Comoros

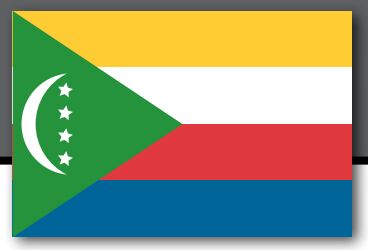


Figure 1: Energy profile of Comoros

Energy Consumption and Production

In 2013, the population of the Comoros was 13.1 million people (Table 1) (World Bank, 2016). Electricity production in 2015 was 6 ktoe, with all of it generated from fossil fuels. Final electricity consumption in the same year was 6 ktoe (AFREC, 2015). Table 2 shows the main energy statistics. Key consumption and production statistics are shown in Figures 2 and 3.

Table 1: Comoros's key indicators

Key indicators	Amount
Population (million)	13.1
GDP (billion 2005 USD)	0.46
CO_2 emission (Mt of CO_2)	157.6

Source: (World Bank, 2015)

Energy Resources

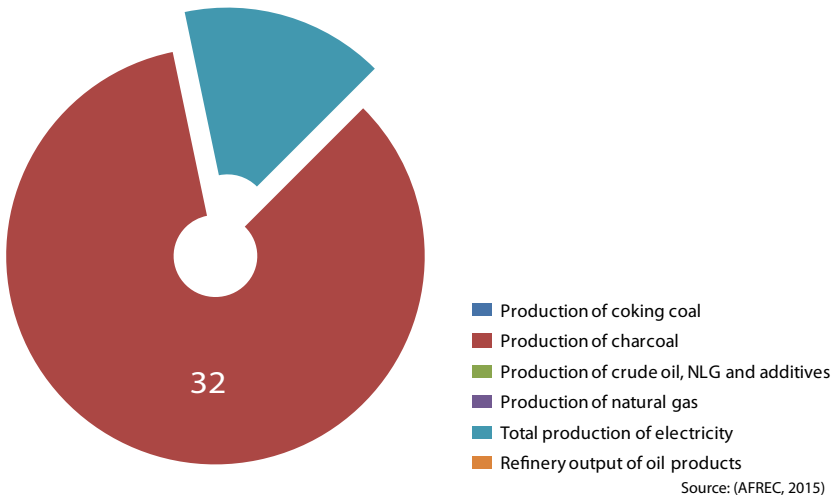
Biomass

Biomass (wood and charcoal) is used to provide about 70 per cent of energy use in the Comoros. Other plants being explored for generating biomass energy include oilseed plants, such as coconut, sesame, peanut and *Jatropha curcas* (REEEP, 2012).

Hydropower

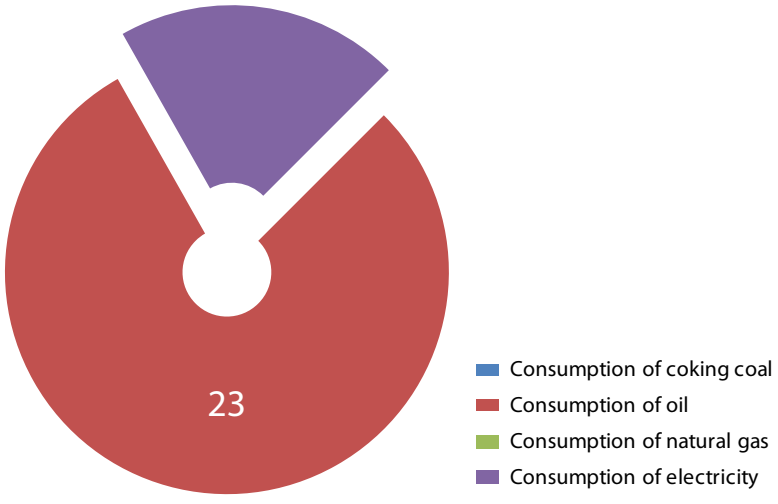
Although there is some hydroelectric potential, the islands have only about 1 MW of installed hydroelectric capacity (REEEP, 2012). More study is required to fully assess the country's available potential. There have been calls to create a national hydrographic and bathymetric service in the past (REEEP, 2012).

