDP and employing 70% of the population. The most important agricultural products in terms of gross production value include groundnuts, rice and milk. The sector has made significant strides in recent years though still possesses great potential for further growth. This is particularly with regards to the horticulture sub-sector.

— Despite significant growth, agricultural production has been unable to meet the food requirements of the growing population. This is partly due to limited access to energy for productive use — around 40% of rural households are connected to the grid. In addition, the use of irrigation systems remains low (less than 20% of land suitable for irrigation is currently being used) and post-harvest losses are estimated at between 30 to 40% for fruits, vegetables and milk (ISRA, 2008). As a result, Senegal continues to rely heavily on food imports. Approximately 65% of rice, which is the population's main staple crop, is being imported at a value of USD 460 million per year.

— The decentralised renewable energy applications as introduced above — solar PV pumps for irrigation, solar PV cooling and biodigesters — have the potential to significantly contribute to efforts to overcome the aforementioned barriers to growth in the agriculture sector:

  a) Data from existing case studies show that solar PV for irrigation is already used in various parts of the world, covering schemes ranging from a few acres to dozens of hectares and is ideally suited to application in Senegal's horticulture sub-sector;

b) Husbandry represents 28.8% of the primary sector and sustains about 30% of the rural population in Senegal. One of the particular challenges for the milk sub-sector is the lack of cooling facilities resulting in up to two thirds of production going to waste. Adoption of solar cooling could be preferred over kerosene or bottled gas refrigerators by reducing the risk of fuel supply, associated transport costs and quality problems;

c) Utilisation of waste through biodigesters to generate biogas for cooking and/or conversion to electricity is a tried and tested method in Sub-Saharan Africa. Sources of organic matter for such developments are widely available and underutilised in Senegal.

— The total market value for the above-mentioned renewable energy applications is estimated at EUR 66.7–123.7 million, with the largest potential identified for solar-powered irrigation. The market has additional potential for growth in the coming decades as Senegal continues to expand its agricultural sector.

— Senegal is also continuously improving its investment climate. The procedures for company incorporation have been greatly improved and several fiscal benefits have been introduced to target investments towards the agriculture and renewable energy sectors. The light-handed permitting system for small-scale energy projects adds further attraction.

One of the key challenges to the successful rollout of renewable energy applications in agricultural value chains in Senegal is access to finance. With an average farmer income estimated at CFA 646,500 (EUR 986) in 2011, and credit access being estimated at 18%–34.5%, innovative business models and risk capital will be required to unlock the market potential. A number of promising pilot projects and initiatives have emerged in recent years, including a Pay-As-You-Go (PAYGO) system for solar-powered micro-irrigation, a EUR 13 million Facility for Water and Renewable Energy led by the Participatory Microfinance Group for Africa and an Enda-Energie/Ecodev led programme building solar PV micro-grids that supply electricity to decentralised milk processing systems and households at the same time. Such initiatives demonstrate an increasing interest in the sector and provide valuable market insights for first movers and investors.

SECTION 1

Introduction

Senegal has made strides in recent years to improve its business climate; this is being recognised through its position as a top-ten Doing Business reformer on several occasions.[1] With a track record as a stable nation, the government is keen to continue on a path of steady economic growth.

Boosting agricultural productivity is one of the pillars for economic and social improvement as well as achieving food security. The lack of access to modern energy services is, however, hampering agricultural development and food production. With rural electrification rates at around 40%, the use of irrigation systems remain low (less than 20% of land suitable for irrigation is currently being used) and post-harvest losses are estimated at between 30 to 40% for fruits, vegetables and milk (ISRA, 2008) due to the lack of proper storage, processing and transportation facilities. In addition, a rural energy source of biogas from converted plant or animal waste that can be used directly for cooking and/or converted to electricity, continues to go under-utilised.

The introduction of decentralised renewable energy applications within agricultural value-chains in Senegal has the potential to address some of the structural barriers limiting the growth of the sector. This Developer Guide describes the opportunity for, and steps to implement such solutions, being focused on the international and national private sector. Targeted stakeholders, including farmers and their associations, project developers, investors and financiers. Essential background information is provided about the nascent market segments[2] of:

a) Solar PV pumps for irrigation in the rice and horticultural value chains;

b) Solar PV cooling applications for the milk value chain;

c) Biodigesters for domestic cooking applications.

The Developer Guide is meant to provide a consolidated resource of key information for early stage market exploration. The Guide is not intended to substitute for on-the-ground market research activities. Indicative information is provided based on document reviews and interviews undertaken with numerous stakeholders in Senegal in late 2017 and early 2018. Due to the absence of some data, the nascent status of the market and the sector's pace of development, readers are encouraged to review the material referenced, consult with relevant authorities and seek insights from their business network to obtain further details and confirm the latest market information in the country.

The Guide is organised across six different sections. Following this introduction, the next two sections target new market entrants and provide an overview of the country, **Section 2**, and its electricity sector, **Section 3**. **Section 4** offers a market segment overview and review of business models for solar irrigation, solar cooling and biodigesters in Senegal. **Section 5** details administrative procedures for business development and implementation in country, with **Section 6** further discussing financing options. The Annexes provide additional information for investors and developers who want to start a business in Senegal including, among others, a non-exhaustive list of key stakeholders and institutions as well as an introduction to the incorporation formalities.

Exchange rates used in this guide are from October 2017:

CFA[3] – EUR	655.957*
CFA – USD	558.95
USD – EUR	1.1735522

*Note: The West African CFA Franc (Franc de la Communauté Financière Africaine), utilised in Senegal, is pegged to the Euro at a fixed exchange rate and guaranteed by the French Treasury.

1) Link: http://www.doingbusiness.org/reforms/top-reformers-2016 – accessed January 2019

2) Agricultural value chains and renewable energy technologies were identified and selected based on consultations with relevant stakeholders in Senegal

3) CFA is utilised throughout this Guide, though FCFA and XOF could have also been used

SECTION 2

Country Profile

Senegal is the westernmost point on the African mainland with its northern region situated in the Sahel belt. It has historically served as the gateway to West Africa and remains one of the most stable nations on the continent having gained independence from France in 1960.

2.1 GEOGRAPHY, TOPOGRAPHY AND CLIMATE

Senegal has a land area of approximately 196,190 km² with a total boundary length of about 3,171 kilometres (km), of which over 530 km is Atlantic Ocean coastline (**Figure 1**). It is fairly flat and is drained by several large rivers including the Senegal and the Falémé. The northern part of the coast has dunes from Cap Vert to Saint-Louis. Behind the coast is a sandy plain, extending to the floodplain of the Senegal River. The Casamance region in the south is low but more varied in relief and rises to a maximum altitude of 581 m. Much of the northwest of Senegal (known as the Ferlo) is semi-desert, but the centre and most of the south, except for the forest of Casamance, are open savanna (Jones, 1992).

FIGURE 1. Map of Senegal[4]

4) Link: http://www.un.org/Depts/Cartographic/map/profile/senegal.pdf – accessed January 2019

Senegal has three types of climate: hot semi-arid (e.g. Dakar, Diourbel), hot desert (e.g. Louga, Dagana) and tropical savanna climate (e.g. Kolda). Temperatures vary according to the season and are lowest along the coast and highest inland with the peak temperatures in the northeast. Whereas there is virtually no rainfall in the desert climate, there is little rainfall in the semi-arid and more in the tropical savanna climates. As shown through the example of Dakar (**Figure 2**), it mostly rains between June and October. The wet season is shorter in the north and longer in the south, especially near the southwest coast. The average annual rainfall ranges from 34 cm at Podor in the extreme north to 155 cm at Ziguinchor, in the southwest.

The semiarid regions in the north are typical of the Sahel zone and are home to pastoral societies. The wetter region in the central and southern part of the country has a mix of settled farming communities and wooded savannas (CILSS, 2016). The central part of the country, which mainly focuses on cash crops such as groundnuts, is characterised by high rural population density which has completely transformed the original landscape (AFD/CIRAD, 2011). The east and southwest have not yet seen the agricultural expansion of the (north-)western parts, but are being subject to extensive exploitation of their forest resources for charcoal production and over-harvesting for timber.

2.2 DEMOGRAPHICS, WEALTH AND POVERTY REDUCTION

Senegal's population was recently estimated at 15.4 million (**Table 1**), with high fertility rates translating into almost 43% being younger than 15 years old (OECD, 2017). The urbanisation rate is relatively high with 44% living in urban areas (**Table 1**). About 42.7% of the population lives below the national poverty line[5], though there are geographic disparities with rural areas registering significantly above that figure at over 57%[6].

TABLE 1. Demographic indicators[7]

Population (2016)	15.4 m
Population growth (2017 est.)	2.39%
Median age (2017 est.)	18.8 years
Urbanisation rate (2015–2020 est.)	3.73% p.a.
Urban population (2017)	44% of total
Rural population (2017)	56% of total
Population density (2017)	82 per km²
HDI (2015)	162 of 188

2.3 POLITICAL AND ECONOMIC SITUATION

Senegal is one of the most stable countries in Africa and has considerably strengthened its democratic institutions over the last decades. Politically, since independence from France in 1960, Senegal has had peaceful transitions. As at the time of writing, the president is His Excellency Macky Sall, with the next presidential election planned for 2019. The legal system is based on the French Civil Law, and the highest court is the Supreme Court (*Cour suprême du Sénégal*).

From the mid-1990s until 2005, Senegal had one of the best performing economies in Sub-Saharan Africa. The share of the population below the national poverty line declined from 68% in 1994–1995, to 57% in 2000–2001, and to 51% in 2005–2006, marking the first sustained increase in average per capita growth since independence in 1960.

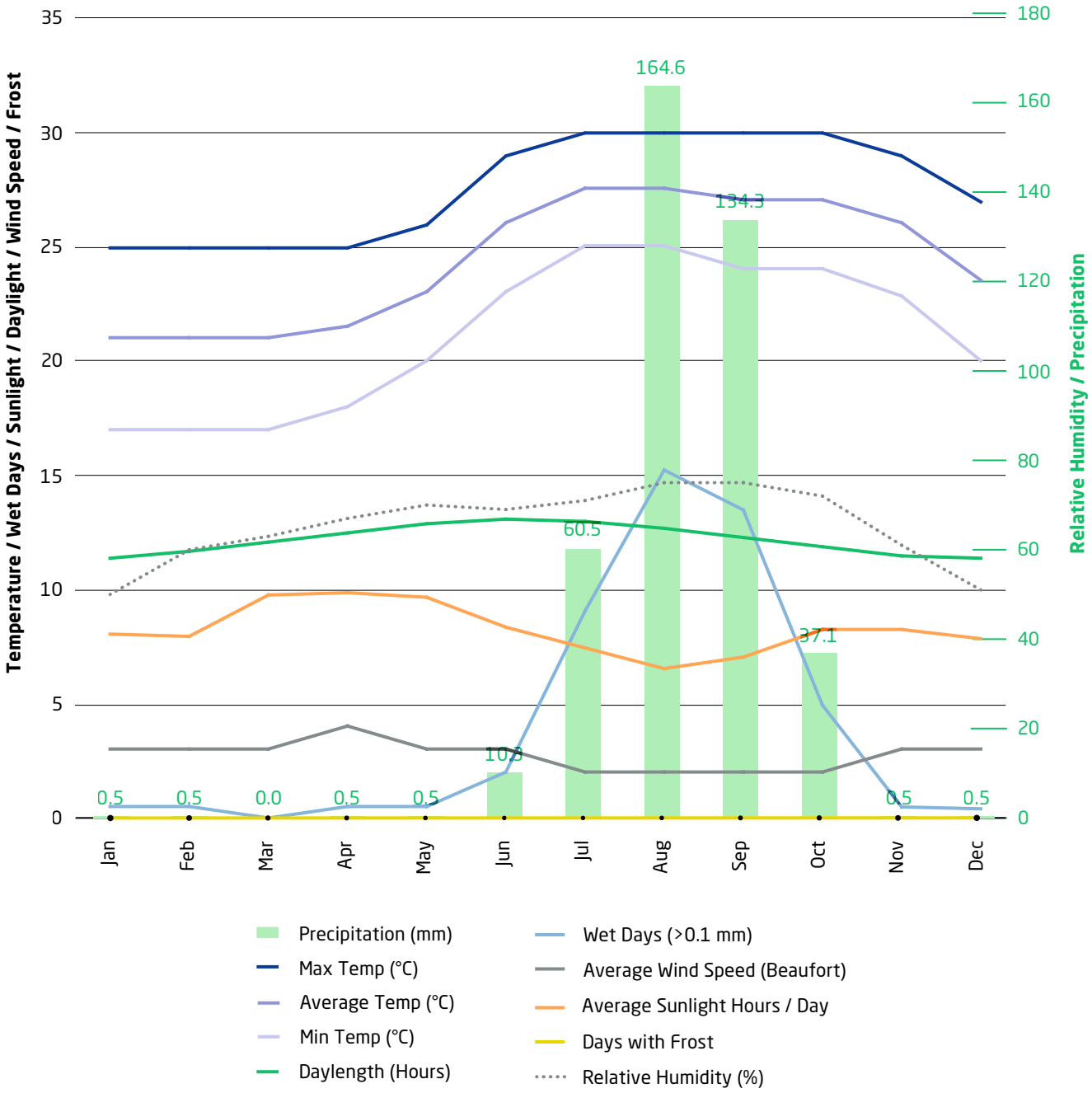
Starting in 2006, several external and domestic shocks took a toll on the economy. Agricultural output experienced a sharp decline due to unfavourable rain fall in 2006–07. In addition, the rising oil prices, the surge in food prices in 2007 and the global financial crisis, which started in 2008, weighed heavily on Senegal's open economy. Domestic shocks, including floods in the Dakar region and continued electricity shortages, further contributed to the general slowdown of the country's economic activity.

5) A 2011 World Bank survey calculated the country specific poverty rate at 46.7%, though the same institution reports (April 2018) that due to good economic growth this rate has reduced by between 4 to 7% (42.7% to 39.7%). Link: https://data.worldbank.org/indicator/SI.POV.NAHC?locations=SN&view=charthttps://data.worldbank.org/indicator/SI.POV.NAHC?locations=SN&view=chart – accessed January 2019

6) Link: https://data.worldbank.org/indicator/SI.POV.RUHC?locations=SN&view=chart&view=charthttps%3A%2F%2Fdata.worldbank.org%2Findicator%2FSI.POV.NAHC%3Flocations%3DSN – accessed January 2019

7) The **Table 1** references can be found in **Table 18** in the document references section

FIGURE 2. Climate chart for Dakar at altitude: 22 m [8]



8) Link: http://www.dakar.climatemps.com – accessed January 2019

In recent years, the economy has started to recover again, making Senegal the second fastest growing economy in West Africa in 2016. Growth remained strong in 2017 being recorded at 6.8%, with the African Development Bank (AfDB) predicting further improvement in 2018 projecting a 7% growth rate (AEO, 2018). The primary sector has been identified as the most dynamic, growing at over 7%[9] with agriculture playing a critical role.

The slowly diversifying economy will also benefit from the continued implementation of the Plan for an Emerging Senegal (PSE — *Plan Sénégalais d'Emergence*). The plan implemented through the five year, 2014–2018 Priority Action Plan (PAP — *Plan d'Actions Prioritaires*) and supporting budget framework are currently in their final year. The aim is to ease bottlenecks to growth and facilitate private initiatives through basic structural reforms. The ultimate goal is turning Senegal into an emerging economy by 2035 with an average growth of 7% at that time (AEO, 2017). The national currency, the West African CFA franc is pegged to the Euro and guaranteed by the French Treasury.

TABLE 2. Senegal – macro-economic indicators[10]

GDP (2017), USD million current	16,375
GDP growth (2017), %	6.8
GDP annual growth rate forecast (Q2 2019), %	7.5
GNI per capita (2017), PPP current int'l USD	2,620
Inflation (May 2018), % year-on-year	0.5
Inflation Rate Forecast (Q2 / 2019), %	0.6
Foreign Direct Investment, net inflows (2016), Balance of Payment current USD	392,815,565
Net official development assistance (2016), current USD	736,390,000
Budget deficit (2016), % of GDP	4.1
Ease of Doing Business (2017), rank of 190	140
Transparency International Corruption Index (2016), rank of 176	64
National Currency	West African CFA franc (XOF/FCFA/ CFA)
Exchange rate (fixed) EUR	1 EUR = 655.957 CFA

2.4 AGRICULTURAL AND LIVESTOCK SECTOR

The agriculture and livestock sector is Senegal's main economic activity, representing approximately 17% of gross domestic product (GDP) and employing 70% of the population. Production has been growing steadily in past years reaching an aggregate value of close to USD 1.5 billion in 2014 with crops making up over 90% of the value.

Senegal is divided into six agro-ecological zones (AEZs) based on biophysical and socio-economic characteristics (**Figure 4**). Although most crops are grown across the country, certain crops are more dominant in specific zones being — River Valley (irrigated rice, vegetables); Niayes (80% of the horticulture produced in the country); the Groundnut Basin (groundnuts, millet); Silvo-Pastoral zone (livestock); Eastern Senegal and upper and lower Casamance (rainfed rice, vegetables and fruits).

The three most important agricultural products in terms of gross production value are groundnuts, rice and milk (**Figure 5**) with the horticulture sub-sector identified as key with great growth potential.

Despite significant growth in recent years, the agricultural sector in Senegal has been unable to meet the food requirements of the growing population. This has resulted in a heavy reliance on food imports, especially rice which is the population's main staple crop with imports accounting for 65% of national consumption at a value of USD 460 million in 2013 (**Figure 6**). Other notable examples include onions and milk with production deficits of 33% and 41%, respectively.

9) Link: http://www.worldbank.org/en/country/senegal/overview – accessed January 2019

10) The **Table 2** references can be found in **Table 18** in the document references section

FIGURE 3. Growth of agriculture and livestock sector in current million USD[11]

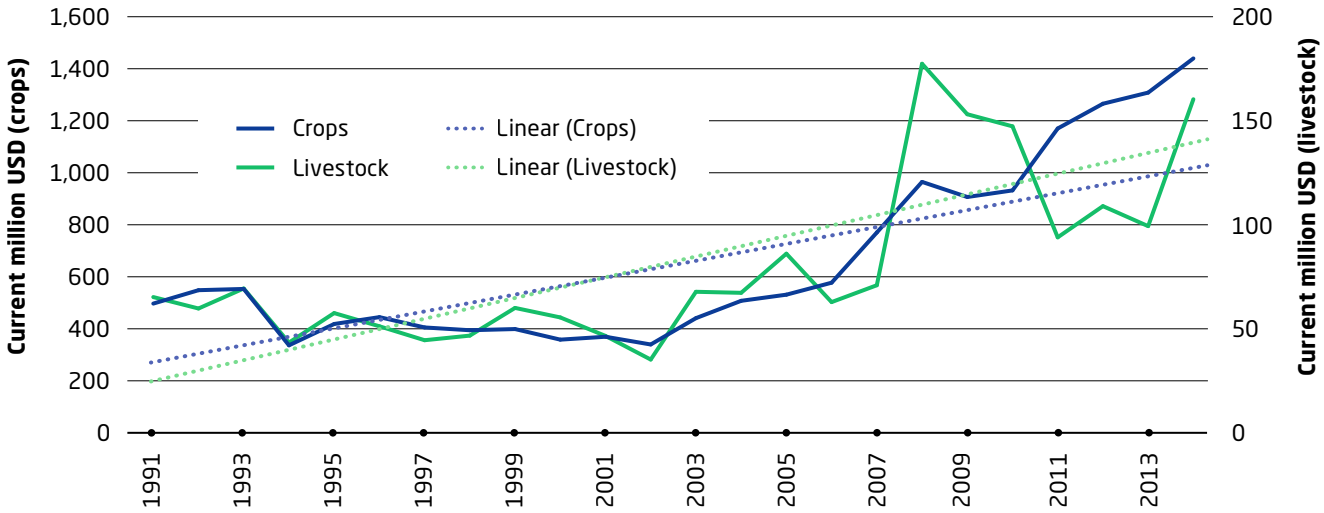
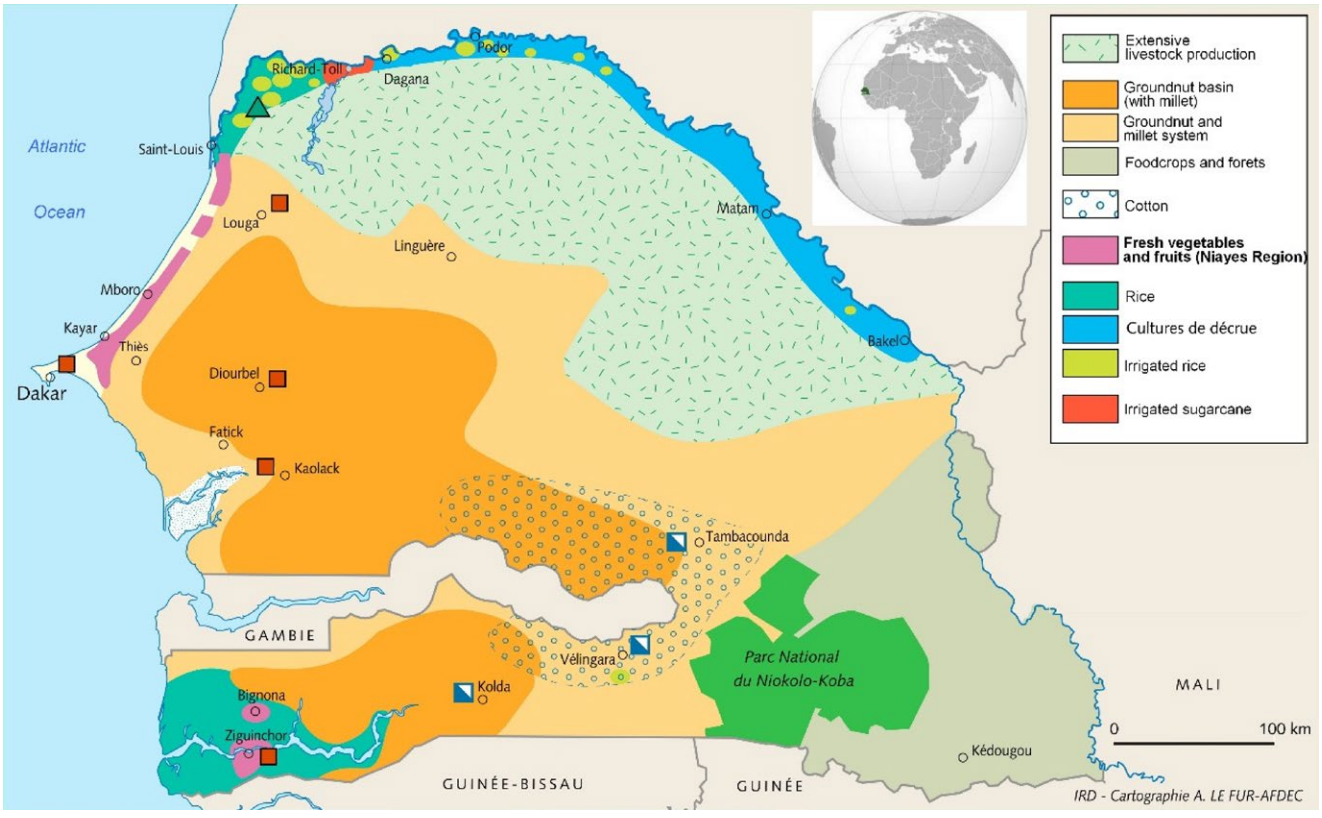


