GHANA WHOLESALE ELECTRICITY MARKET BULLETIN

MARKET WATCH

Monthly Market Data Analysis

ISSUE NO. 33 **1st September 2018 to 30th September 2018**

This Bulletin covers major developments in the Wholesale Electricity Market (WEM) of Ghana from 1st September 2018 to 30th September, 2018. It analyses the performance of the key WEM indicators against their benchmarks, and examines the likely implications of any discernable trends in the market. This edition of the WEM bulletin presents an analysis on the consumption of LCO for electricity generation and issues related to excess capacity and energy efficiency in Ghana.

The Energy Commission (EC) would very much appreciate and welcome comments from readers on the Bulletin. Reasonable care has been taken to ensure the information contained in this Bulletin is accurate at the time of publication, nevertheless, any errors, omissions or inaccuracies therein are regretted.

HIGHLIGHTS OF THE MONTH

Ghana recorded a System Peak Load of 2,402 MW in September 2018, and was 13 MW lower than the 2,415 MW projected under the Electricity Supply Plan (ESP) for 2018. On the contrary, the Ghana Peak Load of 2,291 MW recorded in September 2018 was marginally higher than the 2,282 MW projected under the 2018 ESP by 9 MW. This increase was as a result of a reduction in export at the System Peak Load recorded in September 2018. The total load served to CEB during the System Peak Load was 111 MW, but there was no export to CIE and SONABEL.

A total of 1,323.67 GWh of electricity was supplied in September 2018, which was marginally lower than the 1,334.5 GWh projected under the 2018 ESP. On the contrary, domestic generation of 1,270.06 GWh recorded in September 2018 was 11.66 GWh higher than the 1,258.4 GWh projected under the 2018 ESP. This was due to a significant reduction of 27.6% in the total electricity exported. A total of 53.61 GWh was exported to CIE, CEB and SONABEL in September 2018.

The rate of increase in the water level for the hydro dams increased significantly by over two folds in September 2018 when compared to the flow rate recorded in August 2018. The rate of increase in the water level for the Akosombo GS increased from 0.11 feet per day in August 2018 to 0.35 feet per day in September 2018. Similarly, the rate of increase in the water level for the Bui GS increased from 0.29 feet (0.09 meters) per day in August 2018 to 0.67 (0.2 meters) feet per day in September 2018.

Table 1. Projected and Actual Outturn of electricity demand and supply in August 2018 and September 2018.

	September 2018		August 2018	
	Projected	Actual Outturn	Projected	Actual Outturn
Total Supply (GWh)	1,334.5	1,323.7	1,356.8	1,355.3
Source by Power Plants (GWh)				
AKOSOMBO	285.0	286.6	261.0	280.3
KPONG	49.0	58.0	51.0	58.9
BUI	69.0	51.7	71.0	31.2
Sunon Asogli	118.0	215.4	118.0	232.9
TAPCO	173.0	68.8	179.0	19.7
TICO	196.0	193.3	202.0	215.3
TT1PP	57.0	76.1	-	0.8
CENIT	45.0	-	46.0	-
TT2PP	-	-	-	-
MRP	-	-	-	-
Karpowership	147.0	226.3	163.0	258.5
AMERI	73.0	51.5	76.0	99.6
KTPP	-	-	63.0	75.5
Trojan Power	-	-	-	-
CENPOWER	104.0	22.3	108.0	5.1
AKSA	14.0	26.4	14.0	35.7
BXC Solar	2.1	2.0	2.2	2.3
VRA Solar	0.3	0.2	0.4	0.2
Genser		36.0	-	33.4
Meinergy	2.1		2.2	-
Total Generation (GWh)	1,334.5	1,314.6	1,356.8	1,349.4
Imports (GWh)	-	9.1	-	5.9
Total Supply (GWh)	1,334.5	1,323.7	1,356.8	1,355.3
Deficit/Over supply (GWh)	-	(10.8)	-	(1.5)
Ghana Coincedent Peak Load (MW)	2,211.0	2,290.8	2,209.0	2,159.7
System Coincident Peak Load (MW)	2,384.0	2,401.8	2,342.0	2,296.0

The share of natural gas consumed in the total fuel mix was 65.4% and was marginally lower than the 65.7% recorded in August 2018. The consumption of LPG in the total fuel mix increased from 4.4% in August 2018 to 4.9% in September 2018. The share of liquid fuel decreased marginally in the total fuel mix from 29.9% in August 2018 to 29.7% in September 2018.

ELECTRICITY DEMAND AND SUPPLY

Electricity Demand

The month of September 2018 witnessed an increase in the System Peak Load by 4.6%, from 2,296 MW in August 2018 to 2,402 MW. The increase in the System Peak Load was significantly due to an increase in domestic demand in September 2018. The Ghana Peak Load (Domestic demand) increased by 6.1% to 2,291 MW in September 2018 from 2,160 MW in August 2018. Electricity import contributed 9 MW to both the System Peak Load and the Ghana Peak Load. At the System Peak Load, there was only 111 MW exported to CEB, with no export to CIE and SONABEL. The total electricity exported was lower than the 133 MW projected under the 2018 ESP by 16.5%. Average System electricity demand for September 2018 was recorded at 1,838 MW and was 0.9% higher than the 1,822 MW recorded in August 2018. Likewise, domestic demand increased by 1.8%, from 1,732 MW in August 2018 to 1,764 MW in September 2018. Electricity generation from Hydro sources, contributed 48% to both the System Peak Load and the Ghana Peak Load.

Electricity supply

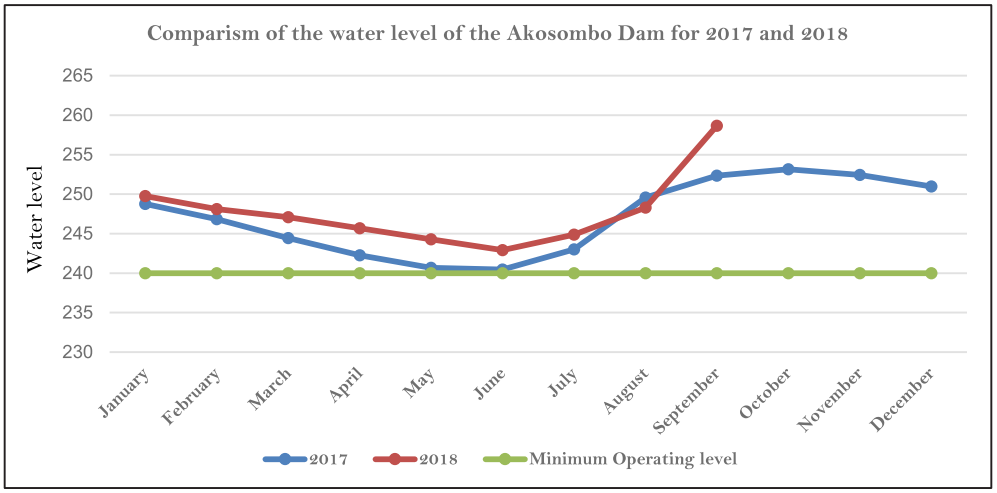
There was a marginal increase in the average electricity supply in September 2018, from 43.72 GWh per day in August 2018 to 44.12 GWh per day in September 2018. On the contrary, there was a marginal reduction in the total electricity supplied by 2.3%, from 1,355.31 GWh in August 2018 to 1,323.67 GWh in September 2018. The reduction in the total electricity supplied was due to greater number of days in August as compared to September. The total electricity supplied in September 2018 was 0.7% lower than the 1,334.5 GWh projected under the 2018 ESP. Out of the total electricity supplied in September 2018, 9.06 GWh was imported from CIE, with the rest from domestic sources. A total of 17.5 GWh, 4.6 GWh and 31.51 GWh of electricity were exported to CEB, CIE and SONABEL respectively. Electricity generation from hydro sources, accounted for 30% of the total supply in September 2018.

