



Figure 1: Energy profile of Senegal



Figure 2: Total energy production, (ktoe)

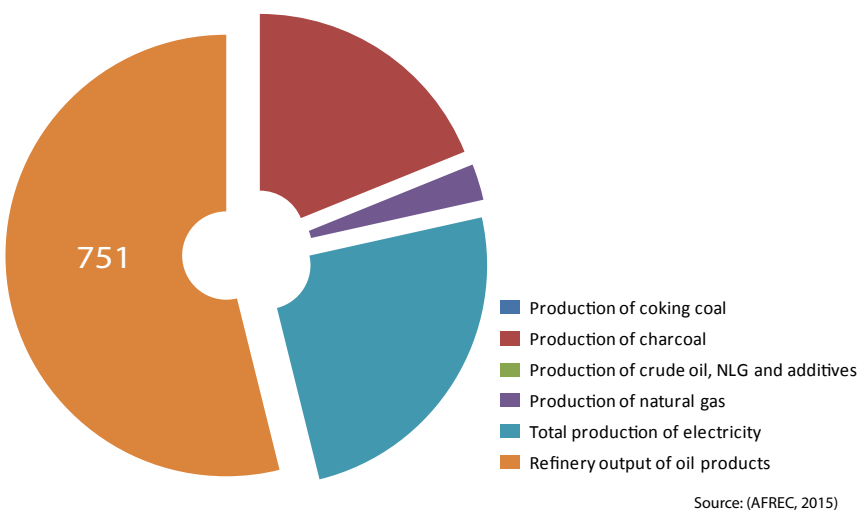
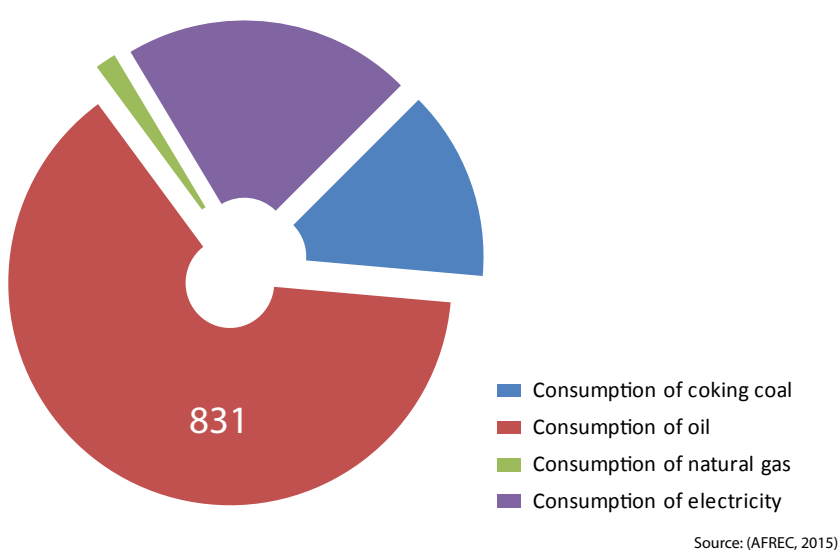


Figure 3: Total energy consumption, (ktoe)



Energy Consumption and Production

In 2013, Senegal had a population of 14.13 million (Table 1). In 2015, total electricity produced was 343 ktoe, with 88.9 per cent from fossil fuels and 9 per cent from solar and wind. Final electricity consumed was 276 ktoe, as shown in Table 2 (AFREC, 2015). Figures 2 and 3 highlight the key energy statistics.

Table 1: Senegal's key indicators

Key indicators	Amount
Population (million)	14.13
GDP (billion 2005 USD)	11.25
CO ₂ emission (Mt of CO ₂)	6.00

Source: (IEA, 2016)

Energy Resources

Biomass

Biomass (firewood and charcoal) is the main energy source used by households, providing more than half of the national energy balance (REEEP, 2014). Charcoal production in 2015 amounted to 263 ktoe (AFREC, 2015). There is potential for the development of solid biomass from agricultural waste and crop residues and liquid biofuels in the country. In 2010, the production of electricity from biofuels and waste was 4 ktoe and this increased to 5 ktoe in 2015 (AFREC, 2015). The National Bioenergy Strategy 2006 aims to use plant species such as Jatropha for biofuel production. The target was 1,134 million litres of refined biodiesel from 2012 (Dafrallah, 2009). The government is also interested in producing biogas from fermenting organic waste.

Hydropower

The Manantali hydroelectricity plant built along the Senegal River is located in Mali, but supplies electricity to Senegal as well as Mauritania. The dam is managed by the Senegal River Basin Development Authority and has a potential of 200 MW (REEEP, 2014). In 2015, the amount of electricity that came from hydro sources was 31 ktoe making up about 9 per cent of total electricity produced in the country (AFREC, 2015).