FIGURE 4. Senegal – agro-ecological zones (IRD)[12]



11) FAOSTAT (2014). Link: http://www.fao.org/faostat/en/#country/195 – accessed January 2019

12) Referenced in Fare et al. (2017). Link: http://dx.doi.org/10.3390/agriculture7070059 – accessed January 2019. Also, adapted from IRD – Institut de Recherche pour le Développement (French). Link: http://www.cartographie.ird.fr/SenegalFIG/evol_agricole.html – accessed January 2019

FIGURE 5. Gross production value of main agricultural products in Senegal[13]

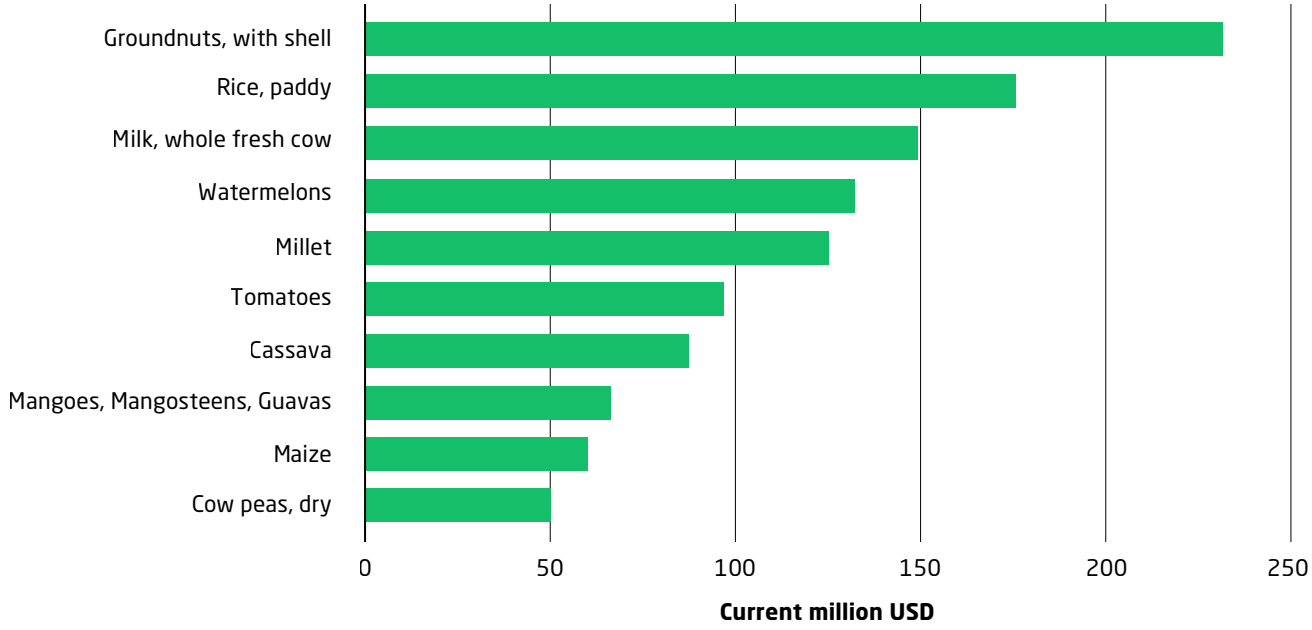
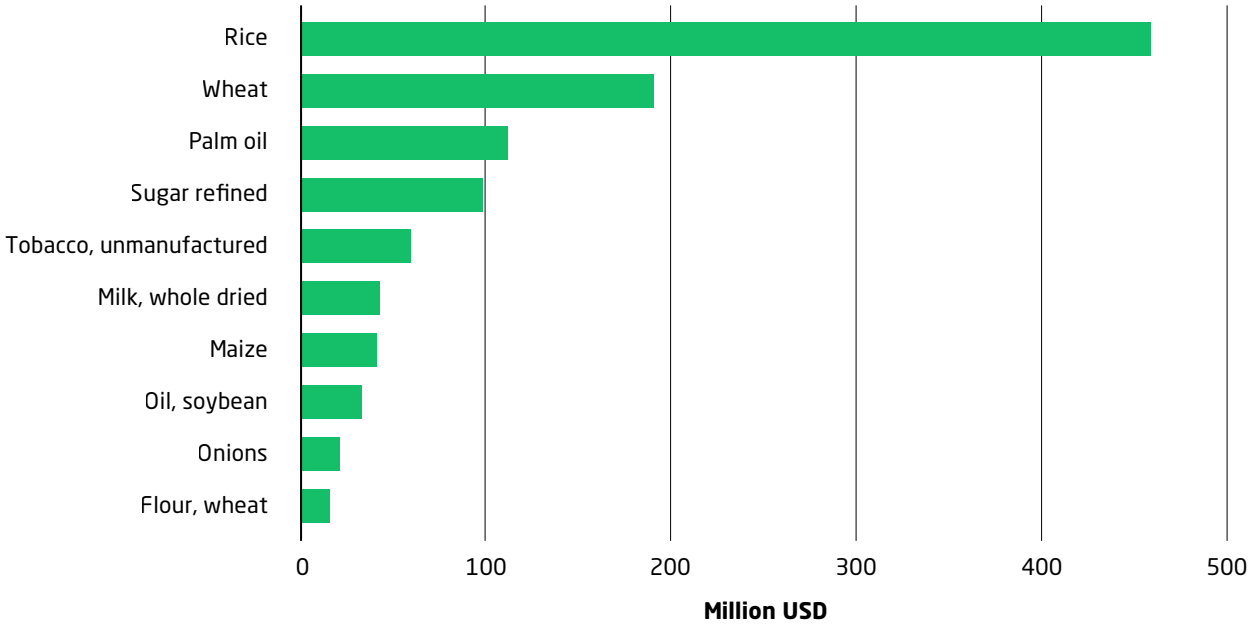


FIGURE 6. Value of food imports in Senegal[14]



13) FAOSTAT (2014). Link: http://www.fao.org/faostat/en/#country/195 – accessed January 2019
14) FAOSTAT (2013). Link: http://www.fao.org/faostat/en/#country/195 – accessed January 2019

Therefore, the Government of Senegal has made agriculture and the promotion of a modern and diversified agribusiness sector a priority. This was highlighted in the country's Strategy for Accelerated Growth (SCA — *Stratégie de Croissance Accélérée*) which aims at promoting more diversified agricultural exports and increased trade revenues. The Government has also directed a number of actions towards the development of commercial agriculture including making structural investments with donor support such as building specialised infrastructure (e.g. post-harvest processing, storage and logistics), improving the judicial framework with the adoption of the investment code and several laws Agro-Sylvo-Pastoral Law (LOASP — *Loi d'Orientation Agro-Sylvo-Pastorale*), and programs. For example, the Great Agricultural Offensive for Food and Abundance (GOANA — *Grande Offensive Agricole pour la Nourriture et l'Abondance*), National Agricultural Investment Programme (PNIA – Programme National d'Investissement Agricole), National Rice Self-Sufficiency Programme (PNAR — *Programme National d'Autosuffisance en Riz*) and the Agricultural Market Development Programme (PDMAS — *Programme de Développement des Marchés Agricoles de Sénégal*).

SECTION 3

Electricity Sector Profile

The Government has made power sector development a key component of the PSE, with main challenges to be tackled including decreasing dependence on imported fossil fuels, ensuring affordability and expanding electricity access — particularly in rural areas.

In recent years, Senegal has shown a strong commitment to renewable energy, for example with the passing of a framework law in 2010 and the formulation of a National Action Plan for Renewable Energy (PANER — *Plan d'Actions National des Energies Renouvelables*) in 2015. Rural electrification, using both conventional and renewable resources, has also been identified as key to reducing poverty and increasing rural living standards.

In 2017, Senelec (*Société nationale d'électricité du Sénégal*)[15], the national utility, reported an installed capacity of 967.83 Megawatts (MW) comprised of 57% of utility owed plants and 43% from Independent Power Producers (IPPs). This total is further complimented through imports contracted regionally, these equal 95 MW from Mali (75 MW) and Mauritania (20 MW) bringing the total capacity serving the country to 1,063 MW.

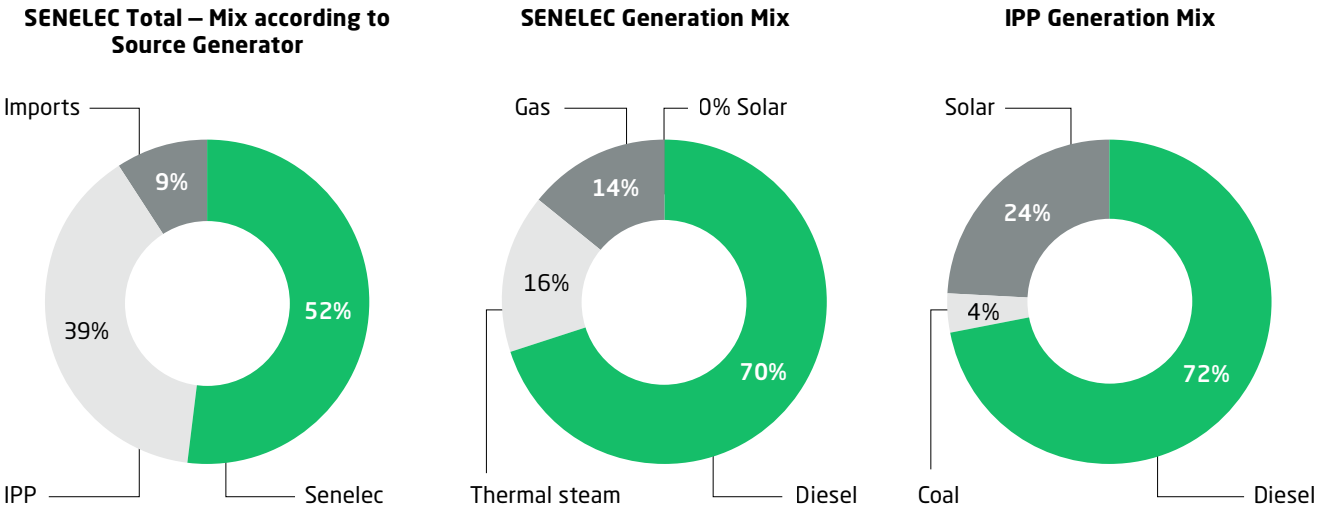
The Senegalese electricity sector is dominated by fossil fuel based power generation with diesel power plants alone representing over 70% of the nationally installed capacity (686 MW of 968 MW) in 2017 (see **Figure 7**). This portion rises further to reach 89% when all fossil fuels are taken into consideration.

Grid connected renewable energy projects are increasing their contribution. The first utility-scale solar PV plant (20 MW) was commissioned in the Northern part of the country (Bokhol) in October 2016, developed and financed by the French platform Greenwish Partners. Since then, an additional three plants are listed in the national figures totalling 79.5 MW — Santhiou-Mekhe (30 MW), Malicounda (20 MW) and Ten Merina (29.5 MW).

3.1 ELECTRICITY POLICIES AND REGULATIONS

The main pieces of legislation governing the electricity sector in Senegal are the Electricity Law of 1998 (*Loi d'Orientation No. 98–29*) and the Renewable Energy Law of 2010 (*Loi d'Orientation sur les Energies Renouvelables No. 2010-21*).

FIGURE 7. Senegalese electricity generation mix[16]



15) Senelec (2017). Link http://www.senelec.sn/production/ – accessed January 2019
16) Senelec (2017). Link: http://www.senelec.sn/production/ – accessed January 2019

The 1998 Electricity Law laid the foundation for the current legislative framework for electricity sector development, leading to important sector reforms aimed at improving electricity supply and access. The Law effectively opened up the market to public and private sector participation, establishing conditions of competitiveness. Its main reforms include the:

— establishment of an independent regulator in the form of the Electricity Sector Regulatory Commission (CRSE — *Commission de Régulation du Secteur de l'Électricité*) , whose function and procedures were further laid out in Decree 98-333;

— establishment of the Senegalese Rural Electrification Agency (ASER – *Agence Sénégalaise d'Electrification Rurale*), whose function and procedures were elaborated in Decree 99-1254;

— introduction of a licensing and concession system for all electricity generators, distributors and retailers, both from the public and private sector. Decree 98-334 sets out further terms and conditions for the issuance of the licenses and concessions.

The Electricity Law was amended in 2002 to transfer the responsibility for tendering IPP contracts from the Senegalese national utility Senelec (*Société nationale d'électricité du Sénégal*) to the CRSE. The 2010 Renewable Energy Law complements the Electricity Law and introduces specific measures to incentivise the implementation of renewable energy projects. The enactment of the Law was followed by the adoption of a number of implementing decrees, including:

— Decree 2011-2013, which provides conditions on power purchase and remuneration for electricity generated by renewable energy plants and grid connection, covering renewable power purchase obligation and tariff calculations.

— Decree No. 2011-2014, which specifies the conditions for purchasing surplus renewable electricity from self-producers. This includes setting the maximum intake from renewable energy sources (variable power) and the purchase price.

On a strategic level, the principal document guiding Senegal's energy strategy is the Energy Sector Development Policy Letter (LPDSE — *Lettre Politique de Développement du Secteur de l'Energie*), which has been published on a regular basis since 1997. The latest revision of the LPDSE, published in 2012, provided a critical look at the achievements to date and introduced an important role for renewable energy with a target of reaching a 20% consumption rate by 2017 and 30% by 2030. The 2012 LPDSE particularly articulated the need to link the energy sector with other sectors (including agriculture). It calls for a broadening of people's access to modern energy services by ensuring a more equitable distribution of efforts, specifically targeting underserved areas. The 50% rural electrification target, which was initially set for 2012, was thereby extended to 2017. The preparation of a new and updated LPDSE 2018-2022 is currently underway with the draft document going through a validation exercise during early 2018[17]. Reports highlight that the letter is being drawn up at a time when key strategic sector studies are being completed, that include the transmission-production master plan for electricity, the rural electrification investment plan for universal access and the first phase of the study assessing purchase of electricity.

Apart from the LPDSE, the Government of Senegal laid out a specific vision for the sector through the National Strategy on Renewable Energy Development in Senegal 2016-2020 (Stratégie Nationale de Développement des Energies Renouvelables au Sénégal 2016-2020). The strategy introduces a number of priority actions, such as strengthening access to modern renewable energy services, including through its use for pumping, cooling and domestic cooking from biogas.

For the implementation of its energy strategies, the Government of Senegal has formulated specific action plans for both rural electrification and renewable energy:

— The National Action Plan for Renewable Energy of 2015 (PANER) was prepared by the ECOWAS centre for Renewable Energy and Energy Efficiency (ECREEE) and the Ministry of Energy and Renewable Energy Development (MEDER — *Ministère de l'Energie et du Développement d'Energies Renouvelables*) in the context of the implementation of the Economic Community of West African States (ECOWAS) Renewable Energy Policy.

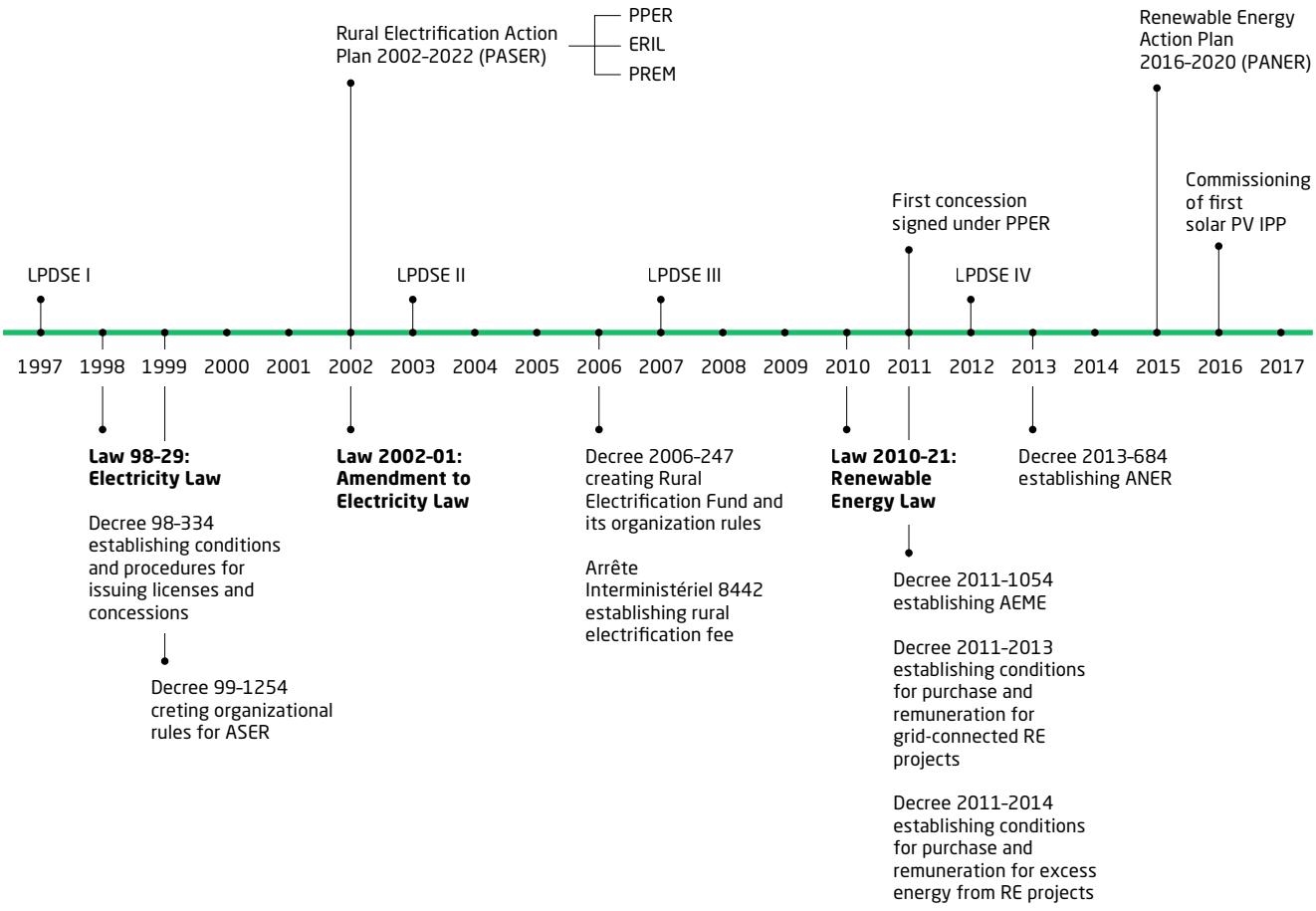
— The Senegalese Rural Electrification Action Plan (PASER — *Plan d'Action Sénégalais d'Électrification Rurale*) is a 20-year strategy focused on mobilising the private sector to increase

17) Link: http://www.aps.sn/actualites/article/un-expert-souligne-la-necessite-d-assoir-une-forte-regulation-dans-le-domaine-energetique – last accessed January 2019, link no longer available

rural electrification rates. PASER came into force in 2002 and it is administered by ASER. Its target is to achieve a rural electrification rate of 62% by 2022. PASER is divided into three programs, addressing different challenges of rural electrification:

- The Rural Electrification Priority Programme (PPER — *Programme Prioritaire de l'Électrification Rurale*), which coordinates regional-scale concessions for electricity services;
- The Local Initiative for Rural Electrification (ERIL — *Électrification Rurale d'Initiative Locale*), which promotes small-scale concessions for communities not benefitting from the priority program;
- The Multi-sector Energy Programme (PREM — *Programme Énergétique Multisectoriel*), which aims to broaden the social and economic benefits of electrification.

FIGURE 8. Electricity sector policies, laws and regulations



3.2 INSTITUTIONAL ARRANGEMENTS

Under the 1998 Electricity Law, the Minister of Energy is responsible for the preparation and implementation of sector policies, the definition of national electrification plans as well as standards applicable to the sector. The Minister grants licenses and concessions as foreseen in the Electricity Law and signs the accompanying contracts.

Under the auspices of the Ministry of Energy, the main actors in the electricity sector are the following:

The aforementioned **Electricity Sector Regulatory Commission** (CRSE — *Commission de Régulation du Secteur de l'Electricité*) acting as an independent regulator whose main roles and responsibilities include:

— Examining applications for generation licenses and concessions for the transmission and distribution of electricity;

— Ensuring compliance with the terms and conditions of issued licenses and concessions;

— Making general changes to licenses, concessions or their specifications;

— Ensuring compliance with the technical standards applicable to companies in the sector;

— Ensuring compliance with competition rules in the electricity sector; and

— Determining the structure and the composition of the tariffs applied by the companies holding licenses or concessions in accordance with the provisions of the Law.

The state-owned utility, **Senelec**, was established by Law 83-72 of 5 July 1983. Until 1998, Senelec held a public monopoly over electricity generation, transmission and distribution. The 1998 Electricity Law saw the generation and distribution of electricity being de-monopolised, however Senelec maintained exclusivity over transmission and bulk purchase and sale of electricity. Senelec is also responsible for the development of generation capacity by using new facilities of its own or through IPPs.

The **Senegalese Rural Electrification Agency** (ASER — *Agence Sénégalaise d'Electrification Rurale*) was formally created by decree in 1999 with the sole aim of promoting rural electrification. The Agency is autonomous, however it functions as an arm of the Ministry for Energy, whilst also reporting to the Ministry of Finance and to the CRSE. Its roles and responsibilities are laid out in Article 30 of the 1998 Electricity law which include:

— Development of rural electrification programs in line with national plans (e.g. PASER);

— Provision of financial and technical assistance to support rural electrification initiatives;

— Encouragement of 'bottom-up' rural electrification project proposals from private operators;

— Organisation of invitations to tender for 'top-down' electricity distribution concessions;

— Provide loans and grants to licensed entities that operate in rural areas;

— Supervision of the contracted installations resulting from these activities;

— Manage the Rural Electrification Fund.

ASER is currently responsible for three rural electrification programmes delivered under the Senegalese Rural Electrification Action Plan (PASER), the aforementioned — Rural Electrification Priority Programme (PPER), Local Initiative for Rural Electrification (ERIL) and Multi-Sector Energy Programme (PREM).

The **National Agency for Renewable Energy** (ANER — *Agence Nationale pour les Energies Renouvelables*) was established by decree 2013-684 with the mandate to promote the implementation of renewable energy projects. Its main role is to facilitate the realisation of the various private and public sector initiatives that emerged after the adoption of the Renewable Energy Law of 2010. ANER has also been tasked with carrying out studies, raising awareness and mobilising international finance.