HYDRO DAM LEVELS

Akosombo Dam Water Level continued to increase in September 2018

The Akosombo GS recorded a significant increase in the rate of increase in the water level by over 2 folds in September 2018. The rate of increase in the water level increased from 0.11 feet per day in August 2018 to 0.35 feet per day in September 2018. Consequently, the water level of 248.3 feet recorded at the beginning of the months increased by 10.35 feet to a month end recording of 258.65 feet. The month end water level recorded by the Akosombo dam in September 2018, was 6.3 feet above the water level recorded for the same period in 2017.

Figure 1: Month-End Water Level for Akosombo Dam from January 2017 to September 2018

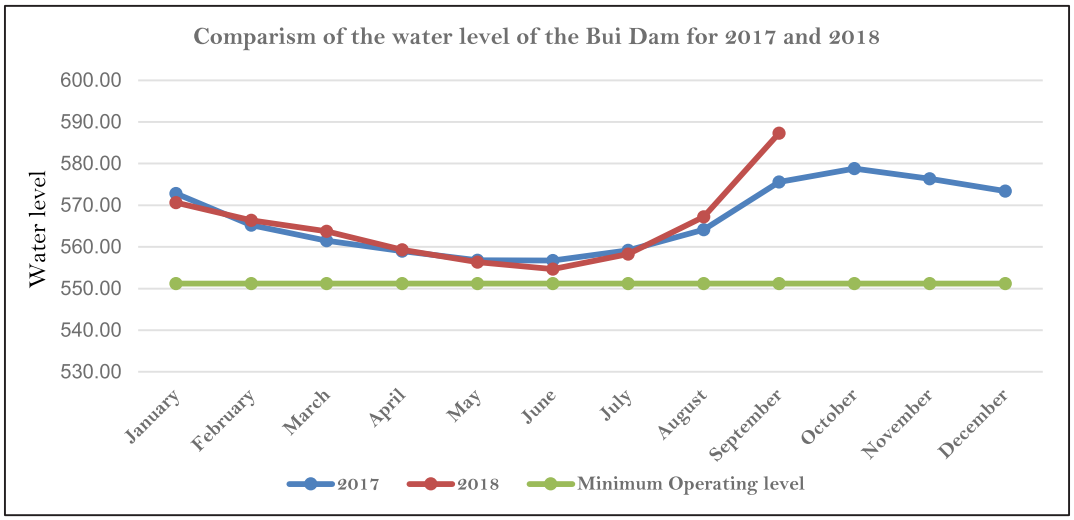


Bui Dam Water Level continued to increase in September 2018

The rate of increase in the water level for the Bui GS increased significantly by over a fold, from 0.29 feet per day in August 2018 to 0.67 feet per day in September 2018. The water level of 567.21 feet recorded at the beginning of September 2018, increased by 20.09 feet to 587.3 feet at the end of the month. The increase in the water level for the Bui dam was due to significant inflows despite the increase in generation. The water level recorded at the end of the September 2018, was 11.73 feet above the water level recorded for the same period in 2017.

Figure 2 shows comparative end of month trajectory of the level of water in the Bui dam from January 2017 to September 2018.

Figure 2: Month-End Water Level for Bui Dam from January 2017 to September 2018



FUEL SUPPLY FOR POWER GENERATION

Average Natural gas flow rate from WAGPCo increased in September 2018

The natural gas flow rate from WAGP to Tema and Kpone continued to increase from 80.02 MMSCFD in July 2018 and 83.44 MMSCFD in August 2018 to 85.84 MMSCFD in September 2018. On the contrary, the total natural gas consumed by power plants at Tema reduced from 2,711.22 MMSCF in August 2018 to 2,614.04 MMSCF in September 2018. The share of natural gas supplied from WAGP in the total fuel mix increased from 31.7% in August 2018 to 32% in September 2018. In the total natural gas consumed, the share of natural gas supplied from WAGP increased from 48.2% in August 2018 to 49% in September 2018. Natural gas from WAGP continued to dominate the total fuel mix in September 2018.

Natural gas flow rate from GNGC increased in September 2018.

Natural gas flow rate from GNGC increased by 5.4%, from 68.47 MMSCFD in August 2018 to 72.14 MMSCFD in September 2018. Consequently, the total natural gas consumed from AGPP was 2,164.28 MMSCF in September 2018 and was marginally higher than the 2,122.54 MMSCF recorded in August 2018. The total natural gas supplied by AGPP in September 2018 contributed 27.3% to the total fuel mix which was higher than the 25.4% recorded in August 2018. The shares of the natural gas from AGPP in the total natural gas consumed was 41.8% in September 2018 which was higher than the 38.7% recorded in August 2018.

Natural gas flow from ENI decreased in September 2018

There was a reduction in natural gas flow rate from ENI to Aboadze by 30.5%, from 21.34 MMSCFD in August 2018 to 14.84 MMSCFD in September 2018. A total of 445.22 MMSCF of natural gas was supplied by ENI in September 2018 and was lower than the 661.44 MMSCF recorded in August 2018. The total natural gas supplied from ENI contributed 6.1% of the total fuel mix and 9.3% of the total natural gas consumed.

Liquid Fuel

The consumption of liquid fuel increased by 5.6% in September 2018, from 381,381 barrels in August 2018 to 402,731 barrels. This was predominantly due to increased electricity generation from Karpowership and AKSA in September 2018 and an increase in consumption of LCO. The shares of Light Crude Oil (LCO) in the total fuel mix and total liquid fuel consumed, on the other hand, increased from 1.4% and 4.8% in August 2018 to 3.8% an 12.8% in September 2018 respectively. The shares of Heavy Fuel Oil (HFO) in the total fuel mix reduced from 28.4% in August 2018 to 25.6% in September 2018. Also, the shares of HFO in the total liquid fuel consumed reduced from 95% in August 2018 to 86.1% in September 2018. The consumption of Diesel Fuel Oil (DFO) in the total fuel mix increased from 0.1% in August 2018 to 0.3% in September 2018 due to the increase in consumption of LCO.