Oil and natural gas

Senegal imported 655 ktoe of oil in 2015 and used 305 ktoe of it to produce electricity (AFREC, 2015). Lately, there have been some finds of oil in the

Table 2: Total energy statistics (ktoe)

Category	2000	2005	2010	2015 P
Production of coking coal	-	-	-	-
Production of charcoal	296	335	424	263
Production of crude oil, NLG and additives	1	0	0	0
Production of natural gas	1	15	22	37
Production of electricity from biofuels and waste	4	4	4	5
Production of electricity from fossil fuels	127	164	234	305
Production of nuclear electricity	-	-	-	-
Production of hydro electricity	0	23	22	31
Production of geothermal electricity	-	-	-	-
Production of electricity from solar, wind, Etc.	0	0	0	2
Total production of electricity	131	191	261	343
Refinery output of oil products	884	874	564	751
Final Consumption of coking coal	0	78	147	182
Final consumption of oil	901	1,004	882	831
Final consumption of natural gas	1	15	22	20
Final consumption of electricity	113	158	221	276
Consumption of oil in industry	157	139	79	95
Consumption of natural gas in industry	0	0	0	0
Consumption of electricity in industry	29	35	60	63
Consumption of coking coal in industry	0	78	147	182
Consumption of oil in transport	608	697	645	618
Consumption of electricity in transport	-	-	-	-
Net imports of coking coal	0	78	135	199
Net imports of crude oil, NGL, Etc.	855	925	612	655
Net imports of oil product	437	583	1,204	1,099
Net imports of natural gas	0	0	0	0
Net imports of electricity	17	23	22	24

- : Data not applicable

0 : Data not available

(P): Projected

(AFREC, 2015)

Senegal basin and the Senegal Guinea Bissau Joint Development Zone. Oil mining activities are known to affect biodiversity and habitats. In particular, one of the blocks — the Sangomar Deep — is located near the Saloum Delta National Park. This area is habitat to sea birds including the Royal Tern (*Thalasseus maximus*), among others (Veen, Dallmeijer, & Diagana, 2008).

Peat

There are about 36 km² of peatland (WEC, 2013).

Coal

Currently, all coal for electricity generation is imported, although there are plans to introduce greater electricity production from coal through IPP investments (REEEP, 2014).

Wind

Wind speeds from a low of 3.7 m/s up to a high of 6.1 m/s have been measured along the 250 km coast between Dakar and Saint Louis (REEEP, 2014). Towards the interior, the wind speeds are low and can only support the smaller traditional wind energy systems.

Geothermal

The potential provided by this sector needs more research.

Solar

Senegal can successfully exploit commercial level solar PV power projects as measurements of the Direct Normal Solar Irradiation over most of the country is over 1,800 kWh/ m²/year (REEEP, 2014). It is one of a handful of countries in Africa that has piloted green mini-grids and is now ready to roll them out for country-wide implementation (World Bank, 2015).

Tracking progress towards sustainable energy for all (SE4All)

The electrification rate for Senegal in 2012 was 56.5 per cent , more than double the rate in 1990 (Table 3 and Figure 4). In rural areas, 26.6 per cent had access to electricity and in urban areas, this figure rose to 87.8 per cent . Access to modern fuels in 2012 was 8 per cent in rural areas and 69 per cent in urban areas (World Bank, 2015); (World Bank, 2016).

The energy intensity (the ratio of the quantity of energy consumption per unit of economic output) of the Senegalese economy was 5.8.0 MJ per US dollar (2005 dollars at PPP) in 2012, up slightly from 5.1 MJ per US dollar in 1990. The compound annual growth rate (CAGR) between 2010-2012 was -0.25 (World Bank, 2015).

The share of renewable energy in the total final energy consumption (TFEC) increased slightly from 42.5 per cent in 2010 to 51.4 in 2012. Traditional solid biofuels form the biggest share of renewable sources at 49.2 per cent of TFEC in 2012, while the modern solid biofuels contributed 1.4 per cent and hydro 0.7 per cent . Renewable sources contributed a 9.8 per cent share of electricity generation in 2012 (World Bank, 2015); (World Bank, 2016).

Intended Nationally Determined Contributions (INDC) within the framework of the Paris climate Agreement

Senegal is keen to contribute to reducing global GHG emissions and has articulated its Intended Nationally Determined Contributions (INDCs). Those related to energy are listed in Table 4.

Institutional and Legal Framework

The Ministry of Energy is in charge of the energy sector. The energy regulator is the Electricity Sector Regulating Committee (CRSE).