The **National Agency for Energy Efficiency and Management** (AEME — *Agence Nationale pour l'Economie et la Maitrise d'Energie*)[18] was established by decree 2011-1054 and is responsible for the promotion of energy efficiency measures across all sectors of the economy.

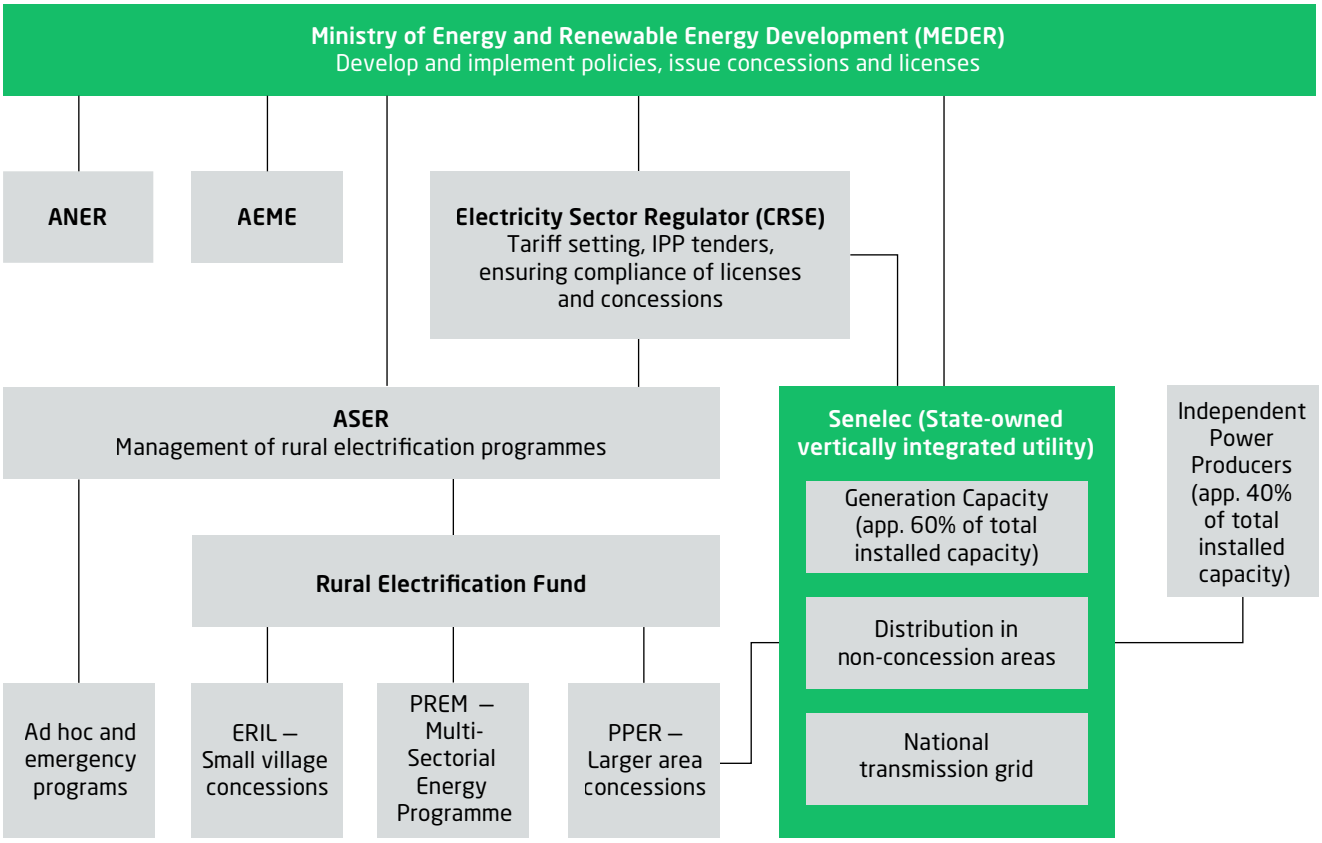
Through these reforms, private sector engagement has increased. This can be witnessed through various IPPs supplying electricity to the national grid and large concessions awarded to third-party actors for the supply and distribution of electricity (see **Section 3.5**).

Figure 9 provides a schematic overview of the main actors in the electricity sector in Senegal.

3.3 ELECTRICITY DEMAND AND ELECTRIFICATION RATES

The country's transmission system is relatively widespread as displayed in **Figure 10**, with losses estimated at around 19% (World Bank, 2017b). Within the map below the high voltage lines are displayed in red, including the connection to the Manantali Hydro power plant (60 MW) in Mali, and the lower voltage lines in green.

FIGURE 9. Structure of the Senegalese electricity sector[19]



18) Formerly the National Agency for Energy Economics (ANEE – *Agence Nationale d'Economie de l'Energie*)

19) Adapted by author from World Bank (2015b: p9)

FIGURE 10. Map of electricity generation and transmission in Senegal (2009)[20]

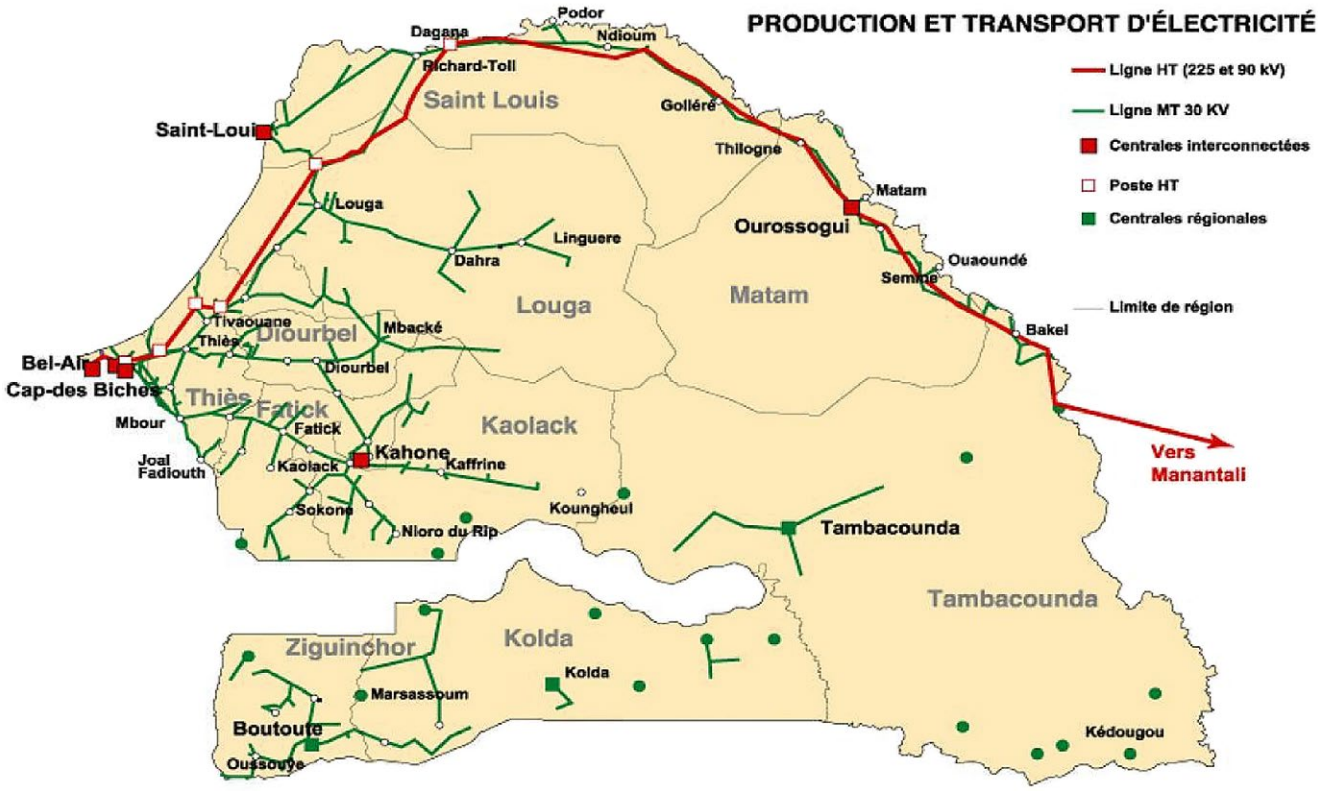
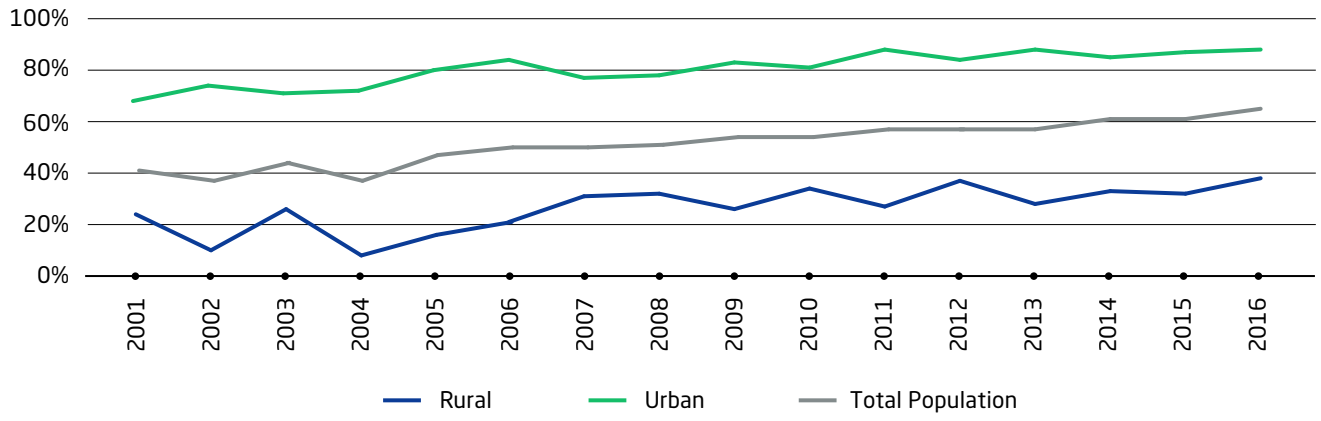


FIGURE 11. Growth of electrification rates in Senegal from 2001-2016[21]



20) World Bank (2015b)
21) Link: https://data.worldbank.org/indicator/EG.ELC.ACCS.RU.ZS?end=2016&locations=SN&start=1991&view=chart – accessed January 2019

Electrification rates have steadily grown over the past two decades (**Figure 11**) and reached over 60% in 2014, the World Bank reporting a figure of 64.5% in 2016 which is high compared to other African countries. Nevertheless, the difference between urban (87.7%) and rural (38.3%)[22] areas remains significant.

Whilst there has been a notable growth in the installed generation capacity from 540 MW in 2010 to over 960 MW in 2016, the new added capacity is unable to meet the demand growth as seen with the supply deficit reported by CRSE at around 31GWh of electricity in the period 2015/16 (CRSE, 2016a). Senelec (2017a) figures report peak demand growth from 533.32 MW in 2015 to 560.3 MW in 2016 representing a 5% increase. The World Bank (2017a) estimates a higher year on year growth rate of 8%. Both figures present a challenge to the relevant authorities, despite the recent capacity additions, to supply secure and low cost electricity to the Senegalese population.

Senelec (2017a) had close to 1.2 million customers in 2016, up almost 7% from the previous year. The largest electricity consumer per economic sector being residential, closely followed by industry and commercial and public services while the agricultural sector is the lowest, as shown in **Figure 12**.

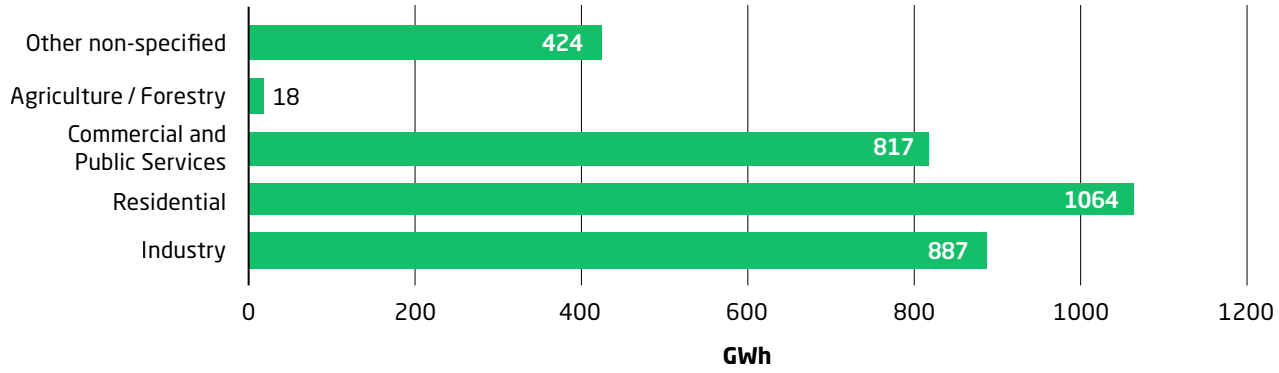
3.4 ELECTRICITY TARIFFS

Considering the average electricity prices across the whole ECOWAS region, Senegal sits below the average. The country is ranked 9th out of 15 in terms of lowest electricity prices (**Figure 13**). Electricity tariffs have been stable over the last five years with Senelec (2017a) reporting an almost static figure of 0.14 EUR/kilowatt hour (kWh) in 2015 and 2016.

The pricing of electricity services is established and controlled by the CRSE with tariffs subject to 'price ceiling' regulation. The tariff conditions and the period of application is defined on a case-by-case basis and are specified in the license or concession documents of the sales license holder or rural electrification concession holder. The tariff definition by MEDER and the CRSE allows for cost-reflection in order to enable concession holders to obtain a normal rate of return.

Table 3 and **Table 4** summarise the tariffs charged by Senelec depending on the client type and electricity use profile. Peak hours cover 19:00 to 23:00 and Off-peak hours cover 23:00 to 19:00. Electricity charges of concession holders in rural areas may differ from the Senelec tariffs though subscribers within a concession pay the same rate for an identical energy service.

FIGURE 12. Electricity consumption per economic sector in 2015[23]



22) 38.3% in accordance with the latest World Bank figure, with initial reports on the latest Senegalese Government figures pointing towards 40% being achieved in 2017. Link: http://www.info24sn.com/petrole-et-gaz-senegalais-le-ministere-du-petrole-fait-letat-des-lieux/ – accessed January 2019

23) Senelec (2016)

FIGURE 13. Average electricity price by country[24]

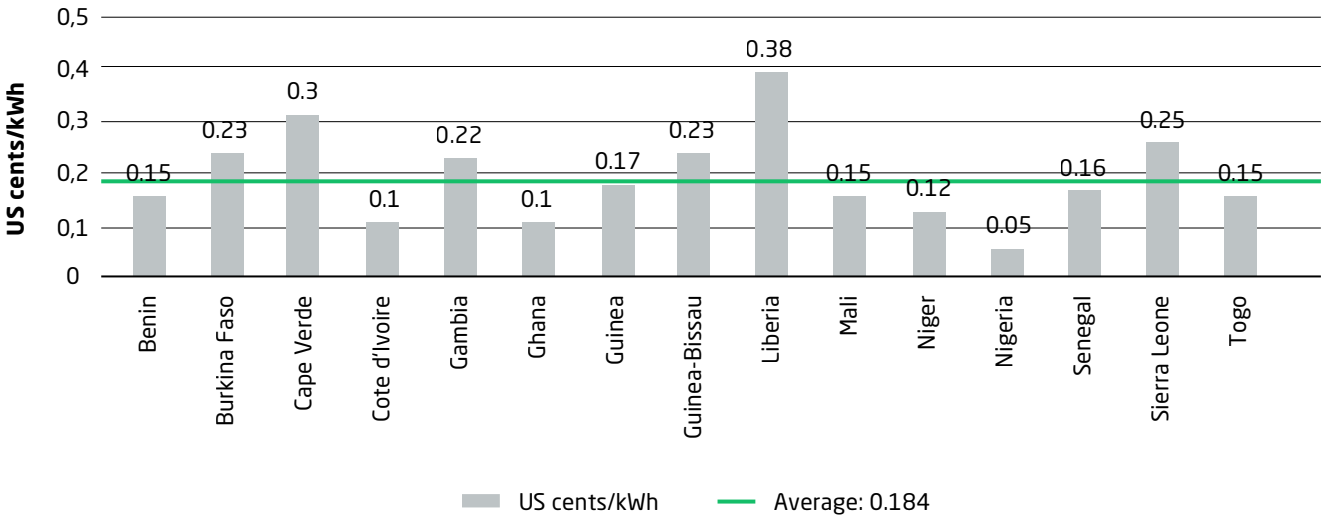


TABLE 3. Low voltage electricity tariffs[25]

CONSUMPTION CLASS	CURRENCY	1ST PORTION < 151 kWh	2ND PORTION 151-250 kWh	3RD PORTION >250 kWh
Domestic use				
<6 kilowattt (kW)	CFA	90.47	101.64	112.65
<6 kW	EUR	0.14	0.15	0.17

CONSUMPTION CLASS	CURRENCY	1ST PORTION < 50 kWh	2ND PORTION 51-300 kWh	3RD PORTION >300 kWh
Domestic use				
6–17 kW	CFA	96.02	102.44	112.02
6–17 kW	EUR	0.15	0.16	0.17

CONSUMPTION CLASS	CURRENCY	1ST PORTION < 50 kWh	2ND PORTION 51-500 KWH	3RD PORTION >500 kWh
Professional use				
<6 kW	CFA	128.85	135.68	147.68
<6 kW	EUR	0.20	0.21	0.23

24) ECREEE (2017)
25) SENELEC (2017). *Tarif d'électricité hors taxe applicable à partir du 1er Mai 2017*. Link: http://www.senelec.sn/tarification/ – accessed January 2019

CONSUMPTION CLASS	CURRENCY	1ST PORTION < 100 kWh	2ND PORTION 101-500 kWh	3RD PORTION >500 kWh
Professional use				
6–17 kW	CFA	129.81	136.53	149.24
6–17 kW	EUR	0.20	0.21	0.23

CONSUMPTION CLASS	CURRENCY	OFF-PEAK HOURS	PEAK HOURS	FIXED CHARGE
Domestic use — larger consumers				
17–34 kW	CFA	86.30	120.81	869.21
17–34 kW	EUR	0.13	0.18	1.32

CONSUMPTION CLASS	CURRENCY	OFF-PEAK HOURS	PEAK HOURS	FIXED CHARGE
Professional use — larger consumers				
17–34 kW	CFA	103.36	165.38	2,607.63
17–34 kW	EUR	0.16	0.25	3.98

TABLE 4. Medium voltage electricity tariffs[26]

TARIFF	UNIT	GENERAL (1,001-4,000 HOURS/YEAR)	SHORT USE (<1,000 HOURS/YEAR)	LONG USE (>4,000 HOURS/YEAR)
Service charge	CFA/month	3,861.89	907.32	9,321.26
Service charge	EUR/month	5.89	1.38	14.21
Peak hours	**CFA/kWh**	**136.46**	**118.51**	**70.07**
Peak hours	**EUR/kWh**	**0.21**	**0.18**	**0.11**
Off-peak hours	CFA/kWh	85.29	183.48	112.12
Off-peak hours	EUR/kWh	0.13	0.28	0.17

3.5 RURAL ELECTRIFICATION

Until 1998, rural electrification was managed through small-scale covenants between the government and Senelec without a long-term strategy. Efforts focused on medium-voltage grid expansion with a few villages electrified by decentralised generators. Generation, transmission and distribution infrastructure were largely state-funded, but connection fees and internal installation costs were passed directly to consumers (Mawhood, 2014). In 2002, following the adoption of the national plan PASER, the responsible agency ASER was tasked with managing rural electrification using a concession approach. Subsequently, three separate but complementary programs were developed:

26) SENELEC (2017) Tarif d'électricité hors taxe applicable à par tir du 1er Mai 2017. Link: http://www.senelec.sn/tarification/ – accessed January 2019

— **The Rural Electrification Priority Programme (PPER)**: Was established as the main mechanism. In essence, PPER is a "top-down" approach under which the country was divided into 10 concession territories. Contracts to build and operate power infrastructure and to provide electricity services are awarded by technology-neutral competitive tenders for a period of twenty-five years. Winning bids are those that propose to connect the greatest number of households in return for a predefined viability gap financing (an additional viability gap financing is available for renewable technologies). The first six large concession contracts were signed between 2008 and 2011 (see **Figure 14**). These concession contracts became operational between 2011 and 2015 with four of the six concessions supplying electricity to customers as of October 2015.

— **The Local Initiative for Rural Electrification (ERIL)**: Within the concessions territories, ASER was also tasked to encourage "bottom-up" village-level concessions by communities, consumer groups or private operators. These projects are primarily targeting areas that will not be connected by the PPER concessions in the short to medium term. Typically, ERILs are small areas, often of village size and their usual promoters include Non-Governmental Organisations (NGOs) and community organisations. In order to obtain an authorisation to create an ERIL, a request form must be filled and validated by the CRSE. Notwithstanding the possible existence of the ERILs within its concession area, the PPER concessionaire retains the exclusivity to the retail sale of low voltage electricity within its territory. The possible take-over of an ERIL project by a PPER concessionaire has to be agreed by the parties under the supervision of the CRSE.

— **The Multi-Sector Energy Programme (PREM)**: The focus areas of PREM are **a)** to maximise the effects of the energy resource on economic and social development in rural areas, and **b)** to stimulate electricity consumption for productive and community use in rural areas. The latter includes various forms of productive use for agriculture and livestock management. PREM's can be implemented by a PPER concessionaire or by other actors. In the latter case, the actor implementing an energy project can sell excess electricity or transfer the entire project to the PPER concessionaire.

