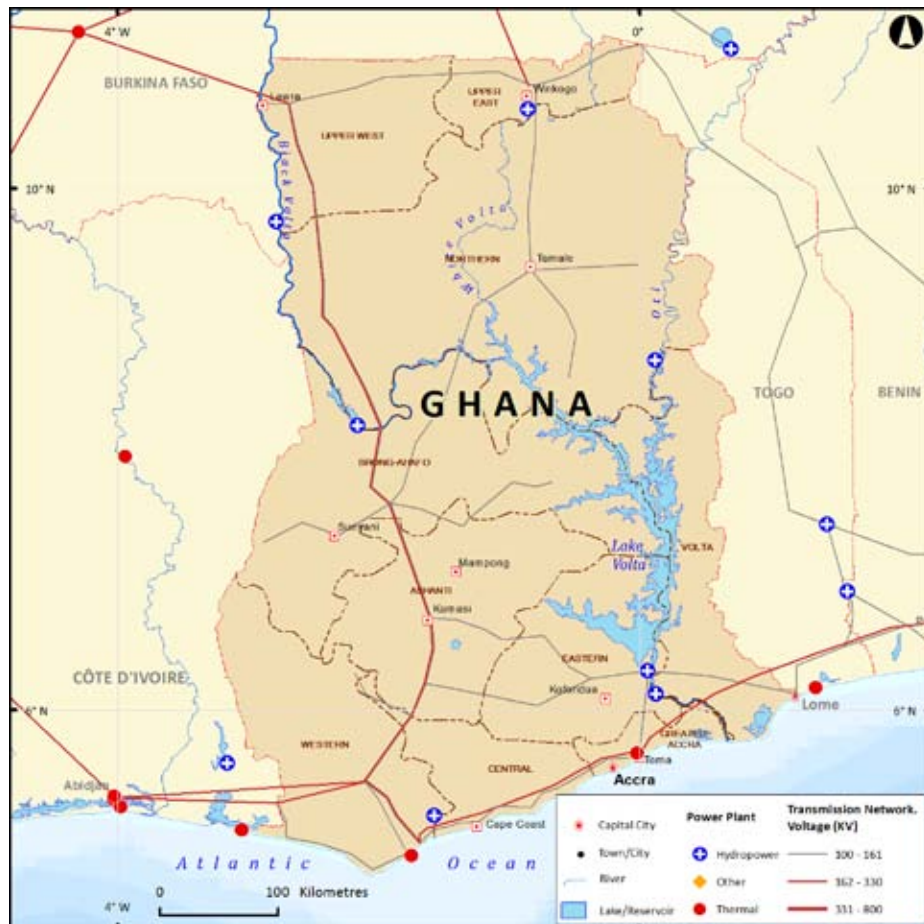




Figure 1: Energy profile of Ghana



## Energy Consumption and Production

Ghana's population in 2013 was 25.91 million (Table 1). Total production of electricity in 2015 was 1,275 ktoe with 41.6 per cent produced from fossil fuels and 46.9 per cent from hydro sources (Table 2). The final consumption of electricity in 2015 was 975 ktoe (AFREC, 2015). Key consumption and production statistics are shown in Figures 2 and 3.

Table 1: Ghana's key indicators

Key indicators	Amount
Population (million)	25.91
GDP (billion 2005 USD)	19.93
CO <sub>2</sub> emission (Mt of CO <sub>2</sub> )	13.65

Source: (World Bank, 2015)

## Energy Resources

### Biomass

Biomass is the main source of energy both in terms of endowment and consumption, with demand for fuelwood and charcoal growing at about 3 per cent per year (MOE, 2010). Biomass resources cover about 20.8 million hectares and supply approximately 60 per cent of total energy used in Ghana (MOE, 2010).

Ghana has much fertile land for growing food as well as crops that can be made into different sorts of solid and liquid biofuels. The two main biofuels on the market are biodiesel and ethanol. The Energy Sector Strategy and Development Plan (2010) aims to sustain the supply and efficient use of wood-fuels while making sure that their use does not contribute to deforestation.