PLANT BY PLANT HIGHLIGHTS

Electricity Generation at the Akosombo Generation Station (GS) increased in September 2018

Average electricity generation from the Akosombo GS increased by 5.6% in September 2018, from 9.04 GWh per day in August 2018 to 9.55 GWh per day. Similarly, the total electricity supplied by the hydro power plant increased from 280.29 GWh in August 2018 to 286.55 GWh in September 2018 by 2.2%. The Akosombo GS' total electricity supplied was 0.5% higher than the 285 GWh projected under the 2018 ESP. The shares of the total electricity generated by the power plant in the total electricity supplied was 21.7% in September 2018. The Akosombo GS contributed 693.8 MW to both the System Peak Load and the Ghana Peak Load. This represents a contribution of 28.9% of the System Peak Load and the Ghana Peak Load in September 2018.

HIGHLIGHTS OF THE MONTH

Electricity supply by Kpong Generation Station (GS) increased in September 2018

The Kpong GS recorded an increase in its average electricity generation by 1.8% in September 2018, from 1.9 GWh per day in August 2018 to 1.94 GWh per day. On the contrary, the total electricity supplied by the power reduced by 1.5%, from 58.91 GWh in August 2018 to 58.05 GWh in September 2018. This was due to a greater number of days in August than in September. The Kpong GS generated 18.5% higher than the 49 GWh projected under the 2018 ESP. The total electricity supplied by the power plant contributed 4.5% to the total electricity supplied in September 2018. The Kpong GS supplied a load of 117 MW to the both the System Peak Load and the Ghana Peak Load. This represent 4.9% of the System Peak Load and the Ghana Peak Load in September 2018.

Electricity supply by the Bui Generation Station (GS) increased significantly in September 2018

There was a significant increase in the average electricity generated by the Bui GS by 71.2% in September 2018, from 1.01 GWh per day in August 2018 to 1.72 GWh per day. Similarly, the total electricity supplied by the power plant increased by 65.7%, from 31.22 GWh in August 2018 to 51.73 GWh in in September 2018. The total electricity supplied by the power plant contributed 3.9% of the total electricity supplied in September 2018 and was 25% lower than the 69 GWh projected under the 2018 ESP. The Bui GS contributed 344.8 MW to both the System Peak Load and the Ghana Peak Load. This constituted 14.5% of the System Peak Load and the Ghana Peak Load.

Generation by the Sunon Asogli Power Plant (SAPP) decreased in September 2018

SAPP recorded a reduction in its average electricity generated by 4.4% in September 2018, from 7.51 GWh per day in August 2018 to 7.18 GWh per day. Consequently, the total electricity supplied decreased by 7.5%, from 232.9 GWh in August 2018 to 215.44 GWh in September 2018. The power plant generated 82.57% more than the 118 GWh projected under the 2018 ESP and contributed 16.3% of the total electricity supplied in September 2018. SAPP contributed 319.7 MW to both the System Peak Load and the Ghana Peak Load, representing 13.3% of both the System Peak Load and the Ghana Peak Load. The Asogli power plant consumed a total of 1,763.66 MMSCF of natural gas, at an estimated heat rate of 8,063.64 Btu/kWh in September 2018. The estimated fuel efficiency of the power plant in September 2018 was slightly higher than the 8,089.43 Btu/kWh recorded in August 2018.

Ameri Energy Power Plant's generation decreased in September 2018

The Ameri power plant recorded a significant reduction in its average electricity generation by 46.6%, from 3.21 GWh per day in August 2018 to 1.72 GWh per day in September 2018. Likewise, the total electricity supplied by the power plant reduced by 48.4%, from 99.64 GWh in August 2018 to 51.46 GWh in September 2018. The total electricity supplied by the power plant was 29.5% less than the 73 GWh protected under the 2018 ESP and constituted 3.9% of the total electricity supplied in September 2018. The Ameri power plant did not contribute to both the System Peak Load and the Ghana Peak Load in September 2018. A total of 508.36 MMSCF of natural gas was consumed by the power plant. The fuel efficiency of 10,654.79 Btu/kWh recorded by the power plant in September 2018 was lower than the 10,211.2 Btu/kWh recorded in August 2018.

The Karpowership Power Plant's generation decreased in September 2018

There was a reduction in average electricity generation from the Karpowership by 9.5%, from 8.34 GWh per day in August 2018 to 7.55 GWh per day in September 2018. Similarly, the total electricity generation from the power plant reduced from 258.47 GWh in August 2018 to 226.35 GWh in September 2018. Karpowership's total electricity generated was 53.98% more than the 147 GWh projected under the 2018 ESP and contributed 17.1% of the total electricity supplied in September 2018. The power plant contributed 454.3 MW to both the System Peak Load and the Ghana Peak Load, representing 18.9% of the System Peak Load and the Ghana Peak Load. The Karpowership consumed a total of 304,516.27 barrels of HFO at an estimated heat rate of 8,139.4 Btu/kWh in September 2018. The heat rate recorded by the power plant in September 2018 was marginally higher than the 8,125.61 Btu/kWh in August 2018.

AKSA Power Plant's generation decreased in September 2018

Average electricity generation from the thermal power plant reduced by 23.5% in September 2018, from 1.15 GWh per day in August 2018 to 0.88 GWh per day. Likewise, the total electricity supplied by AKSA reduced by 26%, from 35.66 GWh in August 2018 to 26.39 GWh in September 2018. The total electricity supplied by the power plant constituted 2% of the total electricity supplied in September 2018 and was 88.5% more than the 14 GWh projected under the 2018 ESP. AKSA power plant contributed 153 MW to the System Peak Load and the Ghana Peak Load, representing 6.4% of the System Peak Load and the Ghana Peak Load. A total of 35,639.47 barrels of HFO was consumed by the power plant. The power plant recorded a marginal reduction in the fuel efficiency from 8,169.67 Btu/kWh in August 2018 to 8,170.57 Btu/kWh in September 2018.

Takoradi International Company (TICO) generation decreased in September 2018

Average electricity generation from TICO power plant reduced in September 2018 by 7.2%, from 6.94 GWh per day in August 2018 to 6.44 GWh per day. Consequently, the total electricity supplied by the power plant reduced from 215.27 GWh in August 2018 to 193.29 GWh in September 2018 by 10.2%. The total electricity of 193.29 GWh supplied by the power plant in September 2018 constituted 14.6% of the total electricity supplied. Also, the total electricity supplied by TICO was marginally lower than the 196 GWh projected under the 2018 ESP by 1.4%. The TICO power plant contributed 104 MW to both the System Peak Load and the Ghana Peak Load, representing 4.3% of the System Peak Load and the Ghana Peak Load. The power plant consumed a total of 1,380.96 MMSCF of natural gas, 4,396.62 barrels of Light Crude Oil (LCO) and 145.57 barrels of Diesel Fuel Oil (DFO). The power plant recorded an improvement in its fuel efficiency from 7,733.6 Btu/kWh in August 2018 to 7,471.87 Btu/kWh in September 2018.