Projects that are implemented under ASER's three rural electrification programmes are eligible for funding from the Rural Electrification Fund (FER – *Fonds d'Electrification Rurale*) in the form of grants and concessional debt. ASER's rural electrification model has had mixed success. On the one hand, the winning bids under the PPER secured a total of USD 52 million of private finance, representing an average 49% of the total investment (Mawhood, 2014). This is significantly greater than the minimum 20% required by the invitations to tender. On the other hand, results in terms of installations are far less impressive. In ten years, the different concession programmes realised 6,121 electricity connections, representing an increase of less than 1% in national rural electrification levels.[27]

3.6 RENEWABLE ENERGY RESOURCES

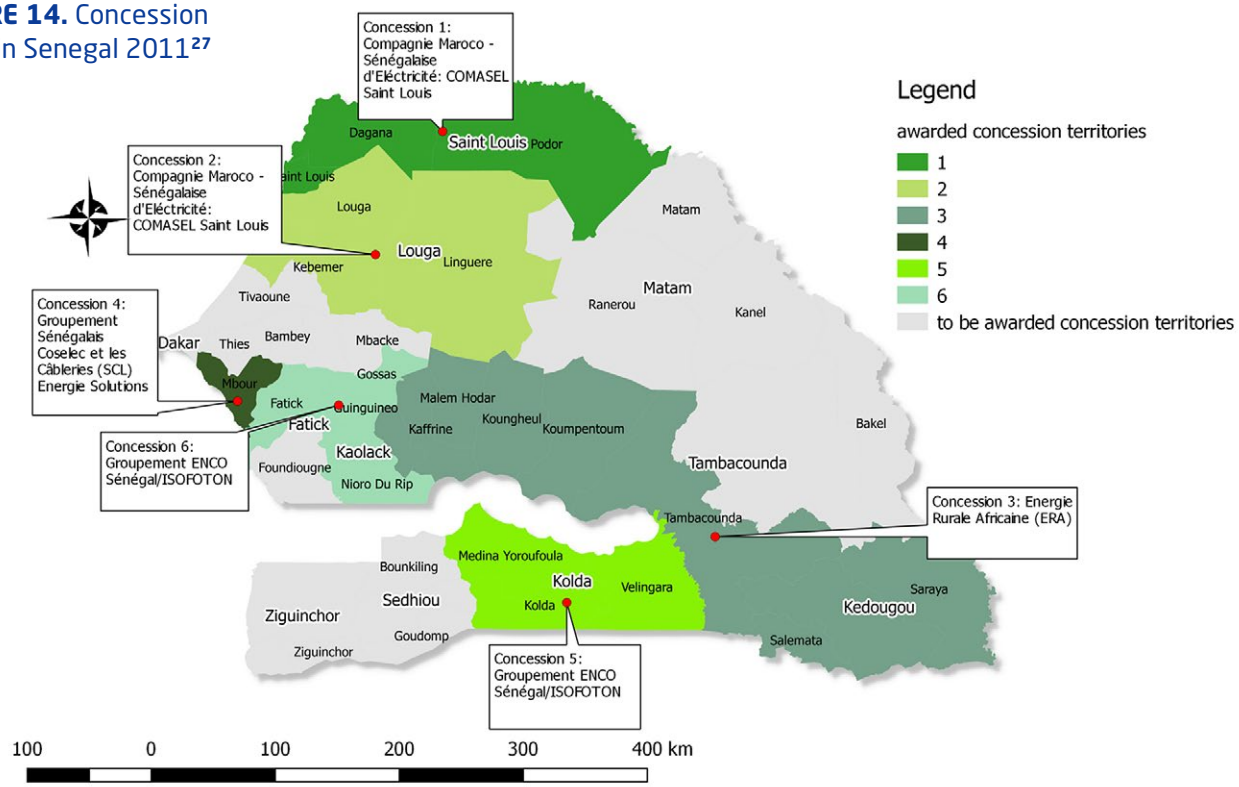
Senegal has strong potential for renewable energy generation, though most of its resources remain untapped. Solar irradiation is above 2,000 kWh/m²/year for Global Horizontal Irradiation across most of the country (**Figure 15**) with an average global daily irradiation calculated at 5.43 kWh/m²/day (REEEP, 2014). This gives excellent prospects for photovoltaic (PV) projects as well as for the use of solar thermal technologies.

Solid biomass in the form of agricultural by-products is available in most parts of the country. Biomass resources, such as agricultural waste (approximately 3.3 million dry tons of agricultural residues) and agribusiness by-products (rice husks, bagasse, peanut shells, cotton stalks, etc.) have potential uses in on-grid and off-grid electricity generation to the extent of 2,900 GWh generating potential (ECREEE, 2015). Animal waste is one of the most important streams with an estimated potential of 32,000 tons of dry matter per day (Vilar, 2012).

27) On 12 November 2017, ASER announced on its Facebook website that 3,020 households had been connected in the Dagana-Podor-Saint Louis concession in 50 days between 28 August and 18 October 2017. This could be an indication that the concession model is still gaining traction

28) ASER (2012). Also, concession operators in English. Link: http://www.crse.sn/operateur-electrification-rurale-0 – accessed January 2019. Concessions 1 and 2 – COMASEL Saint-Louis of the Morocco Senegalese Electricity Company a subsidiary of Morocco's electricity utility, the National Electricity Office (O.N.E – *Office National de l'Electricité*); Concession 3 – African Rural Energy (ERA) whose majority shareholder is Electricité de France (EDF) a French electric utility company, largely owned by the French state; Concession 4 – SCL Energy solutions is comprised of STEG International Services (STEG-IS) a subsidiary of the Tunisian Company of Electricity and Gas (STEG – *Société Tunisienne de l'Electricité et du Gaz*) and COSELEC; Concessions 5 and 6 – The Senegalese Energy Services Company ENCO and the Spanish firm ISOFOTON

FIGURE 14. Concession areas in Senegal 2011[27]



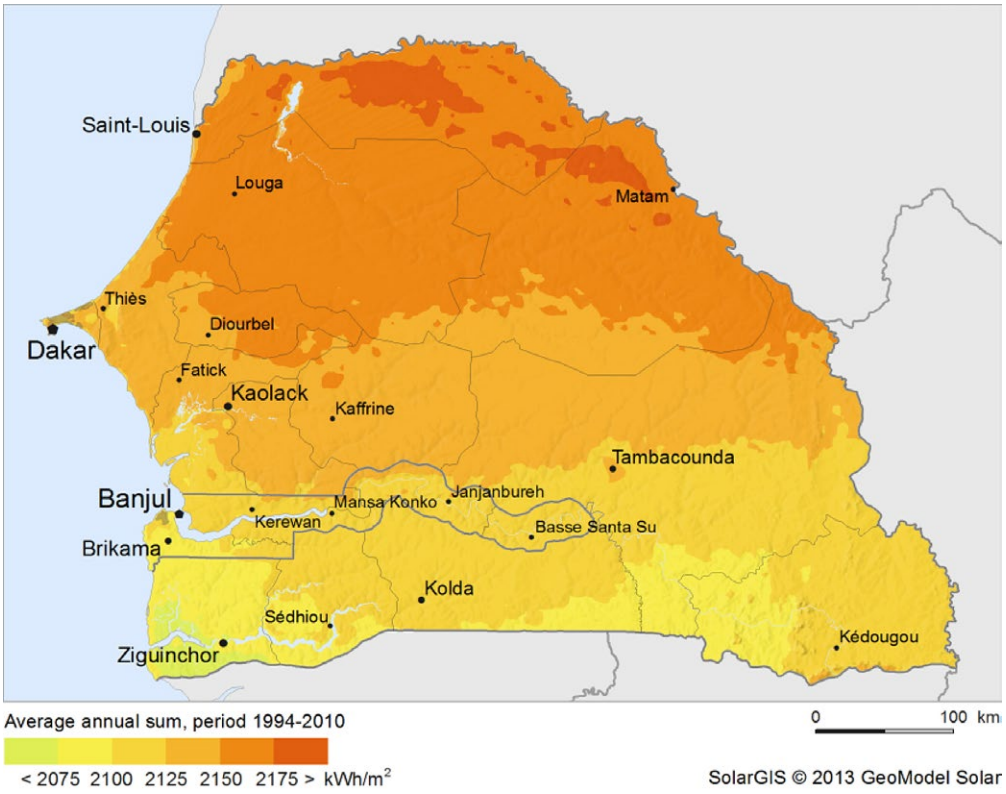


FIGURE 15. Global horizontal irradiation in Senegal

SECTION 4

Scoping the Market Potential for Renewable Energy Applications in Agricultural Value Chains in Senegal

Decentralised renewable energy applications can play a significant role in improving agricultural value chains, increasing productivity and reducing food losses (IRENA, 2016b; EUEI-PDF, 2015). Within this context, this chapter discusses three renewable energy technologies, being solar PV for irrigation, solar PV for cooling and domestic biodigesters. The chapter starts with a brief introduction of the technologies. Next, a customer segmentation and market potential is presented. The chapter concludes with a discussion of different business models to introduce such renewable energy technologies into the agricultural value chains.

4.1 OVERVIEW OF RENEWABLE ENERGY TECHNOLOGIES FOR AGRICULTURAL VALUE CHAINS

Renewable energy technologies can be applied at different stages in agricultural value chains as presented in **Table 5**: Entry points for renewable energy at different stages of the agricultural value chains (IRENA, 2016b). In the context of Senegal, solar PV for irrigation, solar PV for cooling and the use of biodigesters for domestic cooking have been identified as particularly relevant. Each of these technologies is being discussed in more details next.

Solar PV for Irrigation

Solar-powered irrigation has been gaining prominence in the past decade, as one of the measures that can improve yields and reduce vulnerability to erratic rainfall patterns, mostly threatening arid land. The areas that are most affected by changing rains normally also have abundant solar resources, making solar pumping an attractive solution.

Data from existing case studies show that solar PV for irrigation is already used in various parts of the world covering schemes ranging from a few acres to dozens of hectares (ha) and with installed capacities of less than 100 Watts (W) to several tens of kW. Solar PV for irrigation is considered particularly relevant in the context of Senegal given the country's long history of promoting irrigation and the promising growth of the horticultural sector.

Various technical designs for solar pumps[30] exist depending on the use case and specific context. Solar irrigation systems can be installed in combination with submersible pumps or surface pumps and can be used for surface sprinkler and drip irrigation. A schematic overview for the case of drip-irrigation is depicted in **Figure 16**.

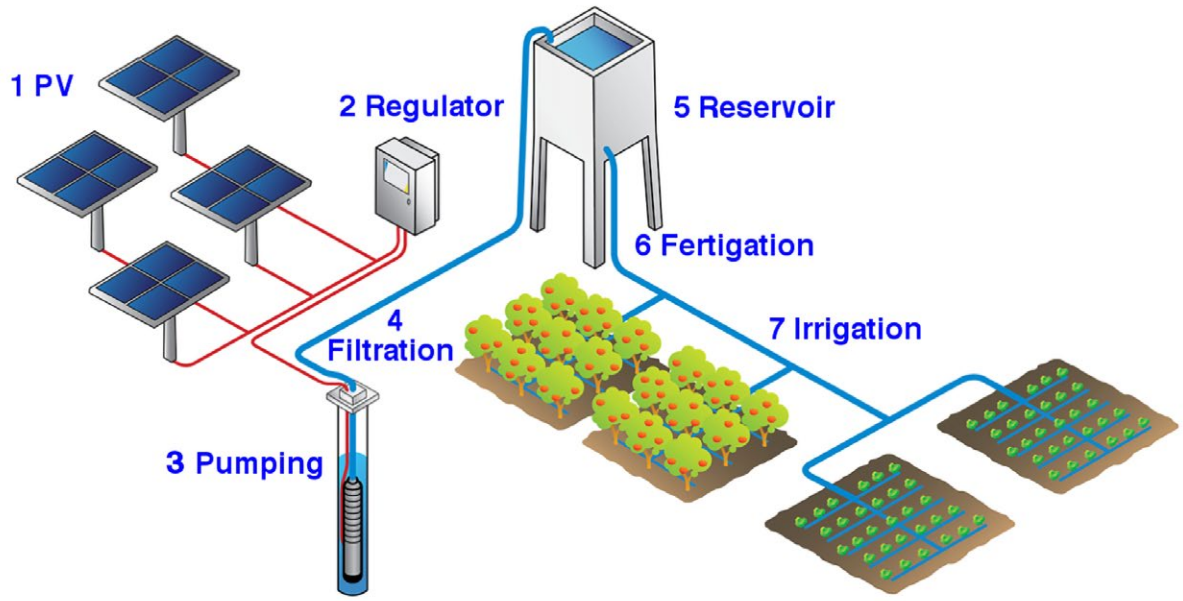
TABLE 5. Entry points for renewable energy at different stages of the agricultural value chains[29]

Primary Production	— Solar, wind-based water pumping — Biofuels for tractors and on-farm machinery — Solar-based desalination, heating and cooling for protected cropping — Biomass residues use for on-site energy generation
Post-Harvest and Storage	— Solar, geothermal food drying — Solar cooling and refrigeration
Transport and Distribution	— Biofuel use for transportation and distribution — Solar cooling and refrigeration
Processing	— Solar, wind, hydro-based milling and threshing — Renewable energy-based electricity and heat applications
Retail, Preparation and Cooking	— Renewable energy-based water purification — Modern biomass use for cooking applications

29) IRENA (2016b)

30) The annex of the GET.invest Model Business Cases for solar irrigation in Senegal contains more details on solar pumps. The Model Business Case can be found at www.get-invest.eu

FIGURE 16. Schematic diagram of a solar PV powered irrigation system[31]



Solar Cooling in the Milk Value Chain

Husbandry represents 28.8% of the primary sector and sustains about 30% of the rural population in Senegal. One of the particular challenges for the milk sub-sector is the lack of cooling facilities. As a result, significant amounts of milk, reported as high as two thirds of the production, goes to waste (ISRA, 2008). The milk-producing regions of the country are also among the least developed, sometimes barely accessible and mostly without access to the power grid. Adoption of solar cooling could, therefore, be preferred over kerosene or bottled gas-fuelled refrigerators by reducing the risk of fuel supply, associated transport costs and quality problems (IRENA 2016b).

Solar energy can be used in two distinct ways to achieve cooling: by absorption refrigeration (Kim & Infante Ferreira, 2008) and by electrically driven refrigeration (Freischlad, 2017). A schematic drawing of the latter is shown in **Figure 17**. More adapted options for rural areas without grid connection can rely on preparing cooled media (e.g. water) with solar and afterwards partly storing in systems (e.g. tanks or ice blocks) for supply during the night.

Domestic Biodigesters

The utilisation of waste through biodigesters to generate biogas and electricity is a method tried and tested in Sub-Saharan Africa with examples from Kenya (Africa Biogas, 2017c) and Ethiopia (Africa Biogas, 2017b) that each supported the installation of over 10,000 small scale units. Biodigesters generate biogas by converting organic matter/biomass (plant or animal waste) into methane and carbon dioxide through anaerobic digestion. The gas can be used for cooking and/or converted to electricity with the wastewater by-product serving as organic fertiliser. Biomass sources in Senegal include pig, cow, goat, donkey and horse faeces as well as plant waste from crops such as millet, maize, peanut, cowpea and rice. Biomass waste is widely available, especially in areas with an active husbandry sector (e.g. Louga, Kolda).

A typical biogas unit consists of a mixing tank (to mix the dung with water), an inlet, a digester tank and an expansion chamber (**Figure 18**). The bacterial decomposition of the mixture produces biogas, which is collected under the dome and pushes the digested slurry out to the expansion chamber. The main technology, that requires relatively little maintenance, can be constructed with materials that are locally available and can be erected by local masons (IRENA, 2016b).

31) Unknown creator, "Schematic diagram of a solar PV powered irrigation system". Not licensed. Link: https://www.energy4impact.org/ – accessed April 2019

FIGURE 17. Schematic diagram of a solar-powered milk cooling tank during charging and discharging[32]

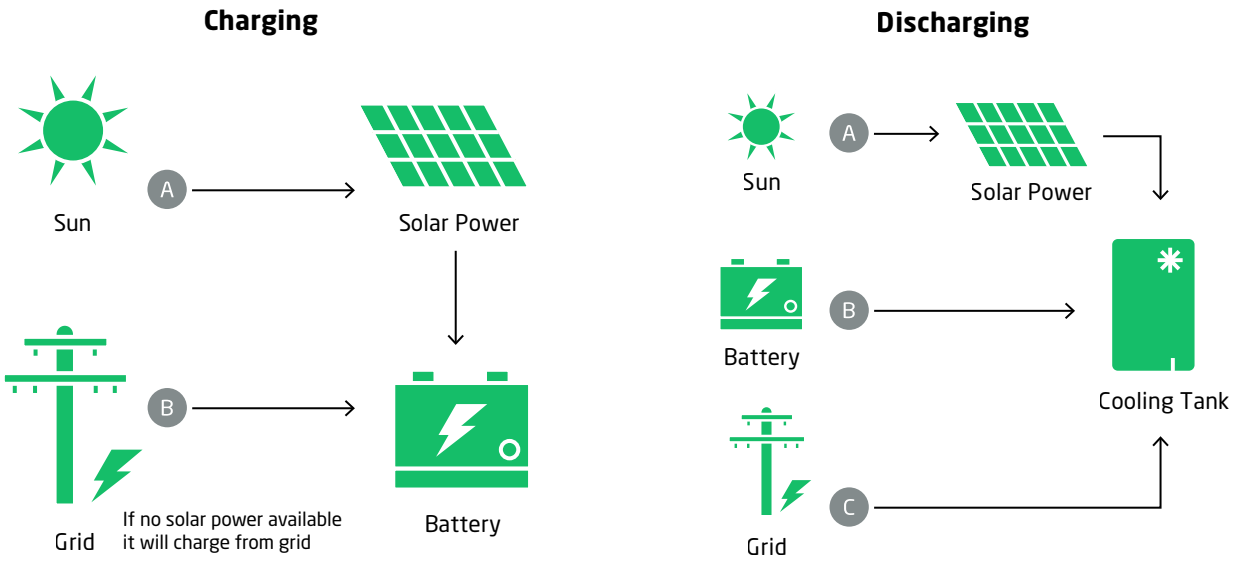
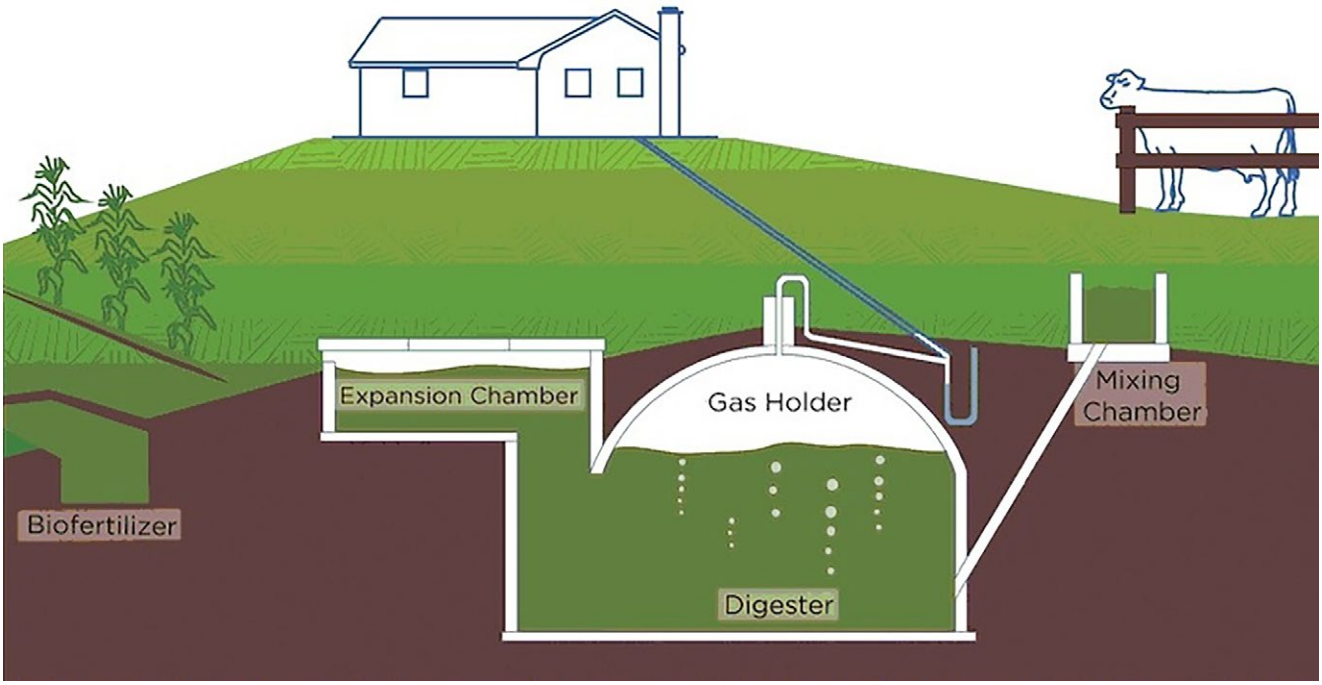


FIGURE 18. Schematic drawing of a biogas unit[33]



32) Link: www.dairyequipments.com
33) Unknown creator, "Model of Biogas Plant". Not licensed. Link: http://biogas-technology.blogspot.com/2013/09/how-biogas-plant-works.html – accessed April 2019

In Senegal, biodigesters with an average capacity of 8–10m³ are currently being installed in rural households (ECREEE, 2015). They provide clean cooking gas and energy for at least one lighting source and the waste water serves as organic manure for crops with an important secondary market emerging for this latter by-product. Easier-to-install second generation biodigesters have recently been proposed to drive down installation time and reduce loading charges.

4.2 MARKET SEGMENTATION AND CUSTOMER PROFILING

Key characteristics of farm practices and agricultural households

Close to 50% or over 750,000 Senegalese households are active in the agricultural sector and are considered "farming households" (ANSD, 2014), meaning that at least one member of the household practices agriculture. This does not include households whose members are employed in the agricultural sector, for example as seasonal laborers. The large majority of agricultural households carry out a combination of rain-fed agriculture and livestock breeding in so-called agro-pastoral systems[34] (**Figure 19**).

Agricultural activities focus both on cash crops (e.g. groundnuts and cotton) and subsistence agriculture with excess production of non-cash crops being typically sold on the local market. Livestock is used for subsistence (milk and milk products), land preparation (oxen), savings and insurance against crop losses. Most agro-pastoral farms only keep a few animals with larger herds being found among pastoralist communities. Pure pastoralism is only found in the drier areas, where approximately one third of the country's livestock is kept (Government of Senegal, 2009). Pastoralist households and communities are characterised by high mobility and are therefore more difficult to reach.

Ninety percent of the agricultural lands in Senegal are occupied by small-scale and family-based farms. Commercial agriculture represented only 5% of the land under production in the early 2000s, but has been growing steadily, accounting for 10.7% in 2013 (FAO/IFC, 2016).[35] Farmers typically hold several plots with plot sizes varying between 1–5 ha. In most cases, crops are only grown during the wet season (**Figure 20**). Exceptions can be found in areas under irrigation where 2 to 3 growing seasons are sometimes used.

In 2011, the average farming income was estimated at CFA 646,500 (EUR 986) per year. In many cases, this income was further complemented by revenue from other activities (employed or non-employed) as well as transfers received from relatives living in the city or abroad. It can be expected that the farming income will have increased since 2011, however, the overall value remains low given that rural families spent 75% of their income on food and housing. In addition, income distribution is found to be unequal with 85.2% of agricultural households earning less than the average farming income of CFA 54,000 (EUR 82) per month (IFPRI, 2017). According to a 2011 survey (ANSD, 2013), poverty is particularly widespread among independent farmers, affecting 61.1% of farming households compared to a 46.7% national poverty rate.