Table 3: Senegal’s progress towards achieving SDG7 – Ensure access to affordable, reliable, sustainable and modern energy for all

Target	Indicators	Year					
		1990	2000	2010	2012	2000-2010	2011-2015
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.1 Per cent of population with access to electricity	26	37	57	56.5		
	7.1.2 Per cent of population with primary reliance on non-solid fuels	32	38	39	39.27		
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1 Renewable energy share in the total final energy consumption	55.6	47.7	42.5	51.4		
7.3 By 2030, Double the rate of improvement of energy efficiency	7.3.1 GDP per unit of energy use (constant 2011 PPP \$ per kg of oil equivalent)			8.2	8.2		
	Level of primary energy intensity(MJ/\$2005 PPP)	5.1		5.8	5.8		

Sources: (World Bank, 2015); (World Bank, 2016)

Table 4: Senegal’s key aspects/key mitigation measures to meet its energy Intended Nationally Determined Contributions (INDCs)

INDC
*Build Solar PV power plants of aggregated total capacity of 160 MW
*Build wind power plants of aggregated total capacity of 150 MW
*Build hydraulic power plants of aggregated total capacity of 144 MW/522 GWh
*Implement rural electrification programme (PNUER) . - 392 villages to be electrified with mini-grid using solar or hybrid (diesel/solar)
*Install 27,500 household bio digesters
*Produce and disseminate 4.6 million improved cooking woodstoves
*Produce and disseminate 3.8 million of improved cooking stoves for charcoal
*Commission wind power plants for a total cumulated capacity of 200 MW
*Commission Solar PV power plants for a total cumulated capacity of 200 MW
*Commission biomass power plants for a total cumulated capacity of 50 MW
*Commission Concentrated Solar Power CSP power plants for a total cumulated capacity of 50 MW
*Add Hydraulic 200 GWh to the existing grid
*Replace the Jindal 320 MW coal power plant with two combined- cycle LNG (CCGN) power plants of 400 MW (2020: 200 MW and 2028: 200 MW)
*Electrify 500 villages using solar (mini-grid) under the universal access to electricity program
*Build and disseminate 7.6 million of improved cooking woodstoves, 6.8 million of improved cooking stoves using charcoal, and 49,000 household bio digesters
*Manufacture typha-based thermal insulation materials in Senegal and adoption of Nubian vault technique in rural habitat and community infrastructure construction
* Run pilot phase to promote facilities of cold storage for food.
*Make energy audits for heavy industries compulsory
*Conduct energy supply studies for new installations (75 studies/year)
*Run pilot program for capacity building in environmental knowledge
*Implement waste recovery/recycling program in the agriculture and food processing industry (biogas)
*Implement efficient lighting program (distribute/sell 3 million LED bulbs)
*Implement energy efficiency programme in tertiary buildings and in the administration
*Promote high-performing facilities of cold storage for food: the plan is to replace up to 95 per cent of existing non-efficient equipment fleet
*Energy efficiency and public lighting (replacing 75,000 street lamps)
* Implement capacity building in environmental knowledge for companies (aiming at 50 companies per year, with financial incentives)
*Implement agriculture and food-processing waste recovery/recycling plan: recycle/recover 4 million GJ of agricultural biomass through co/tri-generation (115 MW)
*Implement energy efficiency program in the cement industry
*Substitute 40 per cent of the coal destined for electricity auto-generation by natural gas

Source: (ROS, 2015)

Figure 4: SDG indicators





Percentage of population with access to electricity	Access to non-solid fuel (% of population)	GDP per unit of energy use (PPP \$ per kg of oil equivalent) 2013	Renewable energy consumption (% of total final energy consumption), 2006-2011, 2012
56.5%	39.27%	8.68	51.36%
			

Table 5: Senegal’s institutional and legal framework

Basic Elements	Response
Presence of an Enabling Institutional Framework for sustainable energy development and services (Max 5 institutions) most critical ones	Ministry of Energy National Agency for Renewable Energies (ANER) Ministry of Renewable Energies Senegalese Rural Electrification Agency (ASER) National Agency for Solar Energy (ANDES) 2010
Presence of a Functional Energy Regulator	Commission de Régulation du Secteur de l’Electricité (CRSE)
Ownership of sectoral resources and markets (Electricity/ power market; liquid fuels and gas market)	Société Nationale d’Electricité du Sénégal (SENELEC) has the monopoly for transmission and distribution of electricity.
Level of participation in regional energy infrastructure (Power Pools) and institutional arrangements	West African Power Pool
Environment for Private Sector Participation	
Whether the Power Utility(ies) is/are vertically integrated or there is unbundling (list the Companies)	
Where oil and gas production exists, whether upstream services and operations are privatized or state-owned, or a mixture (extent) e.g., licensed private exploration and development companies)	
Extent to which Downstream services and operations are privatized or state-owned, or a mixture (extent)	
Presence of Functional (Feed in Tariffs) FIT systems	Feed-in tariff scheme provided in the Renewable Energy Law (No. 2010-21)
Presence Functional IPPs and their contribution	IPPs produce about 50 per cent of power and sell exclusively to SENELEC.
Legal, Policy and Strategy Frameworks	
Current enabling policies (including: RE; EE; private sector participation; & PPPs facilitation) (list 5 max) most critical ones	• Energy Policy (Letter of Development Policy for the Energy Sector) adopted in 2012 • National Bioenergy Strategy 2006
Current enabling laws/pieces of legislation (including: RE; EE; private sector participation; & PPPs facilitation) – including electricitv/arid codes & oil codes (5 max or ves/no) most	• Electricity Law (98-29), 1998 established the Commission for the Regulation of Electricity • Renewable Enerav Law (No. 2010-21) provides for

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