

Figure 1: Energy profile of Uganda



## Energy Consumption and Production

In 2013, Uganda had a population of 36.52 million (Table 1). Total electricity production in 2015 was 276 ktoe with 74.6 per cent produced from hydro, 19 per cent from fossil fuels and 5.4 per cent from biofuels and waste. Final electricity consumption in the same year was 200 ktoe (AFREC, 2015). Table 2 shows the main energy statistics. Figures 2 and 3 show energy production and consumption.

Table 1: Uganda's key indicators

Key indicators	Amount
Population (million)	36.52
GDP (billion 2005 USD)	15.69
CO <sub>2</sub> emission (Mt of CO <sub>2</sub> )	3.79

Source: (World Bank, 2015)

## Energy Resources

### Biomass

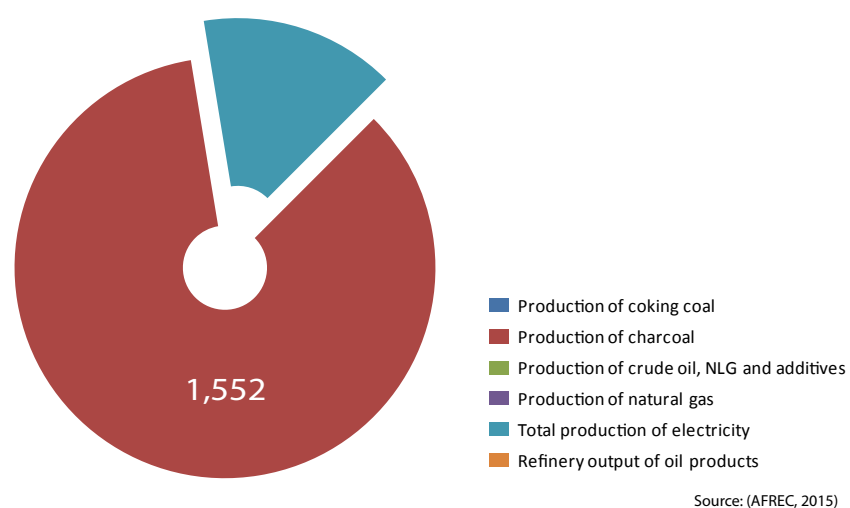
Biomass is the most used energy source in the country with demand averaging 44 million tonnes per year supplied by a combination of fuel wood, agricultural wastes and charcoal (MEMD, 2013). Most of this energy is used at the household level (74 per cent) followed by industry, commercial and institutional use at 18, 5 and 3 per cent respectively (MEMD, 2013). Fuel wood is the most highly consumed primary fuel with annual consumption of about 28 million tonnes, but tree biomass which is the most commonly used form, can only supply 26 million tonnes on a sustainable basis. This unmet need creates undue pressures on the country's biomass resources.

The production of charcoal has been increasing from 245 ktoe in 2000, to 405 in 2005, 506 in 2010 to a high of 1,552 ktoe in 2015 (AFREC, 2015). The conversion of wood into charcoal is highly inefficient and it is estimated that 16 million tonnes of wood are converted into 1.8 million tonnes of charcoal every year (MEMD, 2013). The sugar industry consumes a significant amount of biomass in form of bagasse. Industry is increasingly switching from heavy furnace oil to biomass waste such as coffee or rice husks for their thermal energy requirements. The Biomass Energy Strategy addresses issues of efficiency and technology transfer for sustainable biomass management.

### Hydropower

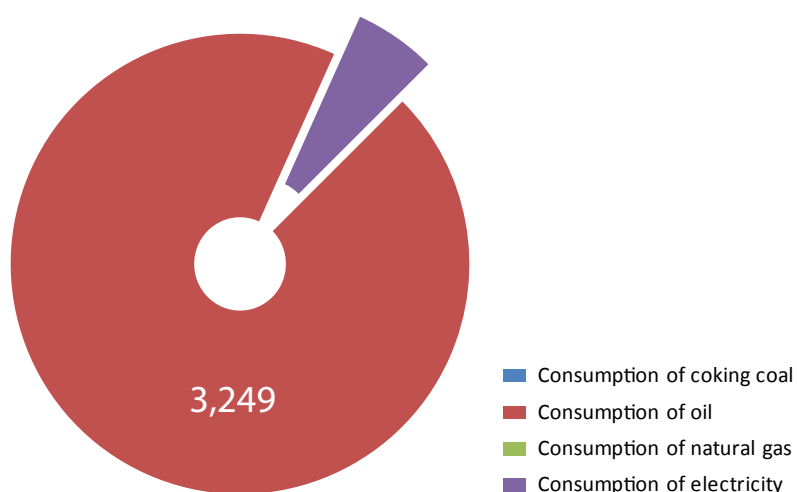
Along the Nile River, the hydropower potential is about 2,000 MW. So far 380 MW at Nalubaale and Kiira and 250 MW at Bujagali have been developed (Tumwesigye, Twebaze, Mukuregye, & Muyambi, 2011). The literature indicates that the 500 m drop of the Nile between Lake Victoria and Lake Albert represents approximately 4,000 MW of energy (NBI, 2013). Additional potential exists on smaller rivers in the upstream catchments such as Semliki (18 MW) (NPA, 2015).