Takoradi Power Company (TAPCO) Plant's generation increased in September 2018

There was a significant increase in the average electricity generated from TAPCO in September 2018 by over 2 folds. The

average electricity generation of the power plant increased from 0.64 GWh per day in August 2018 to 2.29 GWh per day in September 2018. Consequently, the total electricity generated by the power increased from 19.73 GWh in August 2018 to 68.76 GWh in September 2018. The total electricity generated by the power plant constituted 5.2% of the total electricity supplied in September 2018 and was 60.25% lower than the 173 GWh projected under the 2018 ESP. The power plant contributed 103 MW to both the System Peak Load and the Ghana Peak Load, representing 2.3% of the System Peak Load and the Ghana Peak Load. A total of 720.19 MMSCF of natural gas was consumed by the power plant at an estimated heat rate of 10,777.8 Btu/kWh. The fuel efficiency of 10,777.8 Btu/kWh recorded in September 2018 was marginally lower than the 10,655.33 Btu/kWh recorded in August 2018.

Tema Thermal 1 Power Plant's (TT1PP) increased in September 2018

TT1PP's electricity generation increased significantly in September 2018, from 0.84 GWh in August 2018 to 76.14 GWh. The power plant operated throughout the month with an average of 2.54 GWh per day. The total electricity supplied by the power plant constituted 5.8% of the total electricity supplied in September 2018 and was 33.6% GWh higher than the 57 GWh projected under the 2018 ESP. TT1PP contributed 106 MW to both the System Peak Load and the Ghana Peak Load, representing 4.4% of the System Peak Load and the Ghana Peak Load. The power plant consumed a total of 850.38 MMSCF of natural gas, at an estimated heat rate of 11,001.14 Btu/kWh. The efficiency of TT1PP recorded in September 2018 was marginally lower than the 10,964.71 Btu/kWh in August 2018.

Embedded Generation

Genser Power Plant's generation increased in September 2018

The average electricity generation from Genser power plant increased by 11.4% in September 2018, from 1.08 GWh per day in August 2018 to 1.2 GWh per day. A total of 35.99 GWh of electricity was supplied by Genser in September 2018 and was 7.8% higher than the 33.38 GWh it supplied in August 2018. The power plant consumed a total of 9,321.62 tonnes of LPG, at an estimated heat rate of 11,047.06 Btu/kWh in September 2018. The estimated heat rate of Genser for September 2018 was marginally lower than the 11,094.01 Btu/kWh in August 2018.

BXC Solar generation decreased in September 2018

There was a reduction in the total electricity supplied by the solar power plant by 12.5% in September 2018. The total electricity supplied reduced from 2.26 GWh in August 2018 to 1.98 GWh in September 2018. This notwithstanding, the total electricity supplied was lower than the 2.1 GWh projected under the 2018 ESP by 5.9%.

VRA Navrongo Solar generation increased in September 2018

The VRA Navrongo solar power plant recorded a 14.2% increase in its total electricity supplied in September 2018. The total electricity supplied increased from 0.2 GWh in August 2018 to 0.23 GWh in September 2018. The total electricity supplied by the solar power plant in September 2018 was 23.4% lower than the 0.3 GWh projected under the 2018 ESP.

Electricity Exchange – Imports increased significantly while Exports decreased in September 2018

Average electricity import from CIE increased significantly by 58.3% in September 2018, from 0.19 GWh per day in August 2018 to 0.3 GWh per day. Similarly, the total electricity imported from CIE increased by 53.2%, from 5.92 GWh in August 2018 to 9.06 GWh in September 2018. The total electricity imported constituted 0.7% of the total electricity supplied in September 2018. Electricity import contributed 6 MW to both the System Peak Load and the Ghana Peak Load, representing 0.3% of the System Peak Load and the Ghana Peak Load.

There was a reduction in average electricity export to CIE, CEB and SONABEL by 15%, 35.8% and 1% respectively in September 2018. The average electricity export to CIE, CEB, and SONABEL reduced from 0.18 GWh per day, 0.91 GWh per day, and 1.06 GWh per day in August 2018 to 0.15 GWh per day, 0.58 GWh per day and 1.05 GWh in September 2018 respectively. Consequently, the total electricity export to CIE, CEB and SONABEL decreased from 5.6 GWh, 28.16 GWh, and 32.88 GWh to 4.6, GWh 17.5 GWh, and 31.51 GWh in September 2018 respectively.

However, Ghana continues to be a net exporter of electricity in September 2018.

Figure 3a: Shares of sources of fuel in total fuel mix for power generation

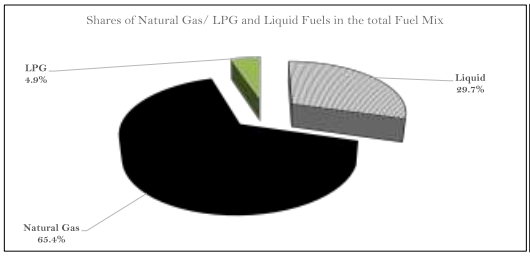


Figure 3b: Shares of fuel type in the generation fuel mix power generation

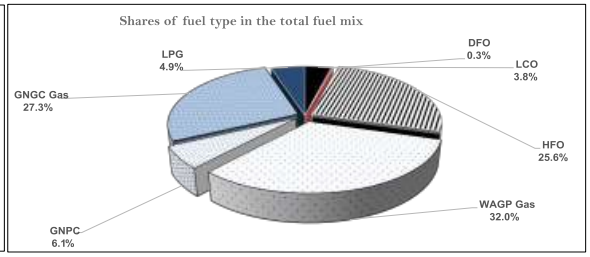


Figure 4a: Contribution of Natural Gas Supply by sources

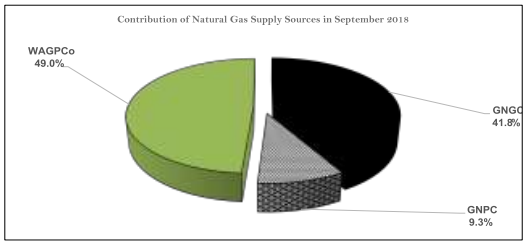
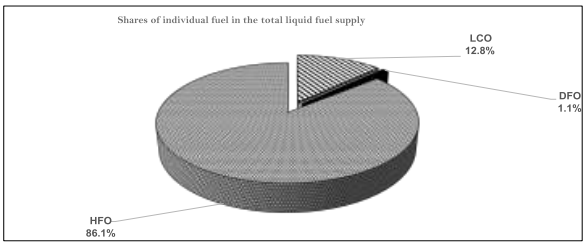


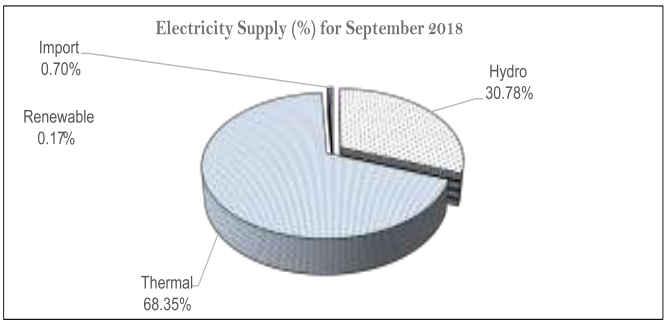
Figure 4b: Contribution of individual fuel in the liquid fuel supply