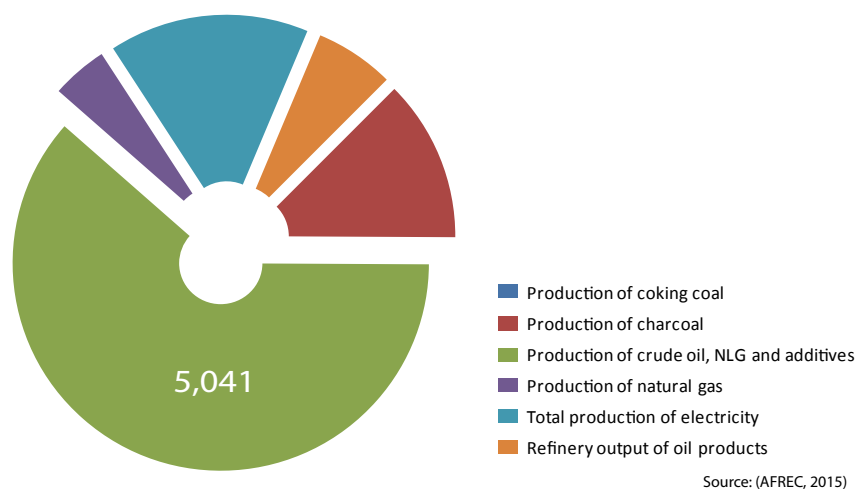
### Hydropower

Ghana has generous water resources that have the potential to provide 2,420 MW of hydroelectricity (REEEP, 2014). Existing dams include the 912 MW Akosombo plant, Kpong (140 MW) and Bui (400 MW) plants all on the Volta river. Ghana is exploring opportunities for alternative energy sources as its reliance on hydroelectricity makes it particularly vulnerable to impacts of climate change.

### Oil and natural gas

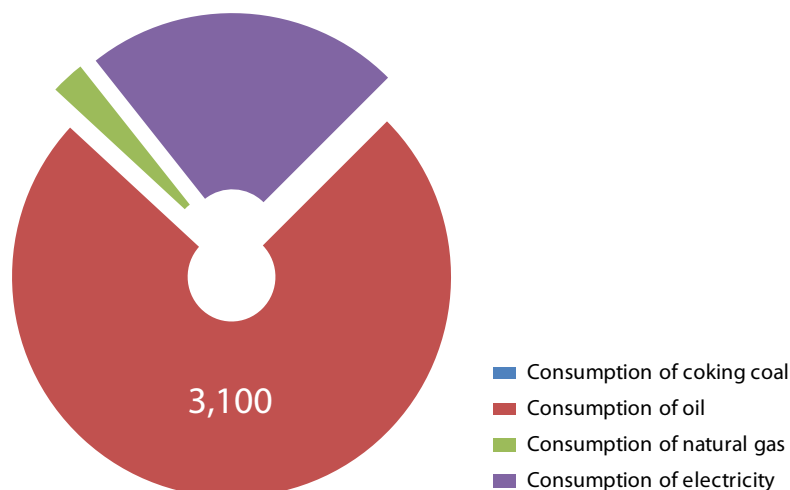
The proven recoverable oil reserves at the end of 2011 were 15 million barrels. Oil production in 2011 was 26,388 thousand barrels. At that time, proven recoverable reserves of gas were 22.7 bcm (WEC, 2013). Ghana produces 140-200 million cubic feet of natural gas per day. But since December 2012, delays in the construction of a gas refinery at Sekondi-Takoradi have constrained production. In 2011, the crude oil industry accounted for about 6 per cent of the Ghanaian economy (WEC, 2013).

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	1,150	1,343	1,664	1,033
Production of crude oil, NLG and additives	0	0	169	5,041
Production of natural gas	0	0	53	358
Production of electricity from biofuels and waste	0	0	0	0
Production of electricity from fossil fuels	53	100	273	531
Production of nuclear electricity	-	-	-	-
Production of hydro electricity	568	458	595	740
Production of geothermal electricity	-	-	-	-
Production of electricity from solar, wind, Etc.	0	0	0	4
Total production of electricity	621	558	868	1,275
Refinery output of oil products	1,032	1,546	949	506
Final Consumption of coking coal	-	-	-	-
Final consumption of oil	1,582	1,935	2,423	3,100
Final consumption of natural gas	0	0	112	103
Final consumption of electricity	522	515	591	965
Consumption of oil in industry	271	330	489	625
Consumption of natural gas in industry	0	0	0	0
Consumption of electricity in industry	346	393	271	344
Consumption of coking coal in industry	-	-	-	-
Consumption of oil in transport	1,022	1,254	1,633	2,135
Consumption of electricity in transport	-	-	-	-
Net imports of coking coal	-	-	-	-
Net imports of crude oil, NGL, Etc.	1,200	1,837	1,497	-2,702
Net imports of oil product	819	580	1,595	2,048
Net imports of natural gas	0	0	394	403
Net imports of electricity	41	15	-80	-45