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	245	405	506	1,552
Production of crude oil, NLG and additives	-	-	-	-
Production of natural gas	-	-	-	-
Production of electricity from biofuels and waste	0	0	9	15
Production of electricity from fossil fuels	1	5	71	53
Production of nuclear electricity	-	-	-	-
Production of hydro electricity	133	158	128	206
Production of geothermal electricity	-	-	-	-
Production of electricity from solar, wind, Etc.	0	0	0	2
Total production of electricity	134	164	207	276
Refinery output of oil products	-	-	-	-
Final Consumption of coking coal	-	-	-	-
Final consumption of oil	417	548	482	3,249
Final consumption of natural gas	-	-	-	-
Final consumption of electricity	6	8	12	200
Consumption of oil in industry	48	100	110	439
Consumption of natural gas in industry	-	-	-	-
Consumption of electricity in industry	2	4	7	109
Consumption of coking coal in industry	-	-	-	-
Consumption of oil in transport	0	0	0	2,150
Consumption of electricity in transport	-	-	-	-
Net imports of coking coal	-	-	-	-
Net imports of crude oil, NGL, Etc.	-	-	-	-
Net imports of oil product	438	576	506	3,173
Net imports of natural gas	-	-	-	-
Net imports of electricity	-2	0	-4	-9

- : Data not applicable

0 : Data not available

(P): Projected

(AFREC, 2015)

Other projects underway include Isimba Power station (183 MW) Karuma Power Station (600 MW). Mini hydropower plants already connected to the national electricity grid include Nyagak I (3.5 MW), Kabalega (9 MW), Kanungu (6.6 MW), Bugoye (13 MW), Mubuku I (5 MW), Mubuku III (10 MW) and Mpanga (18 MW).

### Oil and natural gas

Although oil has been discovered, Uganda is not yet an oil producer, so there are currently no exports of oil. However, oil consumption in 2014 amount to 14,000 bbl/year (IndexMundi, 2015).

Commercially viable deposits of oil in the around Lake Albert in western Uganda were confirmed in 2006. Deposits are estimated at 6.5 billion barrels of oil equivalent and production is expected to start in 2018 (NPA, 2015). Full exploitation of the deposits might require the construction of an export pipeline to the Indian Ocean coast, although other possibilities are being examined.

The Petroleum (Refining, Gas conversion, Transmission and Midstream Storage) Act 2013, the Petroleum (Exploration, Development and Production) Act 2013 and the Public Finance

Management Act 2015 have been passed strengthening the legal and policy foundation for the sector. The National Oil Company and Petroleum Authority are also being set up. Land acquisition for the proposed Oil Refinery at Kabaale in Hoima is almost complete. It is expected to be built on a Public-Private-Partnership arrangement. A crude oil pipeline to the Indian Ocean and petroleum products pipelines are also to be built (MFPED, 2015).

### Wind

Wind is an underexploited energy source possibly because of a dearth of wind data. Wind speeds thought to be commercially viable are found in Tororo (eastern Uganda), Pader (West Nile) and Nakapiripirit (northeastern Uganda). Average wind speeds are in the region of 7-9 m/s at a height of 80 m (Alobo, 2013).

### Geothermal

There is a Geothermal Development Plan 2003-2008 for the sector and the Ministry is planning to develop a Geothermal Policy and a Geothermal Act. Three sites have so far been licensed to private developers (3-year exploration license based on

the Mining Act of 2003). Countrywide geothermal surveys have been undertaken and currently detailed work is underway at Kibiro (Hoima), Panyimur (Nebbi), Buranga (Bundibugyo) and Katwe (Kasese).

### Solar

Average solar radiation is between 5 and 6 kWh/m<sup>2</sup>/day with insolation highest in the drier northeastern regions, and lower in the mountains in the east and south-west (REEEP, 2012). Solar energy is underutilized in the country although this is slowly changing. The use of solar PV started in the 1980s and has been utilized for lighting, vaccine refrigeration in health centres, communications and signalling for the railways and for telecommunication. In 2014, two 10 MW solar power stations (Tororo Solar Power Station and Soroti Solar Power Station) in the east of Uganda were licensed by the Electricity Regulatory Authority (ERA) and should be online soon (ERA, 2016).

## Tracking progress towards sustainable energy for all (SE4All)

Uganda has one of the lowest electrification rates with only 18.2 per cent of people with access to electricity in 2012 and only 8.1 per cent in rural areas and 71 per cent in urban areas (Table 3) (World Bank, 2015) (World Bank, 2016a). The energy access deficit was estimated as 28.5 million people (World Bank, 2013). There have been efforts at addressing this deficit such as the Rural Electrification Strategy and Plan 2001-2010; the Rural and Urban Poor Electricity Access Programme 2001; and the Energy for Rural Transformation programme 2002-2013.