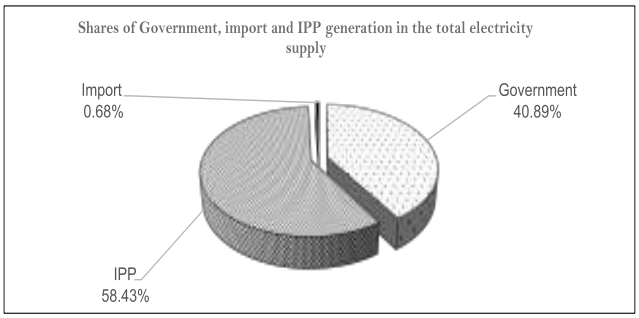


Peak Electricity Supply - September 2018			
Source of Supply	Generation at System Peak Load of September 2018 (MW)	Generation at Ghana Peak Load of September 2018 (MW)	Eleectricity Supply (GWh)
AKOSOMBO	693.80	693.80	286.55
KPONG	117.00	117.00	58.05
BUI	344.80	344.80	51.73
SAPP	319.70	319.70	215.44
TAPCO	103.00	103.00	68.76
TICO	104.00	104.00	193.29
TT1PP	106.00	106.00	76.14
CENIT	-	-	-
TT2PP	-	-	-
MRP	-	-	-
KARPOWER	454.30	454.30	226.35
AMERI	-	-	51.46
KTPP	-	-	-
Trojan Power	-	-	-
CENPOWER	-	-	22.26
AKSA	153.20	153.20	26.39
BXC Solar	-	-	1.98
Safisana	-	-	-
VRA Solar	-	-	0.23
Genser	-	-	35.99
IMPORT	6.00	6.00	9.06
Export to CEB	-	-	17.50
Export to CIE	111.00	111.00	4.60
Export to SONABEL	-	-	31.51
System Coincident Peak Load	**2,401.80**	**-**	**-**
Ghana Coincedent Peak Load	2,401.80	**2,290.80**	**-**
Total Supply	2,290.80	**-**	**1,323.67**
Total Supply without export	-	**-**	**1,270.06**

Ghana Electricity Demand & Supply		
		Sep-18
Maximum System Peak Load	MW	2,401.8
Minimum System Peak Load	MW	2,067.5
Average Peak Generation	MW	2,186.4
System Base Load	MW	1,541.2
Total Electricity	GWh	1,323.7
Load Factor (LF)	%	71.9

OPERATIONAL FACT SHEET





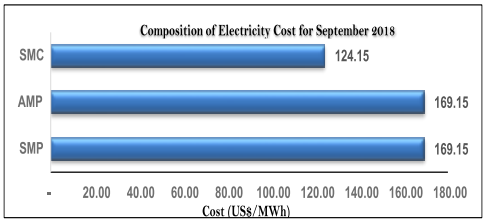
Power Plant Data for September 2018								
	Installed Capacity (MW)	Plant Capacity Utilization (%)	Heat Rate (Btu/kWh)	Natural Gas Consumption (MMBtu)	LCO Consumption (MMBtu)	DFO Consumption (MMBtu)	HFO Consumption (MMBtu)	LPG Consumption (MMBtu)
Akosombo	1,020.00	39.02	-	-	-	-	-	-
Kpong	160.00	50.39	-	-	-	-	-	-
Bui	400.00	17.96	-	-	-	-	-	-
SEAP	560.00	53.43	8,063.64	1,737,202.68	-	-	-	-
TAPCO	330.00	28.94	10,777.80	741,070.66	-	-	-	-
TICO	340.00	78.96	7,475.93	1,421,005.32	23,262.10	783.48	-	-
TT1PP	126.00	83.93	11,001.14	837,626.95	-	-	-	-
CENIT	126.00	-	-	-	-	-	-	-
TT2PP	49.50	-	-	-	-	-	-	-
MRP	-	-	-	-	-	-	-	-
KARPOWER	470.00	66.89	8,139.40	-	-	-	1,842,323.41	-
AMERI	250.00	28.59	10,164.79	523,100.27	-	-	-	-
TROJAN	56.00	-	-	-	-	-	-	-
Cenpower	0.00	-	-	-	282,843.39	24,567.85	-	-
KTPP	220.00	-	-	-	-	-	-	-
AKSA	325.00	11.28	8,170.57	-	-	-	215,618.78	-
Genser	95.00	52.62	11,047.06	-	-	-	-	397,583.68
Total	**4,527.50**			**5,260,005.87**	**306,105.49**	**25,351.33**	**2,057,942.19**	**397,583.68**

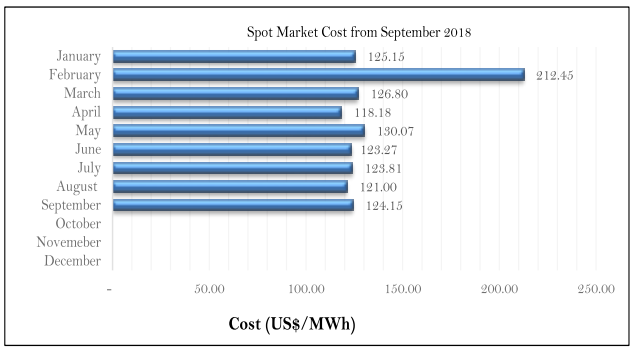
Natural gas flow rate (MMSCF/D)	
Location	**Monthly Average**
Etoki	**92.38**
Tema WAGPCo	**85.84**
Aboadze WAGPCo	**0.00**
Aboadze GNGC	**92.28**

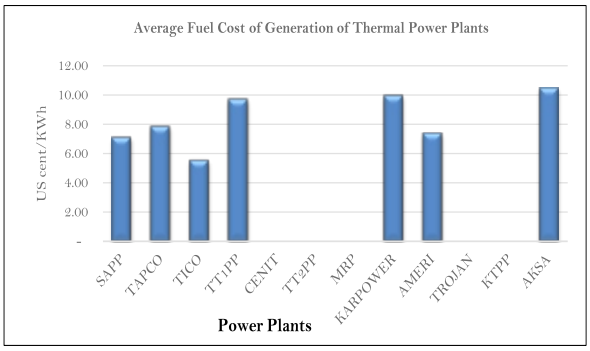
Sep-18			
	Beginning month (ft)	End month (ft)	Change in water level
Hydro Dam			(feet)
Akosombo	248.30	258.65	10.35
Bui	567.21	587.30	20.09

ECONOMIC FACT SHEET

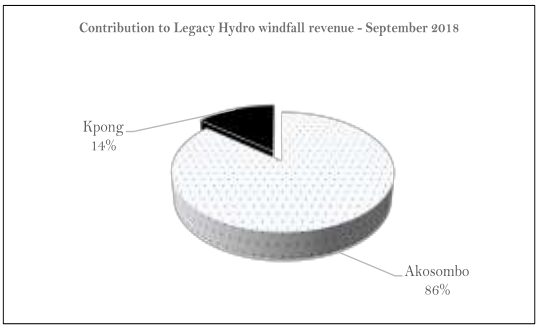
		Sep-18	Aug-18	Change
Average Market Price	US$/MWh	169.15	166.00	3.15
System Marginal Cost (SMC)	US$/MWh	124.15	121.00	3.15
System Marginal Price (SMP)	US$/MWh	169.15	166.00	3.15