Figure 2: Total energy production, (ktoe)



Source: (AFREC, 2015)

Figure 3: Total energy consumption, (ktoe)



Source: (AFREC, 2015)

Table 2: Total energy statistics (ktoe)

Category	2000	2005	2010	2015 P
Production of coking coal	-	-	-	-
Production of charcoal	0	0	0	32
Production of crude oil, NLG and additives	-	-	-	-
Production of natural gas	-	-	-	-
Production of electricity from biofuels and waste	0	0	0	0
Production of electricity from fossil fuels	2	4	3	6
Production of nuclear electricity	-	-	-	-
Production of hydro electricity	0	0	0	0
Production of geothermal electricity	-	-	-	-
Production of electricity from solar, wind, Etc.	0	0	0	0
Total production of electricity	2	5	3	6
Refinery output of oil products	-	-	-	-
Final Consumption of coking coal	-	-	-	-
Final consumption of oil	35	38	44	23
Final consumption of natural gas	-	-	-	-
Final consumption of electricity	2	4	3	6
Consumption of oil in industry	0	0	0	3
Consumption of natural gas in industry	-	-	-	-
Consumption of electricity in industry	0	0	0	0
Consumption of coking coal in industry	-	-	-	-
Consumption of oil in transport	0	0	0	13
Consumption of electricity in transport	-	-	-	-
Net imports of coking coal	-	-	-	-
Net imports of crude oil, NGL, Etc.	-	-	-	-
Net imports of oil product	32	38	44	36
Net imports of natural gas	-	-	-	-
Net imports of electricity	-	-	-	-

(AFREC, 2015)

- : Data not applicable
0 : Data not available
(P): Projected

Oil and natural gas

The country has no known oil or gas reserves and hence has no upstream sector.

Wind

The potential for wind power in the Comoros is low. Measurements indicate that wind speeds rarely go above 3 m/s, the average required to drive a wind generator. For instance, two wind turbines set up in Ngazidja in 1985 (one on the eastern coast at Mtsangadju ya Dimani and the other on the northern coast at Wella) to drive groundwater pumps have not provided the volumes of water originally estimated (REEEP, 2012).

Geothermal

The potential for the Comoros to meet all its energy demands from geothermal sources is high. The key indicator of a potentially exploitable geothermal system on Grande Comore is the presence of a rift system associated with the active volcano. This geological structure along with other measurements, including surface thermal discharges and a geophysical survey, suggest that an active geothermal system is present. Currently the three islands: Grand Comore, Moheli and Anjouan, are being mapped by the Australian Sinclair Knight Merz (SKM) and New Zealand-based Gafo Energy. If successful, Gafo will operate the power installations. Recent analysis by engineers from KenGen, the Kenyan national utility, indicate that both the Karthala and La Grille volcanoes on Grand Comore have great geothermal potential, with reservoir temperatures taken at both sites of up to 300°C, at depths of 2,000 m and deeper (REEEP, 2012). But more data is required to determine the dimensions of both the geothermal reservoir and the heat source and the potential to develop it for power generation (Houmadi & Chaheire, 2015).

Solar

Solar has great potential on these islands since they experience an average of 5.0 kWp/m^2 or 2,880 hrs/yr of sunshine. There are a number of solar installations at domestic and commercial levels. For instance, the World Bank supported a local energy company called ENERCOM to implement about 100 installations on the three islands. There are also a number of hotels implementing solar as a means of reducing their ecological footprint (REEEP, 2012).

Tracking progress towards sustainable energy for all (SE4All)

Just less than 70 per cent of the population of the Comoros has access to electricity: 61.4 per cent in rural areas and 85.1 per cent in urban areas (Table 3 and Figure 4). There are also access disparities between the three islands. For instance, the electrification rate on Grande Comore is 53.6 per cent , while on Mohéli it is 28.4 per cent and on Anjouan 22.6 per cent (REEEP, 2012). About a quarter of the population uses modern fuels, and of these, 10 per cent are in rural areas and 54 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 economy of the Comoros was 4.0 MJ per US dollar (2005 dollars at PPP) in 1990, increasing to 6.1 MJ per US dollar in 2012. The compound annual growth rate (CAGR) between 2010 and 2012 was 3.29 (World Bank, 2015).

The share of renewable energy in the total final energy consumption (TFEC) has been increasing from a low of 1.0 in 1990 to 46.1 in 2012. Hydropower forms the biggest share of renewable sources at 0.5 per cent of TFEC in 2012. Renewable sources contributed 11.5 per cent share of electricity generation in 2012 (World Bank, 2015).

Table 3: Comoros'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	42	45	52	69.3		
	7.1.2 Per cent of population with primary reliance on non-solid fuels	12	21	25	25.52		
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	1.0	1.0	1.3	46.1		
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)	36.9					
	Level of primary energy intensity(MJ/$2005 PPP)	4.0		5.8	6.1	6.10	6.14