TABLE 6. Senegal – agricultural sector facts and figures

Area cultivated	3.5 million ha
Number of farming households	755,559
Main agricultural activities	Agro-pastoralism (combination of rainfed agriculture and livestock), irrigation and pastoralism
Farm types	90% smallholders 10% agribusiness
Average farmer income	CFA 646,500 per year (EUR 986)
Poverty incidence	61.1% of farming households

34) Livestock keeping is practiced in all regions of Senegal, with 73.9% of all households keeping livestock being found in rural areas. Most of these households also practice rain fed crop production, which is the most dominant form of agriculture at 87.1% of all households, in what is known as agro-pastoral agriculture

35) Information pertaining to the approximate number and nature of agri-business operations within a given region is partly possible via the Chamber of Commerce for Industry and Agriculture (CCCI). For example, the Casamance region has 176 member firms in the vicinity of Ziguinchor, 40 in Kolda and 21 in Sédhiou (encompassing all agricultural subsectors). Additional information might be available through the local authorities

FIGURE 19. Number of households per agricultural activity in Senegal[36]

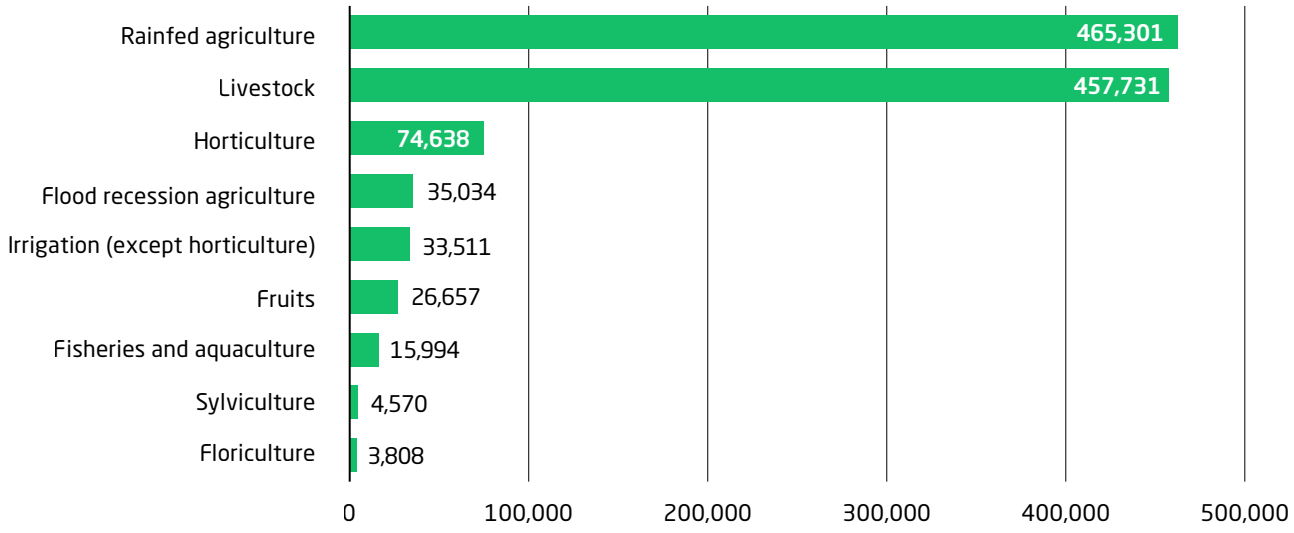
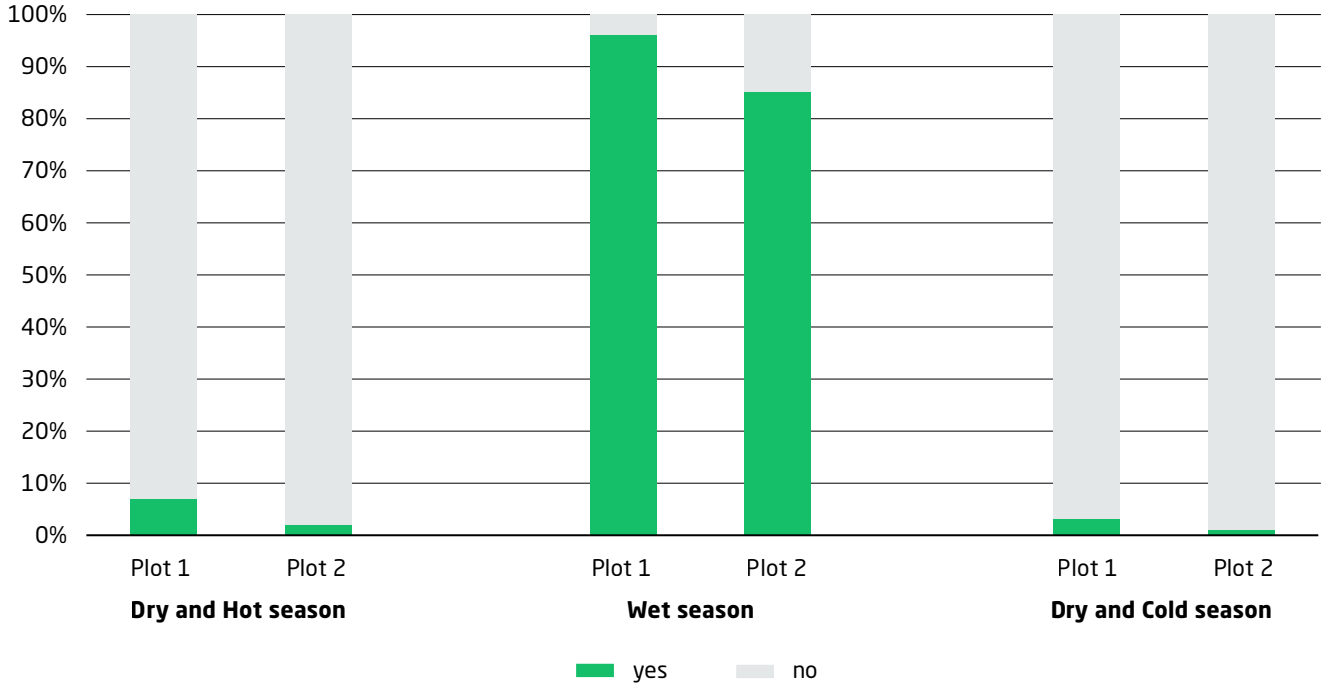


FIGURE 20. Percentage of households growing crops during different seasons and on different plots[37]



36) ANSD (2014)

37) Data based on a survey on farm households prepared by FES, Yale University (USA) and CEEPA, University of Pretoria (South Africa) for the GEF Regional Climate, Water and Agriculture Project: Impacts on and Adaptation of Agro-Ecological Systems in Africa, May 2004. Season 1: dry and hot season (*Contre-saison chaude*), Season 2: wet season (*Hivernage*) and Season 3: dry and cold season (*Contre-saison froide*)

Irrigation

The area of land in Senegal with good potential for irrigation is estimated at 497,500 ha and is concentrated around the Senegal River in the North, the Niayes area in the West and the Groundnut Basin in the centre (**Figure 21**). The total area currently under irrigation ranges from 88,600 ha to 95,400 ha, including 26,000 ha for horticulture and 62,600–69,400 ha for cereals (predominantly rice). As can be seen from **Table 7**, significant potential exists to expand the area that is currently under irrigation.

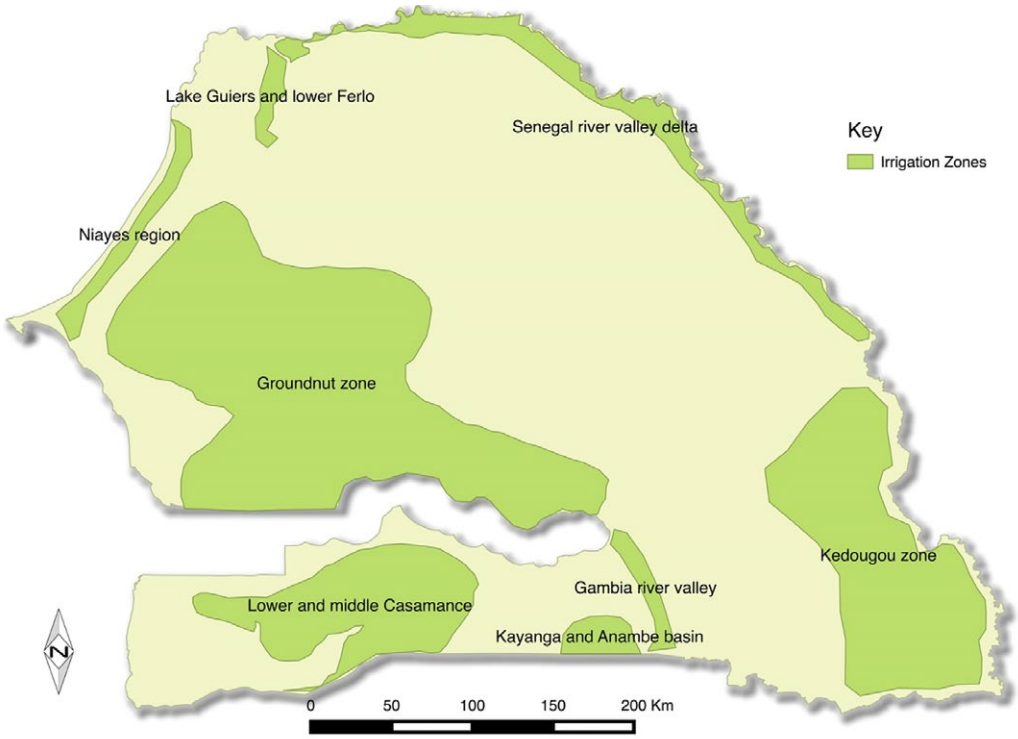
Approximately 90% of irrigation systems are built around surface water bodies such as rivers and lakes. Notable exceptions are the Niayes region and Groundnut Basin where micro-scale irrigation takes place using groundwater from wells. Electric and diesel pumps are frequently used for moving water with hand pumps and buckets also utilised for the micro-irrigation.

Limited information is available about the exact number of traditional pumps in operation in the country with a frequently stated number — from sector stakeholders in country — being 25,000. Individual estimates for regions also exist: the number of diesel pumps in the vicinity of Kayar is said to be 1,050, approximately the same in Mboro, and around 8,000 in the greater Niayes region north of the capital. In Casamance, where only a low number of traditional pumps were available until recently, solar pumps are being fitted as a first option and their installation rate is said to be several hundred units per year. In other regions (e.g. Niayes and around Kayar), initial efforts have been made to substitute old pumps for solar technology. There are a range of smaller and larger solar pumps suppliers in the country, two main players that are known to be active in the market at the time of writing are Grundfos from Denmark and Lorentz from Germany.

Within the different irrigation areas, a distinction can be made between three principal types of irrigation systems and market sub-segments:

Medium and large-scale irrigation schemes range from a few hundred to a couple of thousand ha. They are typically developed, financed and managed by the government (e.g.

FIGURE 21. Overview of main irrigation zones in Senegal[38]

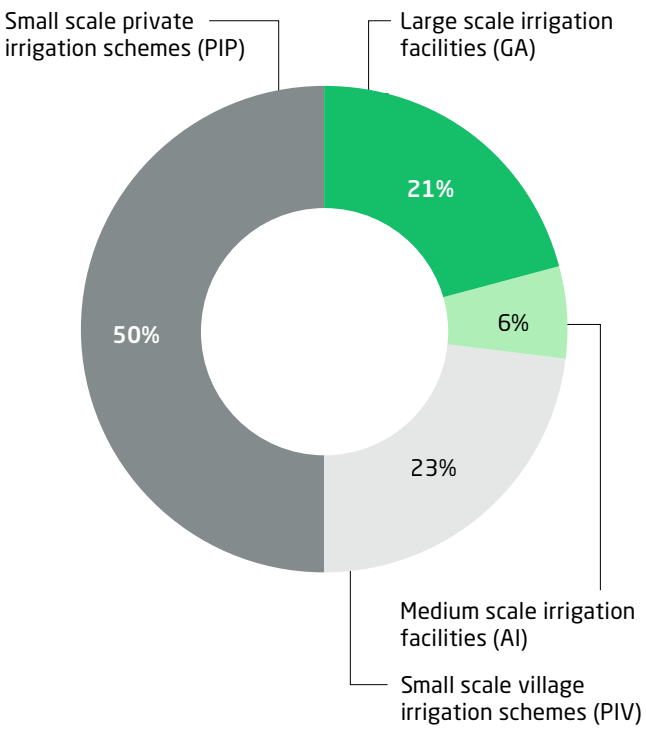


38) Adapted from FAO/IFC (2016)

TABLE 7. Irrigation potential in Senegal

IRRIGATION ZONE	POTENTIAL AREA (ha)
Senegal River Valley and Delta (Vallée et delta du Fleuve Sénégal)	228,000
Lake Guiers and Lower Ferlo (Lac de Guiers et du Bas-Ferlo)	75,000
Lower and Middle Casamance (Basse et Moyenne Casamance)	70,000
Kayanga and Anambé Basin (Bassin de la Kayanga et de l'Anambé)	16,000
Gambia River Valley (Les Vallées du Fleuve Gambie)	20,500
Kédougou Zone (Zone de Bas Fonds de Kédougou)	
Niayes region (Les Niayes)	13,000
Groundnut Basin (Le Bassin Arachidier)	75,000
Total	**497,500**

FIGURE 22. Irrigation schemes in the Senegal River Valley and Delta according to size (%)[39]



The state agency for the development of the Senegal Delta and the Senegal and Faleme River, SAED — *Société Nationale d'Exploitation des Terres du Delta et du Fleuve Sénégal*) with a focus on the production of rice and other cereals. Farmers pay a fee for the water use and over time some areas have been handed over to farmer and village groups. Water is typically pumped using large electric or diesel pumps with the application of gravity for transportation through the irrigation canals. Examples are the large scale irrigation facilities over 500 ha (GA — *Grands Aménagements*) and medium scale irrigation facilities between 100–500 ha (AI — *Aménagements Intermediaires*) in the Senegal River and Valley area in the north of the country.

Group irrigation schemes vary from a few to several ha (less than 100 ha) being organised by (private) groups or associations. Diesel generators are commonly used to pump from surface water bodies. This model is frequently applied along the Senegal river valley through private (PIP — *Périmètres Irrigués Privés*) and village (PIV — *Périmètres Irrigués Villageois*) schemes and the banana area in the Gambia River Valley. These cover close to 75% of the land area under irrigation in the Senegal River Valley and Delta (see **Figure 22**).

Micro irrigation is practiced on individual plots with average sizes ranging from a 0.1 to 1 ha with the water source typically being a well or a small stream. Irrigation takes place using buckets and manual labour, sometimes aided by small diesel pumps. This type of irrigation is common in the Niayes region (horticulture), Groundnut Valley and Lower and Middle Casamance area (fruit and vegetables) and, in recent years, has been increasing in the Senegal River Valley and around Lake Guiers. This is within the country level context of approximately 75,000 households being involved in horticulture and a further 25,000 in growing fruit trees (ANSD, 2014). Against this backdrop, the estimated irrigation area in this sub-segment is 26,000 ha with 11,000 ha for vegetables and 15,000 ha for fruit trees.

Table 8 summarises the principal types of irrigation systems as presented earlier and provides an estimated total market potential. Based on these figures, and assuming a market

39) Link: http://www.memoireonline.com/02/11/4217/m_Etude-comparative-des-couts-des-amenagements-hydro-agricoles-dans-la-vallee-du-fleuve-Senegal-de6.html – accessed January 2019

penetration of 25–50%[40] , the market potential for solar PV for irrigation in Senegal can be estimated at EUR 55–111 million with additional growth opportunities as the area under irrigation expands towards its estimated potential of 497,500 ha.

Solar PV for Cooling

The milk value chain affects more than 450,000 families and contributes to 35% of GDP in the primary sector and 4.8% of the national GDP (ANSD, 2014; Progrès-Lait, no date). Production has gradually increased over the last years and reached a level of 231.5 million litres in 2016. However, during the same period, milk imports remained high and stood at 47% of national consumption in 2016 (**Figure 24**).

Almost 60% of milk production comes from pastoral systems, the remaining 40% coming from pure breeds and crossbreeds (MEPA, 2017). The large majority of livestock is kept under extensive production systems, which is characterised by high milk production during the wet season (June to October) and a very low production during the dry season (November to May). Intensive milk production is found around large urban centres like Dakar with peri-urban farms using modern equipment for milk collection and storage.

Little to no data is available about the number of milk processing units. The country reportedly has one industrial-scale milk processing unit (*Laiterie du Berger* located in Richard Toll – Saint Louis), which uses milk from local herds. The unit markets pasteurised milk, yoghurt, fresh cream and sour milk. Milk is collected from close to 1,000 farmers in a radius of 50 km from the main production facility. At maximum capacity, the facility can process up to 6,000 litres per day though during the dry season this figure drops to 1,500 litres.

Apart from the *Laiterie du Berger*, several smaller dairy processing units exist across the country. In 2009, there were around 70 units, up from 48 in 2006 with each unit having the capacity to transform between 50–1,000 litres per day. Milk is typically collected from farmers in the vicinity and sold to villages and towns in the surrounding areas. An estimated 2,000 farmers were selling milk to transformation units in 2009. The price paid for unprocessed milk is around CFA 200 (EUR 0.3) per litre.

Based on the above limited figures, it can be concluded that the current processing capacity is insufficient, even considering if all the facilities where being run at maximum capacity throughout the year. Against this backdrop, ENDA and Ecodev started a programme in 2014 to establish 100 solar PV mini-platforms (400 W) and 20 larger platforms (11.4 kW) to process and conserve milk supplied by 2,000 farmers in Saint Louis, Matama and Kolda. Eighty per cent of the energy produced by the larger platforms will be used for household consumption whereas the remaining 20% will be used for milk cooling and processing. The platforms are being set up as public private partnerships (PPPs) and in collaboration with local Microfinance Institutions (MFIs).

Given the fact that over 450,000 households in Senegal are involved in livestock breeding, the potential in this market is significant. Using the data of Progres-Lait, it can be estimated that an installed capacity of close to 20 MW would be required to serve all livestock farmers.[41] Assuming a solar PV price of EUR 2 per W and a 20% market penetration, the market value for solar PV for cooling can be estimated at EUR 7.7 million (not including the cooling equipment).

Biogas Digesters

The use of biogas for domestic cooking is a proven technology that has been successfully implemented in several countries around the world (e.g. Kenya, Nepal, Tanzania, etc.). With close to 450,000 farming households involved in livestock keeping, Senegal has a strong basis for the use of biogas. The total waste production by livestock in the country is estimated at 4,317 kilo-ton of dry matter per year (Touré, 2016). Looking more closely at the usable fraction for methanisation, Senegal's National Biogas Programme (PNB — *Programme National de Biogaz Domestique*), based on a study in the Kaffrine region, found that the average usable organic matter from cattle is around 2,145 ton per year with **Table 9** showing the breakdown for further livestock species.

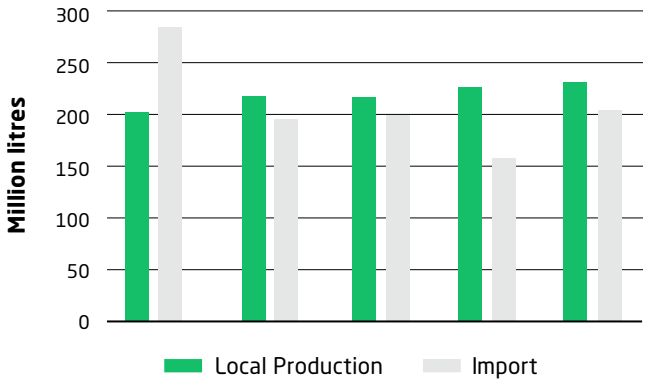
40) Based on discussions with relevant stakeholders in Senegal, it has appeared that demand for small-scale PV pumps is particularly strong. PADEN (see **Annex A**) has for instance reported 8,500 requests for market-based PV-pump installations in 2016 alone (which was also the last year of this Government project supported by the Canadian cooperation). Even though these pumps were sold and not given, what made these requests spike in number is said to be attributed at least in part to the technical assistance for the choice of technology and credit negotiations with institutions that PADEN offered

41) One solar PV platform of 400 W serves 20 farmers and one large platform of 2.28 kW serves 100 farmers

TABLE 8. Estimated market size for different irrigation segments

	AREA (ha)[42]	NUMBER OF IRRIGATION SCHEMES OR HOUSEHOLDS[43]	AVERAGE SIZE (ha PER IRRIGATION SCHEME)	INDICATIVE PUMP SIZE (kW) FOR IRRIGATION SCHEME	INDICATIVE PV PUMP PRICE (EUR)	TOTAL ESTIMATED MARKET VALUE (MILLION EUR)
Medium and large irrigation schemes	19,000	190	100	100	100,000	19
Group irrigation schemes	50,000	2,500	20	25	25,000	62.5
Micro irrigation (Vegetables)	11,000	74,045	0.15	0.05–0.1	1,000	74
Micro irrigation (Fruits)	15,000	26,445	0.57	0.25–0.5	2,500	66
Total	**95,000**	—	—	—	—	**221.5**

FIGURE 23. Milk production and milk import in Senegal from 2012 to 2016[44]



Based on such figures, the aforementioned PNB is targeting the distribution of ten thousand domestic biogas systems to farming households over the next few years. According to a baseline study they carried out in 2013, there were 545 domestic biogas digesters installed in the country. The market potential is therefore still large and can be estimated at close to EUR 5 million.[45]

TABLE 9. Production of methanisable organic matter in the Kaffrine region[46]

SPECIES	AVERAGE GROSS PRODUCTION (T/Y)	AVERAGE CONTROLLABLE PRODUCTION (T/Y)	AVERAGE USABLE PRODUCTION FOR METHANI-SATION (T/Y)
Cattle	3,588	2,180	2,145
Sheep	190	117	112
Goats	211	130	125
Asses	568	525	509
Horses	1,285	1,168	1,128

42) Wade, 2010
43) Number of households are based on ANSD (2014) and used for estimating micro-irrigation potential
44) MEPA (2017)
45) An average price of EUR 500 (CFA 327,979) was assumed based on a cost per biogas unit of EUR 284–895 (CFA 185,930–587,373) (ONAS 2013)
46) PNB (2016)

4.3 BUSINESS MODEL OPTIONS

Several business model options exist for introducing renewable energy technologies into agricultural value chains. The most widely applied approach is still the cash-and-carry model where the customer purchases the equipment and immediately becomes the owner. The main disadvantage of the cash-and-carry model is that the average farming income in Senegal is low combined with limited access to traditional forms of credit.

In order to successfully tap into the market potential as presented in the previous section, it will be essential to develop innovative business models and financing approaches that are tailored to the reality of farmers and agribusinesses on the ground. In recent years, a number of alternative business models have emerged that can (partly) address the challenges faced by the traditional cash-and-carry models (see also Hystra, 2017). This section briefly presents the lease-to-own, the PAYGO and the energy-as-a-Service models. Such models can create new opportunities for entering the Senegalese market.