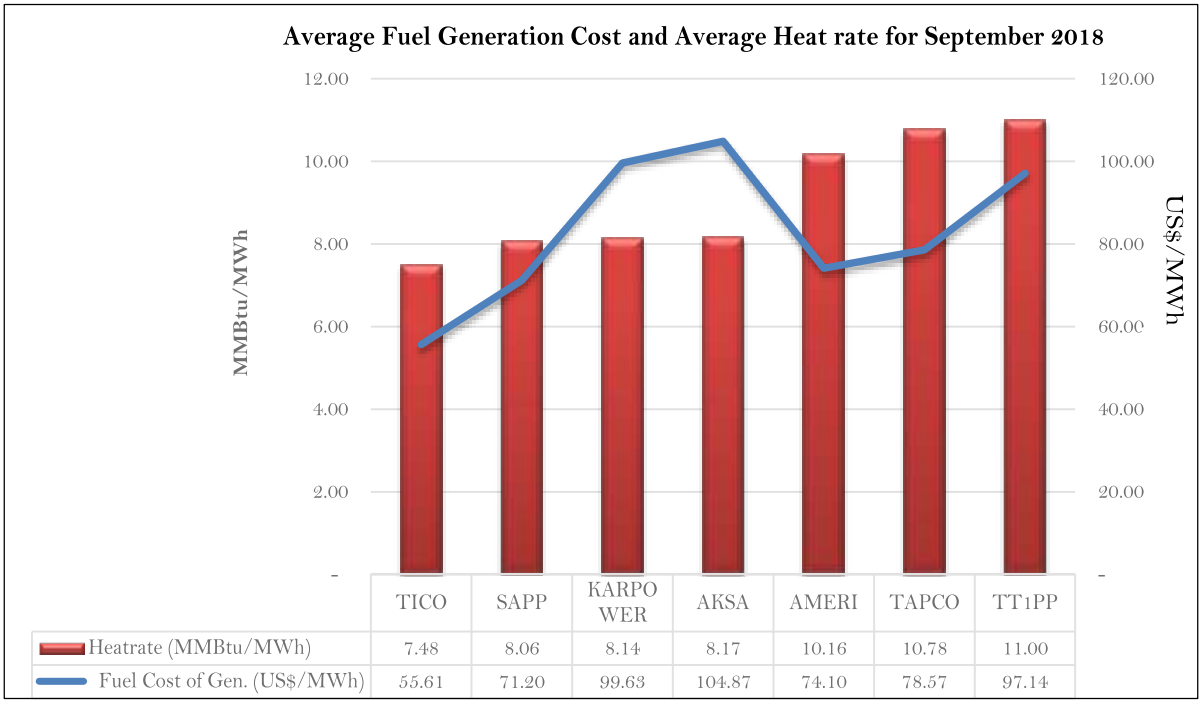


Average Fuel Prices		
		Sep-18
Fuel Type	Unit	Delivered Cost
Natural Gas	US$/MMBtu	8.12
LCO	US$/BBL	88.89
HFO	US$/Tonne	442.26
DFO	US$/Tonne	811.83

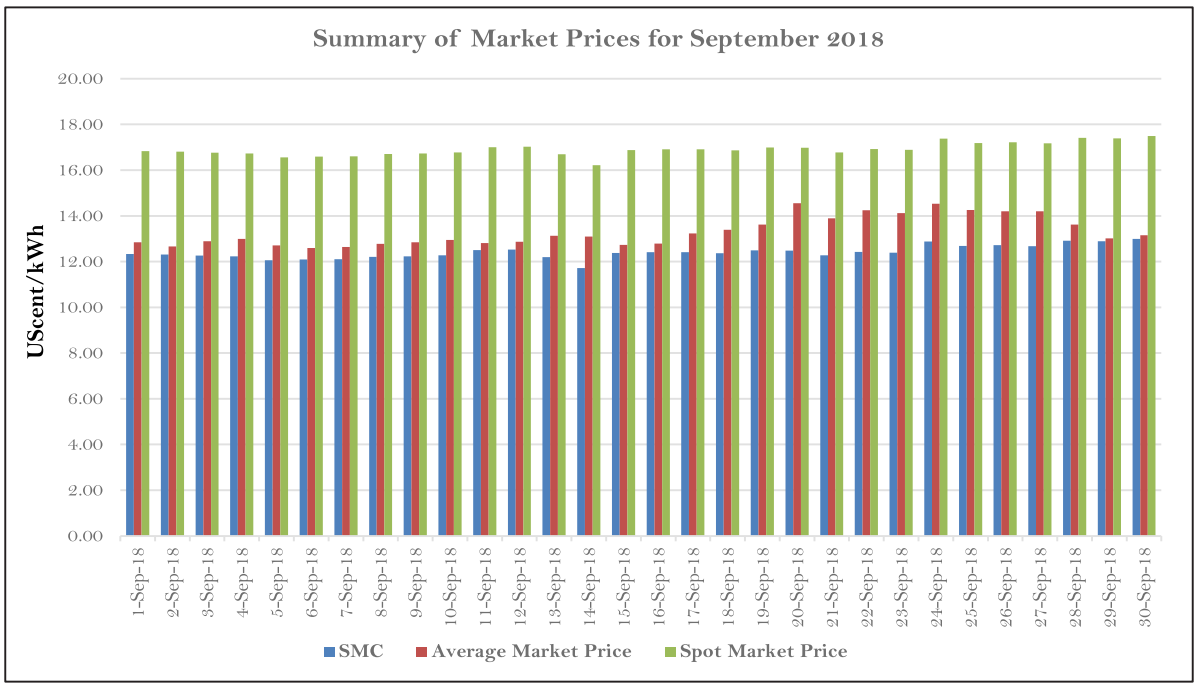


	Fuel Price (US$/MMBtu)		
	Natural Gas	*HFO*	*LCO*
September 2018	8.12	12.30	16.80

Power Plant	Average Heat rate (Btu/KWh)	Average Fuel Cost of Generation (US$/MWh)	Emission Factor kgCO2/kWh
SAPP	8,063.64	71.20	0.43
TAPCO	10,777.80	78.57	0.57
TICO	7,475.93	55.61	0.40
TT1PP	11,001.14	97.14	0.58
CENIT	-	-	-
TT2PP	-	-	-
MRP	-	-	-
KARPOWER	8,139.40	99.63	0.60
AMERI	10,164.79	74.10	0.54
TROJAN	-	-	-
KTPP	-	-	-
AKSA	8,170.57	104.87	0.64
Genser	11,047.06	-	0.70



	TICO	SAPP	KARPOWER	AKSA	AMERI	TAPCO	TT1PP
Heatrate (MMBtu/MWh)	7.48	8.06	8.14	8.17	10.16	10.78	11.00
Fuel Cost of Gen. (US$/MWh)	55.61	71.20	99.63	104.87	74.10	78.57	97.14



1.0 Is Light Crude Oil still vital in Ghana's electricity generation?

Thermal generating capacity has increased over the years from 27.2% in the year 2000 to 61.4% in 2017 and has averaged about 40% of the total installed capacity within the period. Likewise, thermal electricity generation has increased from 8.5% of the total electricity supplied in the year 2000 to 59.9% in 2017. Thermal electricity generation in Ghana uses Light Crude Oil (LCO), Distillate Fuel Oil (DFO), Natural Gas (NG), Heavy Fuel Oil (HFO) and Liquefied Petroleum Gas (LPG).