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

Figure 4: SDG indicators

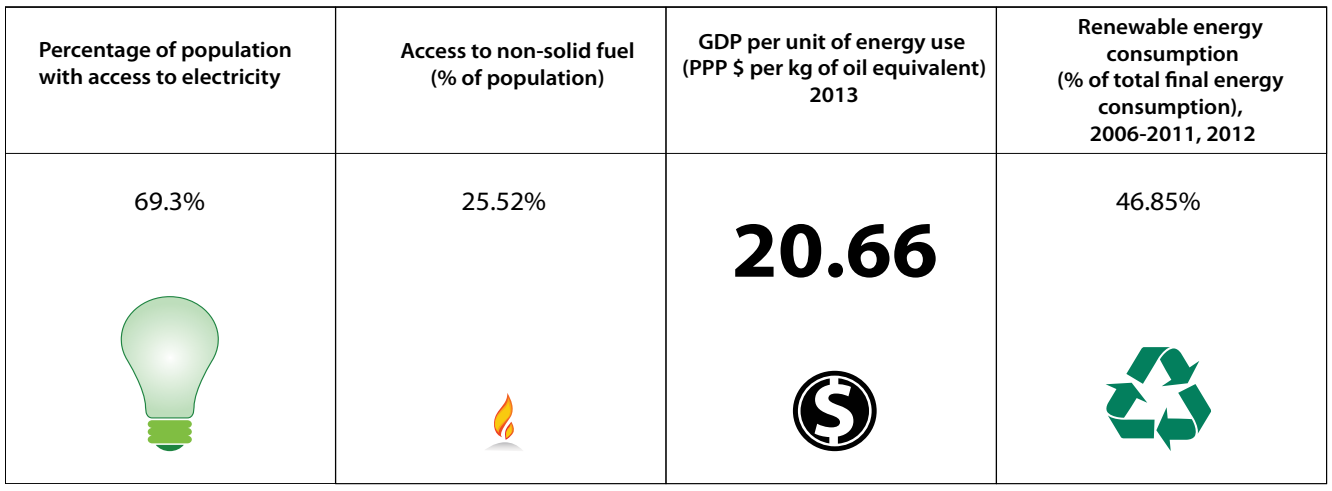


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Table 4: Comoros's key aspects/key mitigation measures to meet its energy Intended Nationally Determined Contributions (INDCs)

INDC
*Reduce losses on the electricity distribution grid.
*Rehabilitate power plants.
Increase solar energy generation.
*Increase hydro generation potential.
*Produce geothermal energy.
*Promote LPG use in lieu of kerosene and fuel wood.
*Promote the use of improved cooking stoves under the framework of reduced fuel wood use plan.

Source: (ROC, 2015)

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

Electricity production is expensive as almost three quarters of the cost goes to diesel fuel. The total installed capacity is 22.6 MW and

Table 5: Comoros'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 Planning • Société Comorriene des Hydrocarbures
Presence of a Functional Energy Regulator	
Ownership of sectoral resources and markets (Electricity/power market; liquid fuels and gas market)	• Société Comorriene des Hydrocarbures • Gestion de l'Eau et de l'Electricité aux Comores (MAMWE) • Electricité d'Anjouan (EDA)
Level of participation in regional energy infrastructure (Power Pools) and institutional arrangements	
Environment for Private Sector Participation	
Whether the Power Utility(ies) is/are vertically integrated or there is unbundling (list the Companies)	Gestion de l'Eau et de l'Electricité aux Comores (MAMWE) is vertically integrated
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)	Comor Hydrocarbures is state owned and has monopoly over oil and gas imports
Presence of Functional (Feed in Tariffs) FIT systems	
Presence Functional IPPs and their contribution	
Legal, Policy and Strategy Frameworks	
Current enabling policies (including: RE; EE; private sector participation; & PPPs facilitation) (list 5 max) most critical ones	• Document de politique de l'energie électrique et des produits pétroliers de l'Union des Comores • Poverty Reduction and Growth Strategy Paper (PRGSP) • Renewable Energy Policy 2008 • Strategy and Energy Action Plan 2013 • National Energy Sector Strategy 2012
Current enabling laws/pieces of legislation (including: RE; EE; private sector participation; & PPPs facilitation) – including electricity/grid codes & oil codes (5 max or yes/no) most critical ones	• Petroleum Code 2012 • Constitution of 2009

This table was prepared with material from (REEEP, 2012); (UOC, undated) and (World Bank, 2013)

the effective capacity is 13 MW. The monthly consumption on Grande Comore only is 3,782.7 KWh. These high costs make the possibility of switching or incorporating more renewable into the energy mix very attractive (Houmadi & Chaheire, 2015). The development of alternative renewable energy is fundamental to the Intended Nationally Determined Contributions articulated by the Comoros in 2015 (Table 4).

Institutional and Legal Framework

There is no government ministry in charge of the energy sector; however the Ministry of Planning monitors the hydrocarbons sector. The *Gestion de l'Eau et de l'Electricité aux Comores* (MAMWE) is the state-owned utility, in charge of the generation and distribution of electricity on the islands of Grand Comore and Moheli. Electricité d'Anjouan (EDA) is responsible for electricity generation and distribution Anjouan island. Both companies also regulate the energy industry on their respective islands. The Comoros does not participate in any regional power pools. The legal framework is guided by the 2009 Constitution and the Petroleum Code 2012 (Table 5).

The main sector policy is the National Energy Sector Strategy of 2012; along with the Poverty Reduction and Growth Strategy Paper (PRGSP), both set ambitious targets for access to energy and electricity.