Lease-to-own

The lease-to-own business model focuses on providing equipment with a set of services and benefits for the farmer:

- If the asset or equipment is in need of repair, the service is typically included at no cost to the farmer;
- Most lease-to-own models do not require a down payment, so the buyer has access to the equipment without making a large upfront payment;
- The business model allows the farmer to take temporary ownership of the equipment with the option of withdrawing from the transaction if he/she is dissatisfied.

Unlike traditional microfinance, which provides monetary loans for working capital to informal businesses, a lease-to-own model involves loaning productive assets or equipment to the customer. The asset itself acts as a form of collateral to help reduce the client's risk of spiralling into debt and further poverty. The customer pays a (minimum) fixed monthly or quarterly fee and interest is charged on the declining principal balance. After the balance is paid in full, the customer owns the equipment.

Lease-to-own can be particularly relevant for solar PV for irrigation and biogas digesters. A form of the lease-to-own model is being adopted by SunFarmer in Nepal, where affordable financing at three-year terms is provided to farmers. The model works closely with cooperatives which identify the farms and collect monthly payments on behalf of SunFarmer (IRENA, 2016c).

PAYGO models

Pay-as-you-Go (PAYGO) models are traditionally used for the distribution of solar home systems. Instead of paying for the equipment upfront, customers can buy energy at a fixed price using mobile money. The built-in connection to the mobile-phone network allows the provider to switch the system on or off remotely. Similar to the lease-to-own model, the equipment is transferred to the customer after a certain period of time. The additional advantage of the PAYGO model is that customer payments are based on actual consumption, i.e. if there is no consumption in a certain period, no payment is required.

PAYGO can be particularly relevant for the irrigation sector. In Senegal, the PAYGO model has been piloted by the Sustainable Energy Lab of Columbia University. Under the pilot, a 6.8 kW solar PV system was set up in the Niayes region providing 3-phase AC power to seven horticulture farmers. The power is used to pump water from shallow wells. The PAYGO metering allows smaller payments at a time, incremental growth and capex costs to be recovered over time, reducing the initial investment hurdle for the farmer. The pre-paid system ensures transparency and accountability for the farmers and the operator and generates revenue from day one to cover operating and maintenance costs. Collecting payment up front through the pre-paid credit eliminates non-revenue water issues that plague typical unmetered solar irrigation systems.

Energy-as-a-Service

Under an Energy-as-a-Service model, energy is sold directly to customers. Unlike lease-to-own and PAYGO models, the ownership of the assets and equipment remains with the service provider. As such, the customer does not have to incur any long-term financial obligations and the service provider is responsible for maintaining and repairing the equipment. Energy-as-a-service can be implemented as a purely private sector approach or as a PPP. Under the latter, different models can be used with a varying degree of private sector involvement. The Energy-as-a-Service model can be particularly relevant in the context of medium and large-scale Solar PV for irrigation and Solar PV for cooling.

Table 10 summarises the main characteristics of the different business models.

TABLE 10. Key characteristics of different business model options

BUSINESS MODEL	CHARACTERISTICS
Cash and carry	The customer purchases the application, becomes owner immediately, operates it and finances it.
Lease-to-own	Consumer payments are usually a flat rate and decoupled from usage of the system. Banks are often involved as lessor. Operation responsibility is taken over by the customer.
PAYGO	The customer prepays for energy using mobile money-based payment platforms with a "locking" mechanism as soon as the purchased energy is used. Operating responsibility remains with the supplier. Once the asset is paid off, the customer becomes the owner of the asset.
Energy as a Service	Energy is sold as a service — customers do not assume ownership of the asset, therefore, do not incur long-term financial obligations and do not assume operation of the asset. Energy service companies (ESCOs) can be **a)** Private companies, **b)** Cooperatives/Communities, **c)** PPPs, (Concession, Build, Own and Transfer (BOT), etc.)

When tailoring the business model to the specific context of Senegal, a number of additional considerations can be taken into account:

Firstly, Senegal boasts a large number of farmer groups, associations and cooperatives that can provide a platform to efficiently reach out to individual farmers and farmer communities across the country. For example, the Senegalese Association to Promote Grassroots Development (ASPRODEB — *Association Sénégalaise pour la Promotion du Développement á la Base*), maintains a database of member federations focusing on different crops and agricultural products (see **Annex B**). Depending on the technology, target segment and area, such organisations can be leveraged to access customers and reach economies of scale more rapidly.

Secondly, Senegal has good experience with outgrower schemes and value chain promotion. **Section 4.2** referred to the Laiterie du Berger, a milk processing facility in the north of Senegal, which purchases milk from close to 1,000 farmers in the surrounding area. Another example is the Senegalese Conserved Food Company (SOCAS — *Société de Conserves Alimentaires du Sénégal*). SOCAS is a Senegalese company specialised in the production and industrial processing of tomatoes for domestic and regional markets. Over the last decades, SOCAS has developed a well-structured tomato value chain and sources its raw material from over 3,000 outgrowers. Every year, before the start of the growing season, SOCAS signs a contract with its outgrowers, which details the conditions for supply and purchase of tomatoes. This contract is a purchase guarantee to farmers and can be used as a collateral to obtain credit from financial institutions (FAO/IFC, 2016). Tomato growing is the only agricultural sector where small-scale farmers have access to commercial finance in the country. Based on the examples from Laiterie du Berger and SOCAS, the Government of Senegal under its PSE is also targeting the roll out of 100–150 Aggregation Projects that will organise small farmers around highly productive modern operators. The Aggregation Projects will include the development of specific service packages (funding, access to inputs, agricultural machinery, marketing, etc.) and establishment of dedicated infrastructure, including storage and processing facilities. Aggregators such as Laiterie du Berger and SOCAS, as well as the planned Aggregation Projects under the PSE, are uniquely positioned to create the necessary conditions for making access to credit easier and act as an anchor point for renewable energy project and venture developers.

Finally, the business model for renewable energy technologies such as solar PV for irrigation and solar PV for cooling can be further strengthened by combining productive uses with other energy uses (e.g. household energy use) under one generation facility. This will increase the load and therefore enhance the economics of the system. This model is, for instance, being piloted by ENDA/Ecodev under their Progrès-Lait programme where solar PV micro-grids are supplying energy to both a milk processing and cooling platform as well as to up to 1,000 households. As such, during the dry season when less milk is being produced, the micro-grid can still sell electricity to households and maintain a base revenue stream.

SECTION 5

Developing a Business for Renewable Energy Applications in Agricultural Value Chains in Senegal

The Senegalese business environment has seen important improvements in recent years. The country scored among the top ten reformers in the Doing Business rankings between 2013 and 2015 as noteworthy changes were made in property registration, access to credit as well as contract enforcement, among others.[47] The country has also reviewed and harmonised its legal framework to comply with global best practices.

5.1 INVESTMENT PROCEDURES AND BUSINESS LICENSING

The 2004 Senegalese Investment Code provides for specific investment protections including protection against nationalisation, freedom to transfer capital and earnings, equality of treatment of foreign companies and individuals and provisions for dispute settlement. The Code is applicable to investments in specific activities and sectors, including those related to agricultural production and processing. Investments have to be larger than CFA 100 million (EUR 150,000) or CFA 15 million (EUR 22,500) in case of small and medium enterprises (SMEs).[48]

Apart from providing investment protection, the Investment Code also includes a number of specific fiscal benefits, which have been amended by Law 2012-32 (see **Section 5.2**). Investors that want to benefit from the advantages offered by the Investment Code must submit a dossier applying for approval to the National Agency for Investment Promotion and Major Projects (APIX — *l'Agence Nationale chargée de la Promotion de l'Investissement et des Grands Travaux*). The forms for applying for an investment approval can be downloaded from the APIX website.[49]

Starting a business has also benefited from recently implemented measures (2015) including:

- a reduction in the tax rate for transfer of ownership to 5% (down from 10%);
- a reduction of minimum capital requirement;
- a reduction of registration fees for business creation.

The most important characteristics of the different types of legal entities can be found in **Table 11** with the related tax regimes and incorporation costs. Incorporation formalities for the companies are straightforward and their exact details can be found in **Annex C**. Most incorporation formalities can be done at the Business Creation Support Centre (BCE — *Le Bureau d'Appui à la Création d'entreprise*), which acts as a one-stop-shop for business incorporation under APIX.

5.2 TAXATION AND FISCAL BENEFITS

General Taxation

In 2012, the Government of Senegal adopted a new General Tax Code (Law 2012-31), which covers the different taxes and tax regimes in one document, including amongst other income, corporate, value added and withholding tax. Law 2012-31 is complemented by Law 2012-32 which seeks to bring together all taxation issues and topics from different laws and regulations under one General Tax Code. As such, Law 2012-32 repeals and amends one charter and 18 laws, including the 2010 Renewable Energy Law and the 2004 Investment Code. The main characteristics of Senegal's corporate tax regime are summarised in **Table 12**.

Fiscal Benefits

Under the new General Tax Code a number of tax benefits and fiscal incentives exist that may be applicable to the introduction of renewable energy applications in agricultural value chains.[50] According to Article 241 of the General Tax Code, agricultural (and other) companies that invest in solar or wind energy can benefit from a reduction on their income tax of up to 30% of the value of the investment. The tax reduction can however not exceed 25% of the tax payable in a single tax year. Among other items, article 242 of the General Tax Code explicitly refers to solar pumping stations as being eligible for this reduction. Entities that wish to benefit from the tax advantage must send a letter to the Director General of Taxes (*Directeur Général des Impôts e Domaines*) with details about the installation, its cost and its location.

47) Link: http://www.doingbusiness.org/reforms/top-reformers-2016 – accessed January 2019

48) SME's are defined as enterprises with annual turnover of less than CFA 250 million (EUR 380,000) and with 3-50 permanent employees (Article 250.3 of the 2012 General Tax Code)

49) Link: http://investinsenegal.com/Legal-and-tax-incentives.html – accessed January 2019

50) Conflicting information exists about the application of certain fiscal benefits. Investors are recommended to seek professional tax advice.

TABLE 11. Main characteristics and obligations of various legal entities in Senegal[51]

LEGAL STATUS	SINGLE PROPRIETORSHIP	LIMITED COMPANIES (SARL)	BUSINESS CORPORATION (SA)	ECONOMIC INTEREST GROUPS
Minimum number of partners	1	1	1	2
Minimum start-up capital	0	0	CFA 10 million (EUR 15,244) minimum; 25% of the capital to be paid up at incorporation, the balance within three years	0
Eligibility to Investment Code Incentives or as Free Export Company	Yes	Yes	Yes	Yes
Registered auditors	None	Not mandatory if capital remains under CFA 10 million (EUR 15,244), turnover below CFA 250 million (EUR 381,100) and staff below 50	Mandatory	None
Management	Entrepreneur	Manager (partner or not) appointed by the associates	General Manager or Managing Director	Chairman
Taxation on profits	Unique Global Contribution; or IS (Impôt sur les Sociétés) on option	Corporate Income Tax (IS, Impôt sur les Sociétés) 30% of net profit	Corporate Income Tax (IS, Impôt sur les Sociétés) 30% of net profit	Unique Global Contribution; or IS (Impôt sur les Sociétés) on option
Minimum flat tax payable in case of loss-making results	0	0.5% of turnover, with a min. of CFA 500,000 (EUR 762) and a max. of CFA 25 million (EUR 38,110)	0.5% of turnover, with a min. of CFA 500,000 (EUR 762) and a max. of CFA 25 million (EUR 38,110)	0
Incorporation costs	Up to CFA 20,000 (EUR 30)	High (more than 40% of minimum capital)	High	Low (CFA 115,500 or EUR 176)

51) APIX S.A. Link: http://investinsenegal.com/ – accessed January 2019

TABLE 12. Main characteristics of the corporate tax regime in Senegal

Corporate Tax rate	The standard corporate tax rate is 30%
Capital gains	Capital gains are treated as operating profits and included in the corporate tax base
Losses	Tax losses may be carried forward for three years. The carry back of losses is not permitted.
Foreign Tax Credit	Senegal tax law does not provide for unilateral tax relief, however, may provide for bilateral relief.
Taxation of dividends	Dividends received from a company other than a subsidiary are taxed as income after a 60% tax abatement on the gross amount. Dividends paid to a resident or non-resident are subject to a 10% withholding
Value Added Tax (VAT)	There is a single rate of 18%
Transfer pricing	Transfer pricing rules are included in the new tax code, under which the tax authorities can adjust the profits if transactions are not made at arm's length
Thin capitalisation	There are no specific thin capitalisation rules, but limits are imposed on the deduction of interest in certain cases.

The General Tax Code also provides for a general tax deduction for investments taking place in the agricultural sector, including storage and packaging of food products (Article 249 and further). The tax benefit is applicable to new companies and expansion projects. Investments need to be larger than CFA 100 million (EUR 150,000) or CFA 15 million (EUR 22,500) in case of SMEs. The allowable tax deduction is fixed at 40% of the total investment amount (30% in case of expansion projects) up to a maximum of 50% of taxable income (70% in case of projects outside Dakar). The tax deduction can be carried forward for five successive fiscal years following the end of the investment period.

In accordance with Article 254 of the General Tax Code, different income tax benefits may be combined but cannot exceed 50% of taxable income. The benefits are however not applicable in case government viability gap financing has been received for the purchase of the equipment (for example through the Rural Electrification Fund — FER).

With regard to VAT, sales and services to clients who have been approved by the Investment Code are subject to a suspension of VAT during the investment period (Article 373). The suspension can turn into an actual exemption in case of services or equipment supplied to clients and projects in the agricultural sector.

Finally, Law 2012-32 provides for the following amendments to the fiscal benefits provided for in the 2010 Renewable Energy Law and the 2004 Investment Code:

— Article 18 of Law 2012-32 amends Article 8 of the Renewable Energy Law and reduces the scope of fiscal incentives to customs taxation only (*fiscalité douanière*). The current General Tax Code does not yet include specific provisions for customs taxation for renewable energy equipment and technologies. Therefore the application of the incentives is not yet clear in the context of renewable energy technologies and an amendment of the General Tax Code may be required to create further clarity on the topic.

— Article 11 of Law 2012-32 repeals the fiscal benefits provided in Article 19A of the Investment Code and reduces the tax exemptions under Article 18 of the Investment Code to an exemption from customs duties only. The previous provisions for the suspension of VAT payable on the import of equipment were thereby cancelled.

5.3 LAND, ELECTRICITY LICENSING AND ENVIRONMENT REGULATIONS

Due to their small-scale nature, technologies described in this developer guide do not face extensive permitting and licensing requirements.

Land

As a general rule, all land belongs to the central government and this right has been transferred to local government, who can give land based on different procedures in every region. A committee at the local level is tasked with analysing the request and making a decision on the allocation of the land.

Generally, a stakeholder consultation is required in order to build public awareness. There are some minor costs associated with these procedures. Investors looking at building on public land

should, therefore, start an enquiry with the local authorities of the specific region. Efforts in Senegal are currently underway to formalise and secure land property rights as part of the Millennium Challenge Corporation program. At present, land tenure insecurity remains a barrier to capital investment.

Licensing under the Electricity Law

In Senegal, all activities related to the generation, transmission and distribution of electricity are subject to the licensing provision of the Electricity Law 98-28. Micro systems (e.g. micro-irrigation pumps) are not considered as generation units and are therefore not subject to the Law. Also activities with an installed capacity of less than 50 Kilovolt-amps (kVA) and activities that are intended for own consumption and built on private land are exempt. Most renewable energy applications for agricultural value chains in Senegal will be below the 50 kVA threshold and will not require a permit or license as provided for in the Electricity Law.

There are, however, a number of additional considerations:

- Article 31 of the 1998 Electricity Law explicitly states that ASER can only provide funding to duly licensed operators. This may be a reason why smaller projects (e.g. ERIL's) apply for a license even if their capacity is below 50kVA.

- According to Article 27 of the Electricity Law, cross-ownership between production and distribution is only allowed under certain conditions. Cross-ownership of generation and distribution assets can for instance occur when a central PV system is established which services the irrigation pumps of different farmers. Also the milk-processing platforms being built by the *Progrès-Lait* would fall under this Article because electricity is also distributed to households.

- Even though the installation of an electricity system for self-consumption is exempt from the electricity licensing procedures, they are still subject to a prior declaration addressed to the Minister in charge of Energy who may also authorise the sale of any surplus (Article 24.2).

In case a licence is required, a developer or investor is advised to consult Decree 98-334, which lays out the modalities and procedures for the issuance and withdrawal of concessions and licenses. Licence and concession fees are provided in the following two application regulations documents:

- *Règlement d'Application* 11-2008 sets the fees that are payable to CRSE upon submitting a request for a license or concession;

- *Règlement d'Application* 12-2013 establishes reduced fees for ERIL projects and projects with an installed capacity of less than 1 MW (CFA 150,000). Regular projects pay CFA 7.5 million (up from CFA 6,780,000 as was established under 11-2008).

Environmental Impact Assessment

The Environment Law (*Loi portant Code de l'Environnement 2001-01*) Decree No. 2001-282 of 12 April 2001 on the Application of the Environment Code regulates impact studies. Projects fall into one of two categories:

- **Category 1:** Projects likely to have significant impacts on the environment, which require a comprehensive Environmental Impact Assessment (EIA);

- **Category 2:** projects with limited impacts or that can be reduced or mitigated, which are the subject of an initial EIA ("*Analyse Environnementale Initiale*").

Annex 2 of the Environment Law 2001-01 lists category 2 projects that only require an initial EIA. These include:

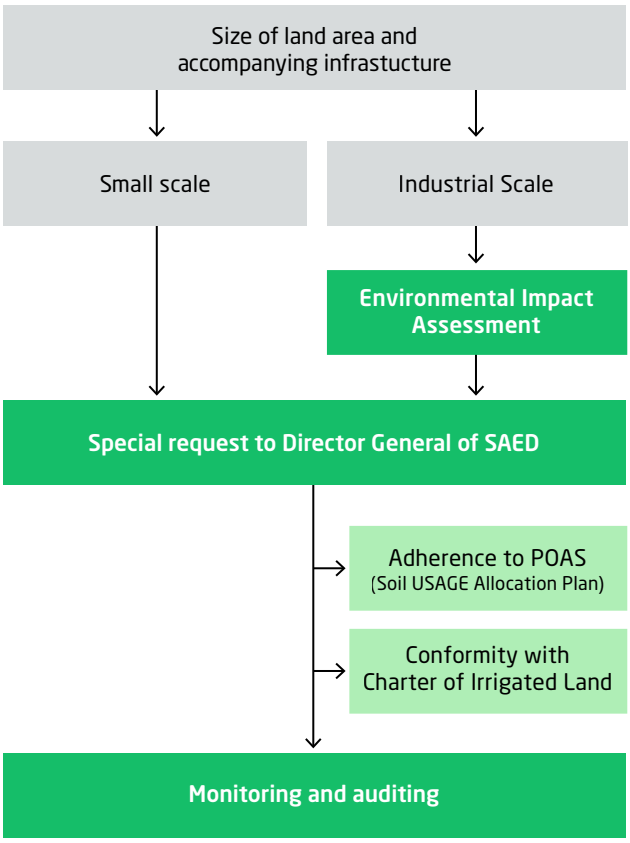
- Small-scale irrigation and drainage;
- Renewable energies (other than hydro-electric dams);
- Rural electrification.

The realisation of EIA studies is the responsibility of the promoter. The minimum content of the EIA report is imposed by *Arrête Ministeriel No. 9472*. The EIA report is sent to the Minister of the Environment, who issues the Certificate of Authorisation after technical advice from the Environment and Classified Establishments Directorate (DEEC — *Direction de l'Environnement et des Etabissements Classés*) of the Ministry of Environment.

Additional permits, licenses and authorisations

Depending on the technology used and the exact scope of the project, a number of additional permits, licenses and authorisations may be required. For example, projects seeking to establish irrigation schemes in the Senegal River Valley will require an authorisation from SAED, the procedures of which are provided in **Figure 24**.

FIGURE 24. Flowchart for permitting procedures for irrigation projects in the Senegal River Valley[52]



Projects that consider taking a PPP approach should follow the guidance and provisions that are provided in the following PPP laws and regulations:

- Law 2004-13 of 1 March 2004 — Law for Build, Operate and Transfer of Infrastructure (*Construction, Exploitation et Transfert d'Infrastructure*), modified by Law 2009-21 of 4 May 2009.
- Decree 2007.169 of 13 February 2007, which fixes the content of BOT contracts.
- Decree 2010.489 of 13 April 2010 fixing the conditions for the transfer of BOT contracts to local communities.
- Law 2004-14 of 1 March 2004 establishing the Infrastructure Council.

5.4 PRODUCT IMPORT PROCESS

In the absence of a local supply chain to provide renewable energy technologies, knowledge of product import procedures are necessary for investors setting up a business within the scope of this Guide. This also provides input to an investor on how they would need to cooperate with ASER in this regard. The detailed steps are as follows:

- Shipments must clearly identify the consignee on the Bills of Lading (BL). This may have financial implications whether especially the company or project has duty-free status. The consignee may not be the owner of the products. For instance, ASER can be the consignee of the shipment because it is opening its tax-exemption to the project/company.
- The customs agent needs to fill out a declaration form in seven copies, and will attach ASER's tax-exemption document and Memorandum of Understanding or other form of legal relationship between ASER and the project. These documents are then submitted to customs with the BL and invoice each time there is a shipment. Customs will put an approval stamp on these documents and keep a copy. This form allows the Government/Minister of Finance to keep track of the import duty-free status to avoid fraud.
- If there is no duty and tax-exemption, the shipper needs to send an invoice to the company showing the total cost of the product prior to shipping. With this invoice the customs agent fills out the prior import declaration form at customs. The customs agent must file this prior import declaration form before the freight leaves the port of shipment if the total value of freight is above USD 6,000 (EUR 5,229). A copy of the prior import declaration form must be sent to the shippers for customs declaration and freight inspection purpose at the port of departure.

52) SAED. Link: http://www.saed.sn/ – accessed January 2019

— When the ship leaves the port of departure; the shipper must scan and send copies of the BL. Original BL must be sent via DHL or FedEx to the consignee. The original BL will be provided to the customs' agent. Once the container reaches the port, the customs agent will fill out what is called a detailed declaration at the customs office. This will be approved and the agent can proceed with formalities to clear the freight. The approval of the port authority will be provided to the shipping line, which will give approval to release the container against the BL stamped by the consignee. This consignee's seal/stamp is very important as without it the container will not be released.

— The choice of the appropriate ground transportation company is a very important element of the process. Though the space is somewhat regulated there are few companies which are properly insured. It is advisable to select companies with a full-service so the customs clearance and ground transportation will be handled seamlessly. The customs agent can do the clearance in a maximum of 72 hours (3 work days) as long as the original BL is received 48 hours before the freight reaches the port in Dakar.