- : Data not applicable

0 : Data not available

(P): Projected

(AFREC, 2015)

**Peat**

Areas of peatland are equivalent to 59 km<sup>2</sup> (WEC, 2013).

**Wind**

Ghana has wind data for quite a number of years now, albeit scattered and inconsistent, and the indications are that there is good potential for exploitation of wind as a source of energy. However due diligence on the technical and financial viability for development at a large scale needs to be done before any serious investments can be undertaken (REEEP, 2014). Wind speeds vary across the country with the highest measured along the Ghana-Togo border in the Volta region where average wind speeds of over 9 m/s at 50 m have been recorded. Along the eastern coastline wind speeds range from 6.2-7.1 m/s at 50 m

and patches towards the north have recorded speeds of between 7.8-8.4 m/s at 50 m (Osei, Ribeiro and Kwofi, 2011). The National Energy Policy, 2010 sites wind energy as a priority area for development and efforts are ongoing in this area. For instance, under its Renewable Energy Development Plan, the Volta River Authority is currently implementing feasibility studies for generating 150 MW of wind energy.

**Geothermal**

Ghana has no known geothermal resource.

**Solar**

Ghana's potential for solar energy generation is high with the data indicating solar radiation levels are about 4-6 kWh/m<sup>2</sup> providing great opportunities for exploitation. Ghana is currently

implementing a 155 MW photovoltaic solar energy plant, the Nzema project, to provide electricity to over 100,000 households. This will increase the country's electricity generating capacity by 6 per cent. There is also a pilot program to replace kerosene lanterns with solar lanterns in remote off-grid communities so as to reduce the national kerosene subsidy. Ghanaians use kerosene as their main source of lighting. The government plans to use this potential to support rural electrification Brong Ahafo (central Ghana) and in the Greater Accra and Volta regions in south-eastern parts of the country.

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

In 2012, the national electrification rate was 64.1 per cent. However, the difference in access rate between the richest 60 per cent and the poorest 40 per cent of the population was more than 40 percentage points. The gap between urban and rural areas is also large. The rate of access to electricity in Ghana is 41 per cent and 85 per cent in rural and urban areas, respectively. The National Electrification Scheme has been critical in extending electricity supply. Access to modern fuels is low. In 2012, only 16.78 per cent of Ghanaians were using non-solid fuels; 4 per cent of these are from rural areas and 29 per cent are in urban Ghana (Table 3 and Figure 4) (World Bank, 2015). A majority of Ghanaians use solid fuels for cooking. However, these are associated with indoor air pollution from burning of woodfuel and deforestation causing major health and environmental impacts. The government policy is therefore encouraging the use of LPG, mainly in urban areas, and the use of improved (energy efficient and smokeless) cook stoves in rural areas.

The energy intensity (the ratio of the quantity of energy consumption per unit of economic output) of the Ghanaian economy was 4.6 MJ per US dollar (2005 dollars at PPP) in 2012. The compound annual growth rate (CAGR) between 2010 and 2012 was -6.51 (World Bank, 2015).