Access to modern fuels is low with only 2.56 per cent of Ugandans using non-solid fuels; 2 per cent of these are from the rural areas and 10 per cent in urban areas in 2012 (World Bank, 2015) (World Bank, 2016). To that end a Modern Energy Service Programme, 2011 is being implemented and will involve the promotion of renewable-energy-based technology for households, institutions, commercial buildings and small-scale industries.

Uganda was among the top 20 countries worldwide with the highest energy intensity level in 2010. The energy intensity (the ratio of the quantity of energy consumption per unit of economic output) in 2012 was 9.1 MJ per US dollar (2005 dollars at PPP). The compound annual growth rate (CAGR) between 2010 and 2012 was -2.76 (World Bank, 2015).

The share of renewable energy in the total final energy consumption decreased slightly from 96.1 to 90 per cent between 1990 and 2012. Traditional solid biofuels form the biggest share of renewable sources at 86.2 per cent of TREC in 2012, while the modern solid biofuels contributed 2.7 per cent and hydro 1.1 per cent only. Renewable sources contributed 42.9 per cent share of electricity generation in 2012 (World Bank, 2015).

**Table 3: Uganda'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	7	9	15	18.2		
	7.1.2 Per cent of population with primary reliance on non-solid fuels	2	3	3	2.56		
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	96.1	94.6	88.8	90.0		
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)						
	Level of primary energy intensity(MJ/\$2005 PPP)	24.4		9.7	9.1	9.23	9.14

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

**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
18.2%	2.56%	NA	90.33%

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

INDC
*Increasing the efficiency in the use of biomass in the traditional energy sector
*Promoting renewable energy and other energy sources Increasing the efficiency in the modern energy sector, mainly of electricity
*Ensuring the best use of hydropower by careful management of the water resources

Source: (MEM, 2015)

utureatlas.com/Flickr.com/CC BY 2.0



Solar panel charging in Uganda

**Table 5: Uganda'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 and Mineral Development Petroleum Authority National Oil Company Rural Electrification Agency 2003
Presence of a Functional Energy Regulator	Electricity Regulatory Authority 2000
Ownership of sectoral resources and markets (Electricity/ power market; liquid fuels and gas market)	
Level of participation in regional energy infrastructure (Power Pools) and institutional arrangements	East 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	Energy policy regularly publishes a standardised Power Purchase Agreement (PPA) with feed-in-tariffs
Presence Functional IPPs and their contribution	
<b>Legal, Policy and Strategy Frameworks</b>	
Current enabling policies (including: RE; EE; private sector participation; & PPPs facilitation) (list 5 max) most critical ones	<ul style="list-style-type: none"> <li>• Energy Policy of 2002</li> <li>• Oil and Gas Policy 2008</li> <li>• Renewable Energy Policy 2007</li> <li>• Electricity Sector Strategic Plan 2014/15-2023/24</li> <li>• Rural Electrification Master Plan</li> <li>• Rural Electrification Fund</li> <li>• Rural Electrification Strategy and Plan 2013-2022</li> <li>• Strategic Plan for the Uganda Power Sector, 1997</li> </ul>
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	<ul style="list-style-type: none"> <li>• The Electricity Act 1999</li> <li>• Petroleum Act of 1964</li> <li>• Petroleum (Exploration and Production) Act of 1985</li> <li>• Petroleum (Exploration and Production) (Conduct of Exploration Operations) Regulations of 1993</li> <li>• Petroleum (Exploration, Development, Production and Value Addition) Bill, 2010</li> <li>• Energy Efficiency and Conservation Bill</li> </ul>

This table was compiled with material from (REEEP, 2012).

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

Uganda's energy-related Intended Nationally Determined Contributions (INDC) published in October 2015 aims to reduce emissions by increasing the amount of renewable energy capacity by at least 1,100 MW compared to business-as-usual by 2030 (GOU, 2015). Activities to achieve this are listed in Table 4.

## Institutional and Legal Framework

The Ministry of Energy and Mineral Development is in charge of the energy sector (Table 5). The Uganda Electricity Generating Company, Uganda Electricity Transmission Company, Uganda Electricity Distribution Company are the companies with responsibility for generating, transmitting and distributing electric energy, respectively. On a regional level, Uganda is a member of the East African Power Pool. The main sector policy is Energy Policy 2002. The legal framework is provided by the Electricity Act 1999 establishes the Electricity Regulatory

Authority and sets the foundation for the entire energy generation lifecycle from transmission to use. The Petroleum (Exploration, Development, Production and Value Addition) Bill, 2010 will operationalise the Oil and Gas Policy 2008.

An Energy Efficiency and Conservation Bill is also in development. It will legislate towards better energy management in industries, households, commercial and institutional buildings; and to promote energy efficiency in the mining, transport and agriculture sectors contributing to climate change conservation.