Timing and Surcharges: The company has 10 days to clear its containers through customs. After that, there are daily SURREX TARI fees of USD 20 for 20-foot (ft) and USD 39 for 40-ft containers. In addition, there are storage fees of USD 23 for a 20-foot container and USD 45 for a 40-foot container paid to Dubai Port (manager of container terminal) at port in Dakar.

Payments: The customs clearance company/agent and the trucking company get paid EUR 683 and EUR 321 per 40-ft and 20-ft container, respectively. Typical terms are 50% paid before work begins and 50% after work is completed. Various fees are paid to the shipping company and Dubai Port amounting to EUR 876. The down-payment of the appropriate amount has to be made available 48 hours before ship arrives at port in Dakar. Additional fees, including that of ground transport from Dakar to the main cities of Senegal are included in **Table 13**.

TABLE 13. Import and ground transportation fees (in EUR)

CONTAINER SIZE (ft)	COMPANY LANDING FEES	TRANSIT FEES	GROUND TRANSPORT (EXCL. TAXES)	
20	724	533	Dakar – Kaolack	376
			Dakar – Diourbel	310
			Dakar – St. Louis	496
			Dakar – Kaffrine	463
			Dakar – Fatick	324
			Dakar – Louga	383
			Dakar – Thiès	184
40	876	686	Dakar – Kaolack	681
			Dakar – Diourbel	550
			Dakar – St. Louis	922
			Dakar – Kaffrine	868
			Dakar – Fatick	577
			Dakar – Louga	696
			Dakar – Thiès	321

5.5 IMMIGRATION AND WORK PERMIT

European Union (EU) nationals do not require a visa for travelling to Senegal. For residing and for working in the country, special permits are needed. Administrative procedures are however straightforward and reasonably prompt. In case residency is sought, the following documents and details are required:

— Original passport along with a certified photocopy of the pages containing the photo, its expiry date and the arrival stamp in Senegal;

— Handwritten request for a residence permit to the Minister of the Interior;

— Birth certificate issued less than six months prior to arrival;

- Police record issued in your home country/recent police clearance certificate from home country or *"certificat de bonne mœurs"* delivered by a local official in the neighbourhood of residence;
- Medical certificate issued by a licensed doctor in Senegal;
- 3 passport-size identity photos (3.5 cm x 4.5 cm);
- Registration certificates of the employing company in Senegal or registration papers thereof;
- Documents proving your financial stability throughout your stay in Senegal;
- Employment contract;
- A CFA 15,000 (EUR 23) stamp;
- Repatriation deposit payment receipt (CFA 75,000–EUR 114).

A Senegalese work permit is dependent on a sponsorship in order to provide proof of permanent income. As such, sponsorship of the employing company or certificates of a registered business operation are required for a work permit. Contracting in Senegal can, therefore, be more difficult as the work permit is tied to one employer. Umbrella companies[53] are often used to provide a convenient and effective solution to this issue.

Wage distribution is very inaccurately measured because of the informality of the labour market. Wages, amongst others factors, are dependent on the firm size: in firms with less than 10 employees it is about 250 CFA/hour (0.38 EUR/hour), while in firms with 11 to 50 employees, the figure is about double that at around 500 CFA/hour (0.76 EUR/hour).

5.6 TECHNICAL STANDARDS AND CERTIFICATION

To date, Senegal does not have a quality labelling system for renewable energy products, making import and distribution of lower-quality products commonplace. At the moment, there is no mandatory scheme to which renewable energy distributors or manufacturers should adhere to.

However, some standards have been adopted in recent years (**Table 14**). Efforts are being made to develop and introduce more, mostly based on international best-practice. In order to strengthen quality control, two laboratories have been set up under the supervision of the Senegalese Association for Standardisation (ASN — *Association Sénégalaise de Normalisation*) with EU funding. The specific task of these laboratories is to ensure the adoption of national standards and harmonisation with international standards for PV components.

TABLE 14. Senegal – standards for solar PV equipment[54]

STANDARD NO.	DESCRIPTION
NS 13-001	Photovoltaic (PV) terrestrial systems
NS 13-002	Photovoltaic modules. Principles for measurement of photovoltaic solar modules
NS 13-003	Photovoltaic modules. Measurement of current-voltage characteristics
NS 13-004	Stationary lead-acid batteries
NS 013-012-1: 2014	Solar thermal installations and their components — Custom-built installations
NS 013-012-2: 2014	Solar thermal installations and their components — Custom-built installations
NS 013-012-3: 2014	Solar thermal installations and their components — Custom-built installations

53) Umbrella companies process payments by billing and collecting money from the employer, calculating taxes and sending a net wage, operations equivalent to the PAYE (pay as you earn) system.

54) ECREEE (2015)

SECTION 6

Financing a Business for Renewable Energy Applications in Agricultural Value Chains

While there are banks, MFIs and private sector organisations working in rural development activities, interest in renewable energy technologies is lagging behind, partly due to the higher perceived risks (Coetzer *et al*., n.d.). This chapter provides key figures about access to credit and discusses national and international support programmes for financing renewable energy technologies in Senegal.

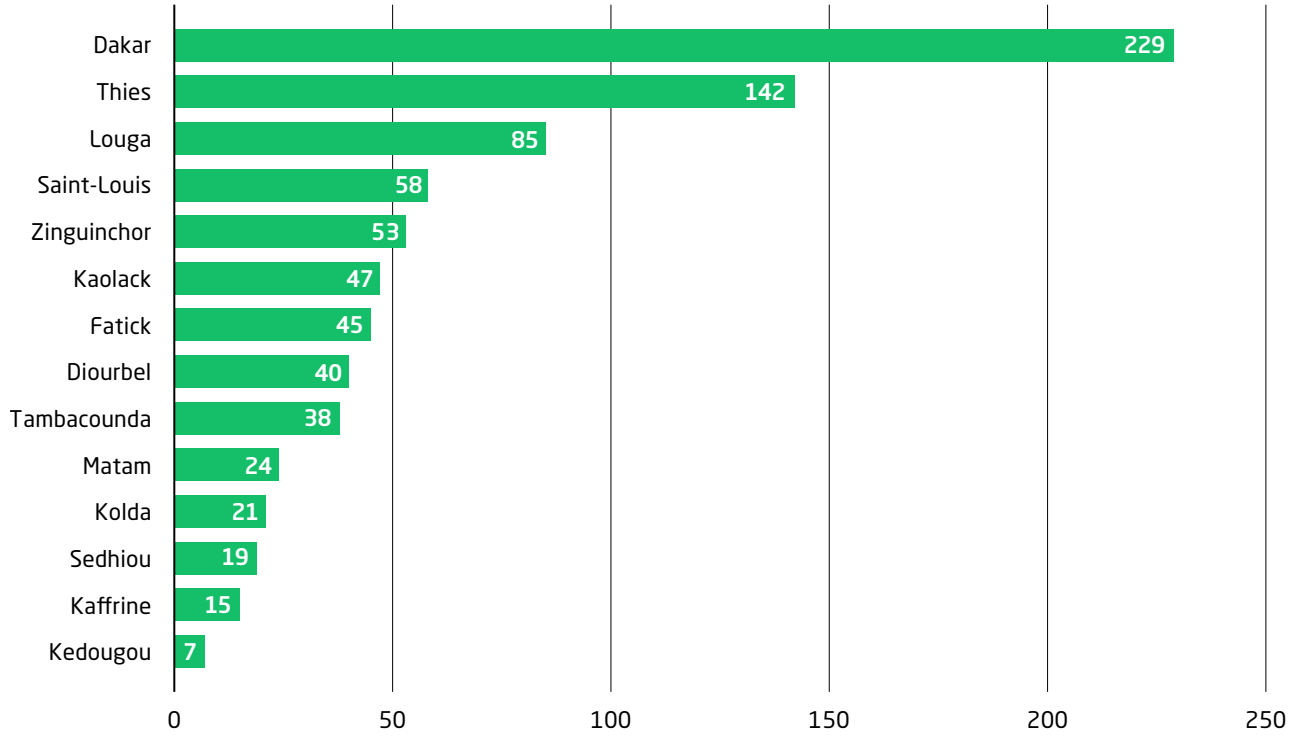
6.1 ACCESS TO CREDIT

The most recent data from the Central Bank of West African States (BCEAO — *Banque Centrale des Etats de l'Afrique de l'Ouest*) indicates that 34.5% of the adult population (aged 15 and over) in the West African Economic and Monetary Union held an account at a formal institution (banks, MFIs, banks savings, treasury, or post office) in 2014. When mobile money users are included, this proportion almost doubles to 61.7%. Other sources, however, are more conservative: the Global Findex places financial inclusion in the region at 13% of adults with an account at a formal financial institution and 18% when mobile money is included.

Senegal had 23 registered banks as of September 2015 with most concentrating on higher-end, urban clientele. The market for MFIs is characterised by cooperatives and *'mutuelles'*, the largest of which have a very extended physical network. In total, there were 81 MFIs with 823 access points across the country (**Figure 25**). Mobile network operators had over 12,500 supply points with a similar distribution.

Data from 2016, shows that the total MFI loan portfolio in Senegal amounted to a little over USD 500 million with 282,745 reported borrowers and over 500,000 depositors.[56] The average loan amount was USD 1,750.

FIGURE 25. Distribution of MFI access points in Senegal[55]



55) Link: http://finclusionlab.org/country/Senegal/analytics?title=National-Overview – accessed January 2019

56) Link: https://www.themix.org/mixmarket/countries-regions/senegal?order=title&sort=desc – accessed January 2019

TABLE 15. Top six MFIs in Senegal by outstanding loan amount[57]

MFI	REPORT DATE	TOTAL LOAN PORTFOLIO (USD MILLION)	NUMBER OF BORROWERS	TOTAL DEPOSITS (USD MILLION)	NUMBER OF DEPOSITORS
CMS	2013	202.5	—	242.9	—
ACEP Senegal	2016	73.9	49,000	19.4	144,020
MicroCred – SEN	2016	101.11	48,000	48.44	215,000
PAMECAS	2016	60.98	89,000	60.69	625,240
U-IMCEC	2015	17.77	21,000	12.52	131,000
MECAP	2014	11.9	—	7.53	—

Out of the existing MFIs, U-IMCEC , a member of the Participatory Microfinance Group for Africa (PAMIGA), has been running a pilot project which offers micro-finance loans to small-scale farmers in Senegal for the purchase of micro-scale irrigation equipment. The pilot supported by the Swiss Development Cooperation was initiated in 2012. As of 30 June 2014, the programme had issued 194 loans to farmers in Thiès, Dakar and Mbour. The total loan amount was CFA 193 million (EUR 300,000) with the average loan amount being EUR 1,500 for a term of 24–30 months. Motor pumps accounted for 86% of the loans with 11% for drilling boreholes and 10% for drip irrigation (PAMIGA, n.d.).

Based on the initial successes of the Senegalese pilot project, PAMIGA Finance S.A. established a Facility for Water and Renewable Energy in Africa. In 2016, the Facility successfully closed a first round of finance with funding from the European Investment Bank, the U.S. government agency Overseas Private Investment Corporation (OPIC) and U.S. Calvert and Rockefeller foundations. With this EUR 13 million, 7-year Facility, PAMIGA Finance S.A. plans to underwrite investments worth EUR 54 million of funding targeting solutions in the areas of irrigation, drinking water, solar energy for households, micro-businesses and villages. This first closing represents one third of the Facility, which has already set up three financing vehicles in Senegal and Benin.[58]

Examples such as PAMIGA's facility show that there is increased interest in financing renewable energy applications for productive use in Senegal. Nevertheless, the lack of access to medium- and long-term agriculture financing and credit, in particular for smallholders facing land tenure issues, remains a critical barrier and will need further attention if the country is to successfully tap into these markets.

6.2 NATIONAL SUPPORT INSTRUMENTS AND DOMESTIC FINANCING OPPORTUNITIES

Rural Electrification Fund

The Rural Electrification Fund (FER — *Fonds d'Électrification Rurale*) was created by decree in 2006 (*Decret No. 2006-247*). The Fund is being managed by ASER. Investments are authorised and supervised by a "Loans and Grants Committee", which includes representatives of the State, local authorities, consumer associations and NGOs.

Target investments of the Fund include (among others):

- Subsidies, loans and guarantees to rural electrification operators;
- Subsidised credit lines with banks and financial institutions;
- Subsidies and loans to developers of productive uses of electricity.

Fund sources includes ASER's annual budget from the State, finance from development partners and the proceeds from a rural electrification fee, which is charged on top of the electricity bill.

57) MIX. Link: https://www.themix.org/ – accessed January 2019
58) Link: http://www.pamiga.org/newsletters-pamiga.php?lg=en – accessed January 2019

FONGIP

The Priority Investments Guarantee Fund (*FONGIP — Fonds de Guarantie des Investissements Prioritaires*) was established in 2013 as a PPP with a mission to provide loan guarantees for financing projects in priority sectors and to refinance MFIs to enable them to grant loans to micro, small and medium-sized enterprises (MSMEs), to women's and youth groups at subsidised interest rates.

FONGIP offers a number of different guarantee products to projects and investments in Senegal. Eligible activities include investment projects in the agricultural and renewable energy sectors. A specific guarantee is available for small-scale projects between CFA 3 and 10 million (EUR 4,500–15,000). For obtaining a guarantee, a 10% own contribution is required. FONGIP provides a guarantee of up to 70% of the unrecoverable principal amount.

Since the start of its operations, FONGIP has supported CFA 17.16 billion (EUR 26 million) of financing to 416 MSME's and 1,500 women and youth groups. FONGIP has also assisted in extending average loan terms from 2 to 4 years and reducing interest rates from 18% to 8%.

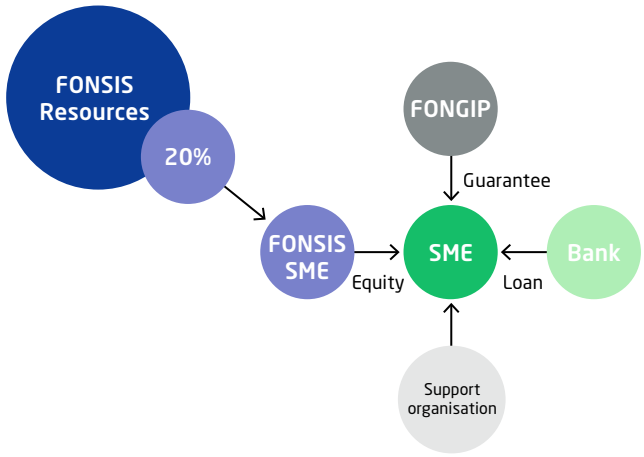
FONSIS

The Sovereign Strategic Investment Fund (FONSIS — *Fonds Souverain d'Investissements Stratégique* was established in 2013. The mission of FONSIS is to promote the role of the State of Senegal, as an investor and partner of the private sector, with the aim of supporting direct investments and accelerate the economic and social development of the country.

FONSIS invests equity and quasi-equity in projects with high potential for economic growth and job creation. Projects can vary in size, ranging from SMEs to major large-scale structuring projects. According to Law 2012-34, FONSIS has to invest 20% of its resources in SMEs. In that context, FONSIS and FONGIP can work together to provide equity and a loan guarantees (see **Figure 26**).

FONSIS invests mainly in the strategic sectors defined in the PSE, including agriculture and renewable energy. The investment horizon ranges from 5 to 12 years, depending on the type of project and sector. Target return on investment is 12%.

FIGURE 26. Investment structure to support SME's in Senegal[59]



Renewable and Efficient Energy Fund

In October 2017, the Renewable Energy and Energy Efficiency Fund (REEF)[60] was officially launched. It is an innovative national financing vehicle developed by FONSIS, AfDB and the Global Green Growth Institute (GGGI). The fund aims to accelerate the development of renewable energy projects as well as energy efficiency in Senegal. In its first phase, the Fund will mobilise USD 50 million, or nearly CFA 28 billion, with an overall target size of USD 200 million (approx. CFA 112 billion).

CNAAS

The National Agricultural Insurance Company of Senegal (CNAAS — *Compagnie Nationale d'Assurance Agricole du Sénegal*) is a PPP between the State and private sector insurance companies with a capital of CFA 1.5 billion (EUR 2.3 million). CNAAS specialises in agricultural insurance and plays an important role for alleviating the risks inherent in agricultural production and thus boost credit-worthiness. Whenever the agricultural land or the grown produce is intended to be used as collateral, insuring it can facilitate the access to credit and de-risk the investment. MFIs also increasingly regard this as a pre-requisite to financing. The EU is working through its "Osiris" programme for example with the Senegalese Pastoral and Farmers Organisations'

59) Adopted from FONSIS (2017). Link: http://fonsis.org/le-sous-fonds-pme-du-fonsis – accessed January 2019
60) Link: http://report.gggi.org/2017/wp-content/uploads/2018/04/18002_PRR_Senegal_GreenGrowthPathways_v02_JM.pdf – accessed January 2019

TABLE 16. Planned amount of investment and objectives of PRACAS for the different agricultural sub-sectors

SUB-SECTOR	OBJECTIVE	INVESTMENT CFA BILLION (EUR MILLION)
Rice	Self-sufficiency by 2017 with a production of 1.6bn t of paddy rice	424.7 (648)
Onion	Self-sufficiency by 2016 with a production of 350M t	20.9 (31.9)
Groundnut	Optimisation to reach a production of 1bn t and exports of 100 to 150M t	92.0 (140.6)
Off-season fruit and vegetable	Development of the sub-sector to achieve 157M t of exports	43.5 (66.48)

Network (RESOPP — *Réseau des Organisations Paysannes et Pastorales du Sénégal*) to provide more widespread access to these instruments.

Agricultural Investment Strategies

The agricultural sector is one of the priority sectors in Senegal. As such, strategies allocating significant amounts of public funds and provisions for PPPs are abundant. For any investor it is important to understand their linkages and aims in order to be able to identify related priority programmes and projects.

A dedicated institutional framework for agriculture is foreseen through the Acceleration Programme for the Senegalese Agricultural Sector (PRACAS — *Programme d'Acceleration de la Cadence de l'Agriculture Sénégalaise*).

The cost of PRACAS investments is planned to represent CFA 581 billion (EUR 886 million) which is divided among specific sub-sectors (**Table 16**).

The specific investments within PRACAS are guided by the National Agricultural Investment Programme (PNIA) which prioritises investment programmes in agriculture according to the Agro-Sylvo-Pastoral Law (LOASP — *Loi d'Orientation Agro-Sylvo-Pastorale*), the bill passed in 2004 to define the long-term objectives for agriculture development.

The National Rice Self-Sufficiency Programme (PNAR) within the PRACAS also acts as a separate strategy with its goals detailed in **Table 16**. In addition, there is a specific strategy governing the optimal functioning of the agricultural markets (PDMAS).

6.3 INTERNATIONAL FINANCING OPPORTUNITIES

ElectriFi

ElectriFI is a specialist debt and equity financing partner for small-scale private companies focusing on new or improved electricity connections as well as on generation capacity from sustainable energy sources in emerging countries. ElectriFI is a 215-million-euro impact investment facility for renewable energy companies active on- and off-grid in emerging markets. Partnering with the European Development Finance institutions, the European Commission launched ElectriFI in December 2015 during the COP21 in Paris. ElectriFI is also funded by contributions from the US Power Africa and Sweden.[61]

AFD's SUNREF and Transforming Financial Systems for Climate

Sustainable Use of Natural Resources and Energy Finance (SUNREF) is a green credit line financed by the French Development Agency (AFD — *l'Agence Française de Développement*) for commercial bank on-lending to smaller renewable energy and energy efficiency projects. The credit line is available to participating banks in East, West and Southern Africa, including Orabank and Société Générale de Banques in Senegal.[62] In June 2017, SUNREF attracted the interest of many project sponsors for renewable energy and energy efficiency projects in Senegal in various sectors, including services, agroindustry and industry, for potential investments amounting to USD 20 million.

61) Link: http://electrifi.eu – accessed January 2019
62) Link: https://www.sunref.org/en/sunref-au-senegal-des-avancees-encourageantes-pour-un-futur-plus-vert/ – accessed January 2019

Beyond SUNREF, in March 2018, AFD submitted a EUR 330 million application[63] to the Green Climate Fund (GCF) of a total EUR 882 million funding package entitled *Transforming Financial Systems for Climate*. "The goal of the Programme is to create a market for investments in climate technologies in 17 countries (including Senegal) by removing the financial and technical barriers faced by Local Financial Partners (LFPs) to enable borrowing by, mainly, the private sector. The Programme will facilitate project funding (through credit lines and guarantee mechanisms) in the target countries and will develop the capacity of LFPs and project developers to scale up climate finance". Proposed sectors to be included cover renewables, water and agriculture in addition to waste and forestry.

Powering Agriculture

Powering Agriculture is an energy challenge fund for clean energy innovations in the agriculture sector of developing countries. Powering Agriculture is funded by the United States Agency for International Development (USAID), the Swedish International Development Cooperation Agency (Sida), the German Federal Ministry for Economic Cooperation and Development (BMZ), Duke Energy and OPIC.

Grantees of Powering Agriculture include the Earth Institute at Columbia University, which received a grant for its pilot Acacia Irrigation project in Senegal. The project piloted a PAYGO systems for supplying solar-PV based electricity to micro-scale irrigation pumps (see also **Section 4.3**).

Green Climate Fund

The GCF helps developing countries limit or reduce their greenhouse gas emissions and adapt to climate change. Entities that seek funding from the GCF need to work through the so-called Accredited Entities. Currently there are two direct access entities accredited that cover Senegal: the West African Development Bank (BOAD — *Banque Ouest Africaine de Développement*) and the *Centre de Suivi Écologique* (CSE). In addition, there are several international access entities that are active in Senegal, such as AFD, World Bank, AfDB, etc.[64] At the Climate Conference in Bonn in 2017 (COP23), new and simplified procedures were approved for small-scale programmes (less than USD 10 million), which should make access to the GCF easier. The small-scale procedures specifically target direct access entities (as opposed to international access entities).

63) Link: https://www.greenclimate.fund/documents/20182/1087995/GCF_B.20_10_Add.08_-_Consideration_of_funding_proposals___Addendum_VIII_Funding_proposal_package_for_FP089.pdf/ef70d023-6d8b-63e5-caf4-93c8768c6bec – accessed January 2019

64) The list of Accredited Entities can be found on http://www.greenclimate.fund/how-we-work/tools/entity-directory – accessed January 2019

ANNEX A

Relevant Stakeholders

GOVERNMENT INSTITUTIONS

Agence National des Ecovillages (ANEV)
The National Agency for Ecovillages was created in 2008 and is dedicated to reinforcing the resilience of rural communities to climate change by using six strategies, which include the promotion of renewable energy and support to rural private sector. Support has been received from the Japan International Cooperation Agency (JICA).

The following activities have been undertaken to establish a system aimed at efficiently increasing the number of Ecovillages: **a)** Establishment of ecovillage platforms in Thies, Fatick and Kaolack regions, **b)** An inventory of villages where the status of the four components of ecovillages was collated and **c)** Pilot activities targeting improved practices, an example is the production of solar pumps in the Niayes zone.