The share of renewable energy in the total final energy consumption (TFEC) almost halved, dropping from 80.6 to 49.5 per cent between 1990 and 2012. Traditional solid biofuels form the biggest share of renewable sources at 33.1 per cent of TFEC in

**Table 3: Ghana'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	31	45	61	64.1		
	7.1.2 Per cent of population with primary reliance on non-solid fuels	2	8	15	17		
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	80.6	74.7	66.5	49.5		49.49 (2012)
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)			7.5	8.1 (2011)		
	Level of primary energy intensity(MJ/\$2005 PPP)	8.0		5.2	4.6	4.69	4.56

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
64.1%	16.78%	<b>11.53</b>	49.49%
			

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

INDC
*Scale up renewable energy penetration by 10 per cent by 2030/5
*Promote clean rural households lighting/1
*Expand the adoption of market-based cleaner cooking solutions/2
*Double energy efficiency improvement to 20 per cent in power plants/1
*Scale up renewable energy penetration by 10 per cent by 2030
-Increase small-medium hydro installed capacity up to 150-300 MW
-Attain utility scale wind power capacity up to 50-150 MW
-Establish 55 solar mini-grids with an average capacity of 100 kW which translates to 10 MW
-Scale up the 200,000 solar home systems for lighting in urban and selected non-electrified rural households
*Promote clean rural households lighting
-Increase solar lantern replacement in rural non-electrified households to 2 million
*Expand the adoption of market-based cleaner cooking solutions
-Scale up adoption of LPG use from 5.5 per cent to 50 per cent in peri-urban and rural households by 2030.
-Scale up access and adoption of 2 million efficient cook stoves up to 2030
*Double energy efficiency improvement to 20 per cent in power plants
-Scale up 120 MSCF12 natural gas replacement of light crude oil for electricity generation in thermal plants.

Source: (ROC, 2015)

**Table 5: Ghana'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	<ul style="list-style-type: none"> <li>• Ministry of Energy and Petroleum</li> <li>• Environmental Protection Agency (EPA)</li> <li>• Ghana Energy Foundation</li> <li>• Ghana Investment Promotion Centre (GIPC)</li> <li>• Public Utility Regulatory Commission (PURC)</li> </ul>
Presence of a Functional Energy Regulator	Energy Commission
Ownership of sectoral resources and markets (Electricity/power market; liquid fuels and gas market)	Ghana National Petroleum Corporation (GNPC)
Level of participation in regional energy infrastructure (Power Pools) and institutional arrangements	West Africa Power Pool (WAPP).
Environment for Private Sector Participation	
Whether the Power Utility(ies) is/are vertically integrated or there is unbundling (list the Companies)	Volta River Authority (VRA) unbundled in 2005. <ul style="list-style-type: none"> <li>• VRA - electricity generation</li> <li>• Ghana Grid Company Limited (GridCo) - electricity transmission</li> <li>• Northern Electricity Department (NED) - sole electricity distributor to the north</li> <li>• Electricity Company of Ghana (ECG) – electricity distributor to the south.</li> </ul>
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)	Petroleum Commission (upstream)
Extent to which Downstream services and operations are privatized or state-owned, or a mixture (extent)	
Presence of Functional (Feed in Tariffs) FIT systems	
Presence Functional IPPs and their contribution	CenPower/Kpone IPP produces 348 MW.
Legal, Policy and Strategy Frameworks	
Current enabling policies (including: RE; EE; private sector participation; & PPPs facilitation) (list 5 max) most critical ones	<ul style="list-style-type: none"> <li>• National Energy Policy</li> <li>• National Electrification Scheme (NES)</li> <li>• National Renewable Energy Policy</li> <li>• Policy Framework for Street Lighting in Ghana (2011)</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>• Energy Commission Act</li> <li>• Volta River Development Act (1961)</li> <li>• Public Utilities and Regulatory Commission Act, 1997 (Act 538); and</li> <li>• Renewable Energy Act, 2011 (Act 832)</li> <li>• National Petroleum Authority Act, 2005 (Act 691)</li> <li>• Petroleum Exploration and Production Bill 2016</li> <li>• Petroleum Revenue Management Act 2011</li> </ul>

This table was compiled with material from (REEEP, 2014) and (IRENA, 2015)

2012, while the modern solid biofuels contributed 9.1 per cent and hydro 7.3 per cent (World Bank, 2015). Renewable sources contributed 67.1 per cent of the share of electricity generation in 2012 (World Bank, 2015).

attain low carbon climate resilience through effective adaptation and reduction of emissions of greenhouse gas (GHG) in the different sectors. The energy-related Intended Nationally Determined Contributions (INDC) are given in Table 4.

Grid Company Limited (GridCo) transmitting it and two companies — the Electricity Company of Ghana (ECG) and the Northern Electricity Distribution Company (NED Co) — distributing the electricity to the southern and northern parts

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