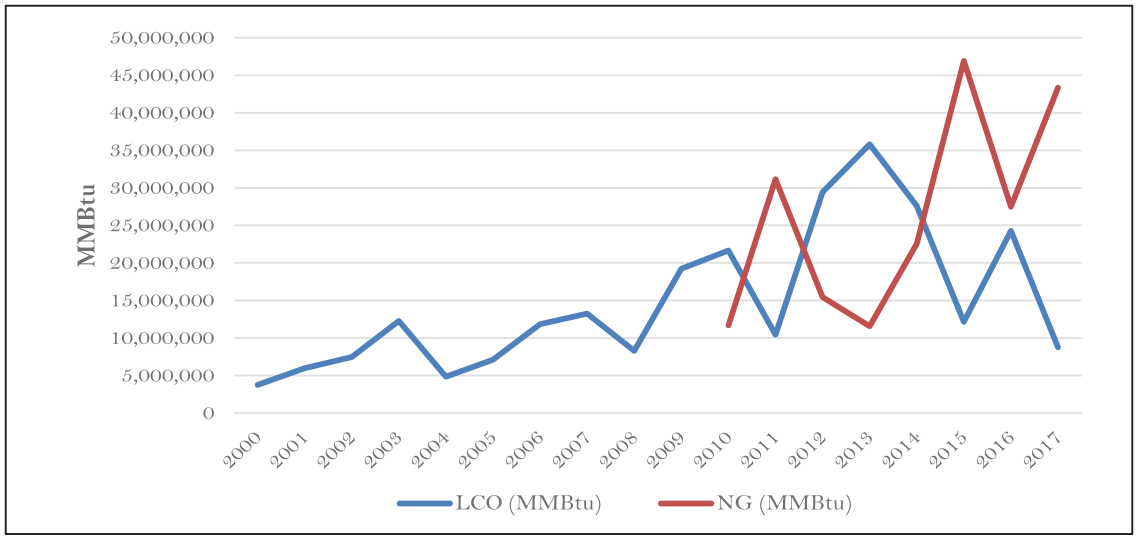
Before the commencement of natural gas supply from the West African Gas Pipeline (WAGP) in 2010 and the subsequent supply from the Atuabo Gas Processing Plant (AGPP) in 2015, LCO was the major fuel used by thermal power plants for electricity generation. LCO constituted 100% of the fuel used for electricity generation from thermal power plants, from the year 2000 to 2006 and reduced marginally to 90.4% in 2007 when DFO was used by power plants such as Tema Reserve Power Plant (TRPP), Emergency Reserve Power Plant (ERPP), Kumasi Reserve Power Plant (KRPP), Mine Reserve Power Plant (MRP) and Tema Thermal 2 Power Plant (TT2PP). This share reduced significantly to 64.7% in 2011 and 74.5% in 2012 when natural gas begun to flow from the WAGP in 2010 for electricity consumption by the Sunon Asogli Power Plant.

Table 1.0: LCO utilization in electricity generation from 2000 to 2012

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Power Plant Generation using LCO Share in the total Electricity Generation (%)	8.50	15.91	30.76	33.93	12.55	17.07	33.35	46.59	25.58	23.23	31.19	32.49	32.88
Power Plant Generation using LCO Generation Share in the total Thermal Generation (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	90.37	90.98	99.14	94.13	64.66	74.50

Power Plant generation using LCO in the total electricity generation increased from 8.5% in the year 2000 to 46.6% in 2007, dropping to 25.6% and 23.2% in 2008 and 2009 respectively. This share increased steadily to 31.2% in 2010 and 32.9% in 2012 due to the coming online of Tema Thermal 1 Power Plant (TT1PP) in 2009 and CENIT in 2012. LCO has been a significant source of fuel thermal power generation in Ghana over the years. Its importance has however diminished due to the supply of natural gas especially from domestic sources.

Figure 1.0: LCO and Natural gas consumption from the year 2000 to 2017



LCO has from 2015 served as a substitute to natural gas when supply of natural gas encounters challenges. LCO consumption increased significantly from 2012 to 2014 when there were natural gas supply challenges from the WAGP. An average of 5.8 million barrels (bbls) of LCO was consumed within the period compared to an average of 3.2 milliom barrels three years prior to this period. LCO consumption has reduced significantly in 2016 and 2017 to 1.7 million bbl and 0.34 million bbls respectively from 4.6 million bbls in 2016 due to the improved supply from the WAGP and AGPP. Natural gas supply has improved significantly in 2018 due to the commencement of natural gas supply from the Tweneboa Enyenra Ntomme (TEN) oil fields and Sankofa gas fields. As at September 2018, LCO consumption dropped from 29.9% of the total fuel mix in 2017 to 1.9% whiles natural gas consumption increased from 54.6% to 57.8%.

LCO has been the second preferred fuel for thermal generation because of the relatively cheaper cost of natural gas. At an average natural gas price of US$8.83/MMBtu, LCO prices has to fall below US$46/bbls (including transport and handling charges) in order to be competitive. With indigenous natural gas prices averaging US$7.29/MMBtu, LCO prices has to fall

below US$38/bbl (including transport and handling charges) in order to be competitive. For 2019, crude oil prices is projected to range between US$60/bbls and US$73/bbl and between US$58/bbl and US$64/bbl in the medium term. This translate into an energy price of between US$11.34/MMBtu and US$13.8/MMBtu for 2019 and US$11/MMBtu and US$12.1/MMBtu in the medium term. Therefore in terms of prices, LCO would not have any competitive advantage over natural gas in the short to medium term.

Also, with a large share of our natural gas supply from indigenous sources, there are greater levels of energy security (fuel supply security) and this would reduce the impact of international price volatility on domestic electricity prices. Natural gas also serves as a cleaner option than LCO because it emit less greenhouse gases when burnt. We will therefore be emitting less amount of CO2 per every kWh of electricity produced. It is estimated that LCO emit 28.8% more CO2 than natural gas when burnt for electricity generation. Storage facilities for LCO especially in the Tema Thermal Power Enclave where TT1PP and CENIT are located is inadequate for the two power plant to operate continuously for over a month. Treated LCO storage tanks available could only operate the two power plants for 18 days continuously.

It is obvious that LCO has lost its dominance as the fuel of choice for thermal power plant as these plants switches to natural gas. This does not mean that LCO is not important for electricity generation in Ghana, LCO could serve as a strategic stock when natural gas supply faces challenges. For instance, when natural gas supply was curtailed in February 2018 and March 2018 at the Aboadze Power Enclave due to routine maintenance of the AGPP, including tie-in works at the Transmission Regulatory and Maintenance Station (TRMS). Ghana experienced some period of load shedding whiles CENIT and TT1PP was shut down but available due to low stocks of LCO at the Tema Thermal Power enclave. It is therefore important to have strategic stocks of LCO in the Tema Thermal Power Enclave, Aboabze Power Enclave and Sunon Asogli Power Plant site.