Agence Nationale de la Statistique et de la Démographie (ANSD)
The National Agency for Statistics and Demography is responsible for the technical coordination of the national statistics system. Their website (www.ansd.sn) produces and distributes statistical data for the Senegalese government, private sector, development partners and the public.

Agence Nationale pour l'Insertion et le Développement Agricole (ANIDA)
The National Agency for Agricultural Integration and Development was created to promote the development of a modern, diversified agriculture based on water management and to provide sustainable employment for young people. It has two main missions: **a)** To ensure the creation of integrated modern agricultural farms and include young farmers; and **b)** To support private initiative in the agro-sylvan-pastoral sector. In order to optimise the impact of its interventions, the Agency focuses on the use of groundwater for irrigation and on the development of a mode of farming which is mixed (off-season and winter) and integrated (plant and animal). It has a programme developing 400 "small integrated farms" by 2020 and is also working with PNB to implement small scale biogas digesters.

PRIVATE SECTOR ACTORS

Agence de Promotion des Investissements et Grands Travaux (APIX)
The National Agency for Investment Promotion and Major Projects is a private company, with the State of Senegal as shareholder. Its main objective is to promote investment in Senegal, both from local and international companies. They provide the full service for establishing a company in the country including supporting administrative procedures, applying for various public support schemes, securing tax exemptions and finding local partners.

Conseil patronal des énergies renouvelables du Sénégal (COPERES)
The Association of Renewable Energy Sector Developers represents the private sector actors in the renewable energy sector with a mission to formulate initiatives and proposals for policy makers. It works with ANER, among others, to foster research and promote the development of renewables in Senegal.

DEVELOPMENT PARTNERS & NGOS

African Development Bank (AfDB)
At the time of writing, AfDB in Senegal was elaborating a mid-term strategy for the transformation of the agriculture sector as a central pillar, including the promotion of food security. The bank is also engaged in the promotion of the LPDSE goals including those relating to renewable energy.

Agence Française de Développement (AFD)

The French Development Agency's subsidiary PROPARCO, dedicated to the private sector, supports job creation, business competitiveness and entrepreneurship. In Senegal, AFD is mainly active through SUNREF.

Enda-Energy

Enda-Energy is a branch of the NGO Enda-Tiers Monde organisation. Its work is embedded in the linkages between energy and development with a focus on energy use and management within Africa. Enda-Energy currently implements the Progrès-Lait programme which provides solar PV cooling solutions to agro-pastoralist communities in Senegal.

Energy4Impact

An NGO, formerly known as GVEP International, that supports the PREM of ASER, and more than 40 other small renewable activities in rural areas, in part through a women's empowerment programme.

European Union (EU)

The EU is an active development cooperation partner in Senegal. Senegal is one of the beneficiary countries of the €6.4 billion allocated to 16 states in the region of West Africa between 2014–2020, mobilised as part of the 11th European Development Fund (EDF) and designed to support investments that generate growth and job creation for the 300 million citizens of West Africa. An initial amount of EUR 347 million is dedicated to Senegal which include agricultural development and food security.

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

GIZ — among others — develops capacities for the sustainable development of the energy sector through the Programme to Promote Rural Electrification and a Sustainable Supply of Domestic Fuel (PERACOD) which is a co-operation programme with the Senegalese government. The programme is aimed at increasing rural energy access through the deployment of domestic fuels and renewable energy.

Global Green Growth Institute (GGGI)

The GGGI works with Senegal to deliver green growth programs and help achieve poverty reduction, social inclusion, environmental sustainability and economic growth. Senegal joined the institute as a member in November 2014 and activities were officially launched with the Ministry of Environment and Sustainable Development (MEDD — Ministère de l'Environnement et du Développement Durable) in 2016. One of their main objectives is to operationalise the National Climate Fund to prepare bankable projects for submission to national and international funds. GGGI is also working with the MEDD on the creation of a roadmap for the conversion of waste into energy in particular through the development of an industrial biogas sector.

KfW Bankengruppe

KfW is the German development finance bank, executing financial cooperation between Germany and Senegal on behalf of BMZ, in close collaboration with GIZ. KfW cooperates with other development finance institutions such as the World Bank and AFD to support the expansion of renewable energies in the country. It also provides subsidies to the Government of Senegal and is a partner in one of the rural electrification concessions.

Practical Action

Practical Action Consulting has an established office in Senegal, with an example of its work being the energy-agriculture-water nexus value chain analyses of key energy markets.

United Nations Development Programme (UNDP) Global Environment Facility

UNDP supports ANEV with a Small Grants Programme for the preservation of biodiversity and low emissions development in the ecovillages with renewable energy being one component. Support was also provided to MEDER on the definition and the implementation of a multi-functional platform, under the Regional Programme for Energy to Reduce Poverty.

United States Agency for International Development (USAID)

USAID supports the Government of Senegal through Power Africa and the Millennium Challenge Corporation. Power Africa provides, amongst other activities, training to Senelec for renewable energy integration, development of energy demand models and optimal generation mix for Senelec and transaction advisory services to energy projects and developers. Its Millennium Challenge Corporation supports, among others, irrigation improvements.

World Bank

Supports, and has supported, the Government of Senegal on various projects including in the renewable energy and agricultural sectors. These include, but are not limited to, the Sustainable and Participatory Energy Management Project Phase I & II, The West Africa Agricultural Productivity Program and the Senegal Taiba Ndiaye IPP Project.

RESEARCH & CAPACITY DEVELOPMENT

Université Cheikh Anta Diop de Dakar (UCAD)

The University in Dakar hosts a Research and Study Centre for Renewable Energy (CERER — *Centre d'Etudes et de Recherche sur les Energies Renouvelables*) and an International Centre for Research and Training in Solar Energy (CIFRES — *Centre International de Formation et de Recherche en Energie Solaire*). Activities covered include studies about renewable energy potential, as well as pilot projects in wind and solar thermal energy.

Institut Sénégalais de la Recherche Agricole (ISRA)

The National Agricultural Research Institute has conducted research on renewable energy that includes analysis on the use of Jatropha for biofuel, promotion of renewable energy in agriculture value-chains and the role of renewable energy in production or post-harvest.

Programme d' Enseignement Supérieur pour les Energies Renouvelables et l'Efficacité Energétique (PESEREE)

The German Academic Exchange Service (DAAD — *Deutscher Akademischer Austauschdienst*), through funding from GIZ, delivers the University Programme on Renewable Energies and Energy Efficiency in Senegal. This is a multilateral cooperation between universities with the partner network comprising of École Polytechnique de Thiès, Université Gaston Berger de Saint Louis, Université Assane Seck de Ziguinchor and Université Alioune Diop de Bambey. The four universities jointly offering a degree course in renewable energies (Master Interuniversitaire en Energies Renouvelables).

ASSOCIATIONS AND COOPERATIVES

Association Nationale pour l'Intensification de la Production Laitière (ANIPL)

The National Association for the Intensification of Dairy Production is a union of intensive milk producers, created in 2007. It includes 20 intensive dairy farms raising a total of 1,600 dairy cattle.

Association Sénégalaise de Normalisation (ASN)

The Senegalese Association for Standardisation is responsible for the effective management of standards and was created in 2002 in order to involve the private sector. ASN is therefore composed of 60% private sector and 40% public sector. The mission of ASN includes the development of national standards, representation of the interests of Senegal in regional and international standardisation bodies (ISO, ECOWAS, etc.) and product certification through the NS-Quality certification mark.

Association Sénégalaise pour la Promotion du Développement à la Base (ASPRODEB)

Senegalese Association for Grassroots Development provides farmer groups with technical and organisational capacity building, financial management and advisory services. The association supports national federations of farmer organisations (Organisations Paysannes), the Peasant Movement (Mouvement Paysan) and producer federations/organisations in various capacities. A list of their partner federations and unions can be found in **Annex B**.

Réseau des Organisations Paysannes et Pastorales du Sénégal (RESOPP)

Pastoral and Farmers Organisations' Network is the most important union of rural cooperatives as recognised in Senegal. The Savings and Credit Cooperative of RESOPP (COOPEC — *Coopérative d'épargne et de crédit du RESOPP*) was created in 2008 and is in charge of the technical, financial, monitoring and control of branches, the improvement of the financial and non-financial services offered by RESOPP and support for rural micro-enterprises.

FINANCIAL INSTITUTIONS

Participatory Microfinance Group for Africa (PAMIGA)

PAMIGA is an initiative of the International Centre for Development and Research (CIDR — *Centre International de Développement et de Recherche*) and leaders in African microfinance. Its mission is to contribute to the unlocking of the economic potential in rural Africa, by promoting the growth of existing financial intermediaries that serve rural areas. PAMIGA intervenes through two distinct sub-organisations, the first is PAMIGA Conseil, which provides advisory and technical assistance services in such areas as digital finance, renewable energy financing and financing in the agriculture value-chain. The second is PAMIGA Finance SA, which provides dedicated and non-dedicated loans and equity. PAMIGA works mainly with MFIs by providing them with loan capital and in Senegal the organisation works with Caurie Micro-Finance, U-IMCEC and is negotiating with ACEP and PAMECAS. Recently, PAMIGA started providing loans directly for amounts exceeding or equal to USD 600,000.

Compagnie nationale d'assurance agricole du Sénégal (CNAAS)

The National Agricultural Insurance Company of Senegal is a PPP in charge of underwriting crop and livestock insurance and partners with financial institutions to distribute these agricultural insurance products. Progress is limited by partners' understanding of insurance products and efforts are being made to assess the distributors and identify the most appropriate channels to strengthen their management capacity to better understand how insurance can mitigate the risks of their institutions and customers.

OTHER

Bureau de Mise à Niveau (BMN)

Created in 2004, the BMN is funded by the Senegalese government, AFD and the EU, with technical assistance from the United Nations Industrial Development Organization (UNIDO). Its mission is to improve the competitiveness and development of Senegalese companies. Since 2010, BMN has introduced an environment and energy efficiency theme which supports private sector companies adopt a cleaner approach to production, reduce pollution and implement energy management. The programme is aimed at leveraging competitiveness at a strategic level with companies able to benefit from environmental and energy assessments and financial incentives to implement renewable energy investments.

Centre de Suivi Écologique (CSE)

The Ecological Monitoring Centre is a national entity whose core activities include environmental monitoring, natural resources management and conducting environmental impact assessments. It has built partnerships at the local (subnational) and national levels, as well as with international donors recently securing accreditation to the GCF. The Centre's activities focus on developing climate change projects and programs, particularly in the areas of agriculture and livestock.

Initiative Prospective Agricole et Rurale (IPAR)

IPAR is a public policy think-tank for the agricultural sector of West Africa, formalised in 2005. It was initiated by agricultural and rural area specialists who already supported farmers' organisations and were interested in creating permanent spaces for prospective and strategic thinking.

Société Nationale d'Aménagement et d'Exploitation des Terres du Delta du Fleuve Sénégal et des Vallées du Fleuve Sénégal et de la Falémé (SAED)

The national agency for the development of the Senegal Delta and the Senegal and Faleme River valleys mission is to promote the development of irrigated agriculture on the banks of the Senegal River and Falémé. Activities are concentrated around 7 main areas including development and maintenance of hydro-agricultural facilities and infrastructure, water and environmental management and support to rural entrepreneurship.

Société de Développement Agricole et Industriel du Sénégal (SODAGRI)

The Society for Agricultural and Industrial Development in Senegal was created in 1974 as a public limited company with technical oversight from the Ministry of Agriculture and is responsible for the management of Niandouba and Confluent dams and the associated irrigation schemes.

Organisation pour la Mise en Valeur du fleuve Sénégal (OMVS)

The Senegal River Basin Development Organisation is a regional cooperative management body of the Senegal River which currently includes Guinea, Mali, Mauritania, and Senegal. It was created in 1972, following several years of severe drought with its mandate to manage the river water resources to promote irrigation.

Programme d'Aménagement et de Développement Economique des Niayes (PADEN)

The Programme for Land Use and Economic Development of Niayes aims to develop entrepreneurship and empower producers of targeted sectors in a high potential area. The PADEN approach in the Niayes area emphasises the value chain and the integration of production and marketing, as well as other parameters such as financing and capacity building for producers. The targeted sub-sectors include horticulture (onion, potato, carrot and cabbage).

ANNEX B

APRODEB Member Federations and Unions

TABLE 17. List of APRODEB Member Federations and Unions

ACRONYM	NAME	MAIN SUB-SECTOR	CONTACT EMAIL
Agriculture			
CCPA	*Cadre de concertation des producteurs d'arachide* (Peanut producers concertation framework)	Peanut & Cereal	ccpakl@yahoo.fr
FENAGIE/H	*Fédération Nationale des Groupements d'Intérêt Economique Horticoles* (National Union of Economic Interest Grouping in Horticulture)	Fresh vegetables	baba.ngom@cncr.org
FEPROBA	*Fédération des Producteurs du Bassin de L'Anambé*	Rice	landinganambe@gmail.com
FNPC	*Fédération Nationale des Producteurs de Coton* (National Federation of Cotton Producers)	Cotton	fnpc@orange.sn
FPA	*Fédération des périmètres autogérés* (Federation of Self-Managed Irrigation Areas)	Rice	fpasenegal@live.fr
FPMN	*Fédération des producteurs maraîchers des Niayes* (Federation of Vegetable Growers in Niayes)	Fresh vegetables	dierygaye2005@yahoo.fr
FPTI	*Fédération des Producteurs de Tomate Industrielle* (Federation of Industrial Tomato Producers)	Tomato	tomatecomite@yahoo.fr
RNCPS	*Réseau National des Coopératives de producteurs de Semences d'Arachide* (National Network of Cooperatives of Producers of Peanut Seeds)	Peanut & Cereal	planifierprojets@yahoo.fr
UNCAS	*Union Nationale des Coopératives Agricoles du Sénégal* (Senegalese Union of Agricultural Cooperatives)	Peanut & Cereal	dieyepapa66@gmail.com
UNPMN	*Union Nationale des Producteurs Maraîchers des Niayes* (National Union of Vegetable Producers in Niayes)	Fresh vegetables	unpmth@yahoo.fr
SAPCA-EGAS	*Société d'Approvisionnement, de Production, de Commercialisation et de Conseil Agricole des Ententes des Groupements Associés du Sénégal*	Peanut & Cereal	sapcaegas2013@gmail.com

Livestock			
ADENA	*Association pour le Développement de Namarel* (Association for the Development of Namarel)	Livestock	adenasn@yahoo.fr
ANAPES	*Association nationale pour la promotion de l'élevage au Sénégal* (National Association for the Promotion of Livestock Farming)	Livestock	anapeselevage@yahoo.fr
ANPROVB	*Association nationale des professionnels de la viande et du bétail* (National Association of Meat and Livestock Professionals)	Meat and Livestock	anprovbs@gmail.com
DINFEL	*Directoire National des Femmes en Elevage* (National Organisation of Women in Livestock)	Milk	dinfel2010@gmail.com
FAFA	*Fédération des Acteurs de la Filière Avicole* (Federation of Poultry Industry Workers)	Poultry	fafavicolesenegal@gmail.com
FENAGIE/E	*Fédération Nationale des Groupements d'Intérêt Economique Eleveurs* (National Union of Economic Interest Grouping in Livestock)	Livestock	fenagie.e@gmail.com
UNCES	*Union nationale des coopératives d'éleveurs du Sénégal* (National Union of Livestock Cooperatives)	Livestock	assanedjiborysow@gmail.com

Cross-sector			
FNGPF	*Fédération Nationale des Groupements de Promotion Féminine* (National Federation of Women's Advancement Groups)	Agro-sylvo-pastoral	fngpf1@orange.sn
FONGS	*Fédération des Organisations Non-Gouvernementales du Sénégal* (Federation of NGOs in Senegal)	Agro-sylvo-pastoral	fongs@orange.sn

ANNEX C

Company Incorporation in Senegal[65]

A. MANDATORY FORMALITIES

There are eight (8) mandatory incorporation formalities in Senegal:

1) Presentation of the police clearance (for the Manager); foreigners must, in addition to that, present the police records of the country of origin or any other equivalent document (24 hours);

2) Establishment of notarial documents (for companies) (24 hours if step 1 is done);

3) Provide proof of capital formation with a Notary or Bank (for companies) (24 hours if step 1 is done);

4) Filing of the articles of organisation (for companies and Economic Interest Groups (GIE's — *Groupement d'Intérêt Economique*) (24 hours if step 1 is done);

5) Filing with the Registry of Commerce and Movable Assets (RCCM — *Registre du* **Commerce** *et du Credit Mobilier*) (24 hours if step 1 is done);

6) Filings with the tax registry to obtain the national identification number for companies and associations NINEA — *Numéro d'identification national des entreprises et associations* (24 hours if step 1 is done);

7) Declaration of Establishment (24 hours if step 1 is done);

8) Publication in the legal gazette (for companies).

B. SINGLE PROPRIETORSHIP

The documents required are the following:

a) Two copies of the National identity card or copies of the passport (for foreigners)

b) Police clearance of less than 3 months;

c) The police record of the country of origin for foreigners of less than 3 months;

d) Certificate of residence;

e) Marriage Certificate (if any)

f) Two revenue stamps of CFA 2000 (for the Trade Register and the NINEA)

The incorporation charges are:

— CFA 10,000 worth of registry fees for single proprietorship without trade name;

— CFA 20,000 for single proprietorship with trade name, broken down as follows:

  — CFA 10,000 for the registration of the trade name with the African Intellectual Property Organisation;

  — CFA 10,000 for the registry fees.

65) Source APIX

C. LIMITED COMPANIES (SARL – A SOCIÉTÉ À RESPONSABILITÉ LIMITÉE) AND BUSINESS CORPORATION (SA – SOCIÉTÉ ANONYME)

The incorporated company establishment procedure is divided in two stages:

- The establishment of the Statutes at a Notary and the deposit of the capital (within 24 hours). The Statutes must be signed by all the founding associates or their duly authorised representatives;
- The recording of the deeds of incorporation and the registration of the company at the Business Creation Support Centre (BCE) of APIX.
- The public notices related to incorporation and company modifications are made either online on the website of the Ministry of Economy and Finance by BCE, or by the notary in the authorised newspaper. The documents required for the creation of an SARL or an SA are the following:
- The Manager's police clearance of less than 3 months ;
- The police record of the country of origin (for foreigners) of less than 3 months;
- The photocopy of partners' identity card or passport (for foreigners).

It should be noted that the assessment of the contributions in kind for SARL and SA is done by an auditor selected on a list of comptrollers. For the SA, the resort to the comptroller for the assessment of the contributions in kind is mandatory whatever their value, while for the SARL, only the contributions amounting to more than CFA 5 million must undergo assessment by an auditor.

In case of a SARL with the capital, it can be deposited with a notary or in a bank account titled "account of a company being set up", the account is unfrozen immediately after the company is registered at the RCCM. The notary charges are about:

- CFA 20, 000 for SARL with a capital between CFA 0 and 500,000;
- CFA 70, 000 for SARL with a capital between CFA 500,000 and 5,000,000;
- CFA 700,000 for SA with a capital of CFA 10 million.

D. ECONOMIC INTEREST GROUPS (GIE)

GIE, like a Single proprietorship, can be created at the BCE of APIX.

The Statutes, by-laws and minutes of the constituent General Assembly are drafted by the founders, but must be registered at the Tax and State-owned Land Department (*Impôts et Domaines*). Standard forms of Statutes, By-laws and minutes are available at BCE.

Following are the documents required for the creation of a GIE:

- 3 copies of the Statutes, By-laws and minutes of the constituent General Assembly;
- 1 copy of members' identity card or passport;
- The Chairman's police clearance of less than 3 months;
- 2 revenue stamps of CFA 2,000.

The costs are broken down as follows:

- Registration fees amounting to CFA 35,000;
- Incorporation fees worth CFA 30,000 divided as follows:
  - CFA 20,000 for the trade name protection at the with the African Intellectual Property Organisation;
  - CFA 10,000 for the registry fees.

E. OTHER LEGAL ENTITY TYPES

There are other types of company, less known, but envisaged under the Organisation for the harmonisation of business law in Africa (OHADA — *Organisation pour l'harmonisation en Afrique du droit des affaires*) uniform act on trade companies and GIEs and by the Civil and Trade Obligations Code (COCC — le Code des obligations civiles et commerciales) of Senegal. These are:

— The Co-partnership (*Société en Nom Collectif*): it is a company in which the partners share unlimited and joint liabilities. Due to its high level of risk, this type of company is almost non-existent;

— The Limited Partnership (*Société en commandite simple*): it is a new form of company planned under AUSCG. There are two categories of associates in a *Société en commandite simple*: the "General Partners" that are indefinitely and jointly and severally liable for the company's debts, and the "Limited Partner" who are liable for the partnership debt to the extent of their contributions;

— The Professional Civil Society (*Société Civile Professionnelle*): this type of company is envisaged under COCC.

DOCUMENT REFERENCES

TABLE 18. References of demographic and macro-economic figures in **Table 1** and **Table 2**

ACRONYM	NAME
Population (2016)	http://www.worldbank.org/en/country/senegal/overview
Population growth (2017 est.), %	https://www.cia.gov/Library/publications/the-world-factbook/fields/2002.html
Median age of population (2017 est.), years	https://www.cia.gov/library/publications/the-world-factbook/fields/2177.html
Urbanisation rate (2015–2020 est.), % p.a.	https://www.cia.gov/library/publications/the-world-factbook/fields/2212.html
Urban population (2017), % of total	https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS
Rural population (2017), % of total	http://data.worldbank.org/indicator/SP.RUR.TOTL.ZS
Population density (2017), per km2	http://data.worldbank.org/indicator/EN.POP.DNST
HDI (2015)	http://hdr.undp.org/en/composite/HDI
National Currency	https://www.cia.gov/library/publications/the-world-factbook/
Exchange rate (February 2017), USD	http://www.xe.com
GDP (2017), USD million current	http://data.worldbank.org/indicator/NY.GDP.MKTP.CD
GDP growth (2017), %	http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG
GDP annual growth rate forecast (Q2 2019), %	http://www.tradingeconomics.com/forecast/gdp-annual-growth-rate
GNI per capita (2017), current international USD	http://data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD
Inflation (May 2018), %	http://www.tradingeconomics.com/country-list/inflation-rate
Inflation Rate Forecast (Q2/2019), %	http://www.tradingeconomics.com/forecast/inflation-rate
Foreign Direct Investment, net inflows (2016), Balance of Payment current USD	http://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD
Net official development assistance (2016), current USD	http://data.worldbank.org/indicator/DT.ODA.ALLD.CD
Budget deficit (2016), % of GDP	https://www.cia.gov/library/publications/the-world-factbook/fields/2222.html
Ease of Doing Business Index (2017), rank out of 190	http://www.doingbusiness.org/rankings
TI Corruption Index (2016), rank out of 176	http://www.transparency.org/news/feature/corruption_perceptions_index_2016

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