2.0 Excess Capacity and Energy Efficiency in Ghana

Demand Side Management (DSM) are measures aimed to modify or reduce end-users energy demand. The promotion of Demand Side Management (DSM) is to address the following issues; reliability and network issues, environmental and social improvement, cost reduction and improved market. Demand side management broadly achieves three programmes; Load management, Energy reduction and Load growth and conservation. All players in the electricity supply chain stands to gain depending on the DSM measure undertaken.

Energy Efficiency (EE) is one of the tools used in DSM for mainly load management and energy reduction. Energy efficiency is using less energy to perform the same task and thereby eliminating waste. Energy efficiency is an important DSM tool and according to the International Energy Agency (IEA), Energy Efficiency is the first fuel of a sustainable global energy system. The IEA also state that, Energy Efficiency, can mitigate climate change, improve energy security and grow economies while delivering environmental and social benefits. Energy Efficiency will consequently lead to reduction in energy demand and energy consumption.

The Government of Ghana has enacted several laws to enforce Energy Efficiency measures. In 2005, the Energy Commission enacted the Energy Efficiency Standards and Labeling (Non-ducted Air Conditioners and Self Ballasted Fluorescent Lamps) Regulation, 2005 (L.I. 1815). This obligate appliance manufacturers who export to Ghana and retailers who sell in Ghana are obliged to display a label which indicates the energy efficiency rating of the product before the first retail sale. Also, L.I. 1932 which prohibit the manufacturing, sales or importation of incandescent filament lamps, used refrigerators, used refrigerator-freezer, used freezer and air-conditioners was enacted in 2008. L.I. 1958 and its amendment, L.I. 1970, (enacted in 2009 and 2010 respectively) sets Energy Efficiency Standards and Labeling for household refrigerating appliance. The final regulation, L.I. 2353, enacted in 2017 set minimum energy efficiency standards for Self-Ballasted Fluorescent Lamps and Light Emitting Diode (LED) Lamps. This regulation also provides for the labelling of lamps.

Ghana has embarked on numerous energy efficiency programmes over the years. In 2006, the Energy Commission embarked on Compact Fluorescent Lamp (CFL) exchange programme where all incandescent bulbs were changed to CFL bulbs. In the programme six (6) million incandescent bulbs were exchanged for its CFL equivalent. In doing this, peak electricity savings of 124 MW was achieved and a delay in investment cost in thermal energy generation of US$ 105 million was realized. CFL penetration increased from 20% in 2007 to 79% in 2009 with a corresponding reduction in incandescent bulbs from 58% in 2007 to 3% 2009. In 2010, the Energy Commission was awarded the EE Global Visionary Awards for the success achieved in implementing the efficient lighting projects. In September 2012, the Energy Commission started the refrigerator rebate scheme on a pilot basis and implemented it fully in May 2013. The scheme replaced old energy inefficient fridges and freezers with energy efficient ones. After the programme, 10,742 inefficient refrigerating appliance was replaced with an estimated 400 GWh of electricity saved. It is also estimated that household average consumption of electricity has reduced from 1,200 kWh/yr to 385 kWh/yr.

Energy Efficiency is a good tool for reducing end user consumption and a way of reducing peak demand. It helps in reducing loads on transformers, delay the purchase of thermal generation capacity and reduces the countries carbon blue print. Ghana enacted and pushed the Energy Efficiency measures during period of demand and supply imbalance which led to severe load

shedding. The Energy Efficiency measures served as a means of reducing load and delaying the financing of new thermal generation and enabling greater grid stability. The challenge however is, how do Ghana continue to implement Energy Efficient measures whiles there are excess generating capacity. It is estimated that Ghana's excess capacity has grown from 4.2% in 2014, 15% in 2015 to 33.1% in 2016. As at September 2018, excess capacity reduced to 30.5% and is projected to reduce to 25.2% in 2019 and 18.6% in 2020. Despite the projected drop in excess capacity, there would still be an average of about 22% of capacity that need to be consumed.

Ghana need in the short to medium term grow its demand in order to consume the excess demand and reduce the cost in making capacity payment for capacity not utilized. To grow our demand, Ghana need to intensify its rural electrification which has the potential of stimulating increased demand growth. Studies have also shown that reducing electricity tariff could also stimulate increased demand growth. A report conducted by Gatton College of Business and Economics for the Kentucky Department of Energy Development and Independence Coal Education (Authored by Garen J. et. al) noted that in the short term, a 1% increase in price electricity results in a 0.2% drop in demand. It is therefore necessary for Government to undertake measures that will not increase electricity tariff but reduce it. The successful implementation of the One District One Factory (1D1F) could also be a major boost to growing electricity demand. Large energy consumers such as steel companies and VALCO need to be stimulated in order to increase their consumption by providing special tariff that will enable stimulate their consumption.

The question still remains; is there the need for Energy Efficiency and conservation measures in the wake of the excess generation capacity? It is imperative that Ghana shifts its focus from load management to load growth in order to reduce the excess capacity but should not lose site of the important of Energy Efficiency. The fact that there is excess generation capacity does not also suggest that people do not have the right to save on electricity cost. Energy efficiency measures that promote social change and behavioral changes still remains important and need to be pursued. People need to learn how to consume electricity efficiently and institution mandated to promote Energy efficiency and conservation measures needs to undertake these programmes. It is incumbent on off-takers on electricity to instigate or promote energy consumption to reduce the effect of excess capacity on their finances.

Acronyms

AGPP = Atuabu Gas Processing Plant
CBGC = Composite Bulk Generation Charge
DFO = Distillate Fuel Oil
ECG = Electricity Company of Ghana
ESP – Electricity Supply Plan
GHp = Ghana Pesewa
GWh = Giga-watt Hours
KTPP = Kpone Thermal Power Plant
MRP = Mine Reserve Plant
LCO = Light Crude Oil
LTA = Long Term Average
MMscf = Million Standard Cubic Feet
NITS = National Interconnected Transmission System
SAPP = Sunon Asogli Power Plant
SNEP = Strategic National Energy Plan
TT2PP = Tema Thermal 2 Power Plant
VRA = Volta River Authority
WAGP = West African Gas Pipeline
Btu = British Thermal Units
CUF = Capacity Utilization Factor
EC = Energy Commission
EMOP = Electricity Market Oversight Panel
FPSO = Floating Production, Storage and Offloading
GNGC = Ghana National Gas Company
HFO = Heavy Fuel Oil
kWh = Kilo-watt hours
LEAP = Long-range Energy Alternative Planning
LI = Legislative Instrument
MW = Megawatt
MWh = Mega-watt hours
PV = Photovoltaic
SMP = System Marginal Price
TEN = Tweneboa, Enyenra, Ntomme
TT2PP = Tema Thermal 2 Power Plant
WAGPCo – West African Gas Pipeline Company
WEM = Wholesale Electricity Market

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